Mr. Hard, from the Committee on Roads and Canals, made the following REPORT:

The Committee on Roads and Canals, to which was referred the report of the Secretary of War of the result of the survey of the several routes of a ship canal round the falls of Niagara, to connect the navigable waters of the Lakes Erie and Ontario, together with several memorials on the same subject, have had the same under consideration, and beg leave to report:

That the project of a ship canal, to connect the navigable waters of Lakes Erie and Ontario, has, for many years, claimed the attention of the General Government as one of conceded public utility, and one whose construction was intimately connected with the military and commercial prosperity of the country.

On the sixth day of March, one thousand eight hundred and eight, the Secretary of the Treasury, in pursuance of a resolution of the Senate of the United States, submitted to that body an able and elaborate report on the subject of roads and canals, in which, among many others of general interest that might require the aid of the General Government, was included one around the falls of Niagara. In obedience to the requisitions of the resolution, he projected a grand scheme of internal improvement, embracing such objects only as were deemed worthy the aid of Congress, and for whose construction it might, without infringing the rights of the several States in which they were situated, or transcending its own constitutional limits, appropriate a portion of the public money. He arranged the numerous routes recommended into four classes, according to their geographical position and direction; they are as follows:

1. Great canals from north to south along the Atlantic coast.
2. Communication between the western waters and the Atlantic.
3. Communications between the Atlantic, the great lakes, and the river St. Lawrence.
4. Internal canals.

Within the third class was comprehended the plan of a ship canal around Niagara falls, which was represented as both practicable and of primary importance to the interests and domestic policy of the Union. It alludes to the limited project, which had been previously started by the enterprise Blair & Rives, printers.
of private individuals, for cutting a canal from Porter's store-house, so called, near old Fort Schlosser, to Devil's hole, about half-way to the foot of the rapids, and recommends the enlargement of the plan, so as to extend it by a flight of locks to the level of the river at Lewiston.

In the year 1826 another and more accurate survey was effected under the direction of private individuals, who had associated themselves together, with the view of obtaining a charter from the State of New York, incorporating a joint-stock company, for the purpose of accomplishing this work. Under this survey, the canal was intended to commence at the same point, and terminate at the foot of the rapids at Lewiston; and the estimated cost was computed at a million of dollars.

Again, in the summer of 1835 the present Executive of the United States ordered a third survey to be made on a still more enlarged scale, and, for this purpose, Captain Williams, of the engineer corps, a competent and faithful officer, was sent out to accomplish it: a duty which he performed with an accuracy and minuteness which cannot but inspire confidence.

It is a fact worthy of remark, that, in every instance, where a survey has been ordered and estimates made, they have uniformly been followed by results that establish the fact of its feasibility.

In thus tracing the history of this measure, it has afforded matter of gratification that, in again bringing the subject to the consideration of Congress, the committee are not chargeable with the responsibility of introducing any new project, nor of pressing any new or unusual claim upon the munificence of the General Government, but that they are acting in unison with the views and opinions of the Executive branch of the Government for three successive administrations.

In settling the question of the expediency of the undertaking, three topics of discussion seem to arise for consideration—

1. The practicability of the measure;
2. The constitutionality of the measure; and
3. The ultimate utility.

In relation to the first, the investigation has been met with no impediments, as the practicability has been frequently made the subject of inquiry by competent engineers, founded upon accurate surveys; and, as these surveys have been accompanied by detailed estimates of the expense in labor and money, and have, in every instance, favored the project, it was but reasonable to adopt them as the safest and more sure guides. As the question of practicability is ascertained alone by scientific skill and calculation, founded upon actual local observation and mensuration, and as these elements are ably combined and developed in the survey and report of Captain Williams, the committee beg leave to extract from it that portion which relates to this branch of the subject, and adopt it as a part of their report. It will be found appended, and marked A.

In deciding upon the most practicable route for the canal, various lines, and different modifications of the same line, were run by the engineer, and comparative statements made of their probable cost, respectively.

One line commences at Porter's store-house, and terminates below the rapids, at the village of Lewiston. The second starts at the same point, and terminates at the mouth of the Four Mile creek, on Lake Ontario. The third general line follows up Cayuga creek, crosses the Lewiston ridge at Pekin, and debouches at the mouth of Twelve Mile creek. While the
fourth general route leaves the Niagara river, at the mouth of Tonnewonta creek; meets the Erie canal at Pendleton, and follows that to Lockport; descends the ridge there, and pursues the valley of the Eighteen Mile creek to its mouth. As all these routes are pronounced feasible, and present each of them their characteristic advantages, which seem to divide their claims to preference, it is thought proper, in framing the bill which accompanies this report, to leave it with the Executive to make the selection, and designate the route. This course is thought the more advisable, as it is a work confessedly of a military as well as commercial character, and would, therefore, require the advisement of a practical engineer to decide upon that location which would best promote the great object of its construction. The committee, therefore, with a view to furnish all the information in their power upon the comparative merits, beg leave to transcribe and make a part of their report that portion which relates to that subject. It will be found in the appended document (marked B.)

The next question that presented itself in the course of investigation was, whether this identical case was embraced in that class over which Congress had conceded jurisdiction; not that the committee apprehended that any valid objection could be raised on that score; but as the object was one of no ordinary magnitude, and in its construction must necessarily draw from the public treasury a sum of money of no inconsiderable amount, it was thought to be due to the Government, whose powers are limited, and to the several States, who are interested in its funds, and, finally, to Congress itself, whose reasons for such measures should always appear of record, and whose duty it is to authenticate every act for the appropriation of money by the strongest possible evidence of legal sanctions.

It is not necessary for the purpose of this report to enter into a profound argument in defence of literal grants or constructive powers of Congress; it is sufficient merely to state those portions of the constitution under which Congress claims the right to legislate on these objects, and then to establish that right by recorded evidences of an uninterrupted practice, and long acquiescence in that species of legislation.

By the constitution, the confederacy has expressly charged the General Government with the guardianship of all their military and naval interest and operations; so, too, has it intrusted it with the unreserved power of regulating commerce with foreign nations, among the States, and with the Indian tribes. It is manifest, therefore, that every object of internal improvement, whose construction will essentially promote the interests of either of these branches of public policy, has a legitimate claim upon the aid of the Federal Government.

That the Niagara canal has a direct tendency to such results, might be assumed upon a slight reflection and observation; but it will appear the more clearly so, when its multiplied benefits are represented more in detail; a duty belonging more appropriately to another branch of this report. This and similar measures have been presented to the attention of Congress by the Executive branch of the Government, through every administration, from the year 1805 to the present day. Thus, the Delaware and Chesapeake canal, the Chesapeake and Ohio canal, the Louisville and Portland canal, and the Dismal Swamp canal, have all, in turn, received their portion of federal munificence, upon the general principle of commercial expediency.
In the report of the Secretary of the Treasury, already referred to, which was submitted under the order of the Senate of the United States of the 2d of March, 1807, a magnificent scheme of internal navigation was brought forward, and pressed upon the consideration of Congress with all the force which the distinguished talent and patriotism of that administration, and the intrinsic merits of the scheme, were capable of bringing to its aid. The general plan which it recommended has already been stated in a former part of this report.

An elaborate and detailed account was furnished of each individual object, followed by an aggregate estimate of what would be required to accomplish them, which was stated at twenty millions of dollars. The report assigned the reasons, also, for recommending them to the aid of the General Government; and as these afford a clew to the doctrine entertained in relation to the powers of Congress over the subject of internal improvement under that memorable administration, a liberal extract from the report will be here inserted.

After stating what is universally conceded by all nations at the present age, the great importance of artificial roads and canals to the physical and moral prosperity of every people, it continues:

"The present population of the United States, compared with the extent of territory over which it is spread, does not, except in the sea ports, admit the extensive commercial intercourse within short distances, which in England and some other countries form the principal support of artificial roads and canals. With few exceptions, canals particularly cannot, in America, be undertaken with a view solely to the intercourse between the two extremes of and along the intermediate ground which they occupy. It is necessary, in order to be productive, that the canal should open a communication with a natural extensive navigation which will flow through that channel.

"It follows that, whenever that navigation requires to be improved, or when it might at some distance be connected by another canal to another navigation, the first canal will remain comparatively unproductive until the other improvements are effected, and until the other canal is also completed. Thus, the expensive canals completed around the great falls of the Potomac will become more productive in proportion to the improvements first of the navigation of the upper branches of the river, and then of its communication with the western waters. Some works already executed are unprofitable; many more remain unattempted, because their ultimate productiveness depends on other improvements too extensive or too distant to be embraced by the same individuals. The General Government can alone remove the obstacles. The early and efficient aid of the General Government is recommended by still more important considerations."

"The inconveniencies, complaints, and perhaps dangers, which may result from the vast extent of territory, can no otherwise be readily removed or prevented than by opening speedy and easy communications through all its parts. Good roads and canals will shorten distances, facilitate commerce and personal intercourse, and unite, by a still more intimate community of interests, the most remote quarters of the United States. No other single power of government can more effectually tend to strengthen and perpetuate that union which secures external independence, domestic peace, and internal liberty."
In this short extract are compressed all the prominent arguments in favor of general expediency as the basis of federal authority in the construction of roads and canals, and it affords a fair exponent of the construction which that talented and popular administration gave to the constitutional powers of Congress over that branch of federal legislation.

The argument acquires additional strength from the fact, that the resolution upon which this report was founded limited in its terms the inquiry of the Secretary to such a scheme as was within the means, and came within the powers of Congress. It is true the Secretary ascribed to Congress greater powers, and gave to it more liberal grants, than would be necessary to contend for in defence of a measure like this, of conceded national utility; but it leads to the origin of the high and unquestioned authority which so ably sustains the object of this report.

Neither the scheme nor the doctrine was permitted to expire with the termination of that administration. The execution of the first was suspended by the unhappy interruption of the friendly relations between this and the British Government, which was followed by actual hostilities; but after these obstructions were removed, and peace and mutual harmony restored, the succeeding Executive, relying upon the soundness of the principle upon which it was founded, again introduced to the consideration of Congress (to use his own language) "the comprehensive scheme of roads and canals."

President Madison, in his annual message of the 3d of December, 1816, immediately on the restoration of peace, in enumerating the objects of general interest, says: "I particularly solicit the attention of Congress to the expediency of exercising their existing powers, and, when necessary, of resorting to the prescribed modes of enlarging them, in order to effectuate the comprehensive scheme of roads and canals, such as shall have the effect of drawing more closely together every part in the common stock of national prosperity."

It is manifest, from the phraseology of that message, the Executive had direct reference to the comprehensive scheme of roads and canals which had been projected under the preceding administration. This portion of the message was referred to a select committee, who made an enlightened, and it might be added, patriotic report, in which the great valley of the lakes was particularly adverted to as the grand theatre upon which the General Government was destined at no remote period to act a distinguished part in effectuating one of the proudest schemes of internal navigation the world ever beheld. With such high authority before them, the committee felt that they would be justified in recommending the construction of this canal upon the authority of general expediency, as it is undoubtedly an object coming clearly within that class of cases; but, to clear it of all doubt, they have availed themselves of more recent decisions sanctioned by every branch of the Government, that give them metes and bounds of constitutional authority.

When the question of State rights, which had been settled by the famous resolutions of 1798, was re-opened by the introduction of a protective tariff, various and conflicting opinions obtained in different sections of the country in regard to the true limits of the powers conferred on Congress over the subject of internal improvements. Objects similar to those over which Congress had, by common consent, exercised undisturbed jurisdiction, and
on which it had expended vast sums of the public treasure, were now declared out of the pale of its authority.

The necessity which some of the statesmen discovered, of drawing closer than ever the cords of strict construction, in order to defeat the scheme of protection, obliterated or defaced all the ancient landmarks which had hitherto guided the Government in this branch of its duty, and wholly suspended the operation of a system from which the country had already begun to reap some of its richest fruits, and mistified every rule and principle in relation to that branch of federal legislation. The fearful shock which the constitution received from the violence of these political concussions, staked its whole safety upon the event of mutual compromise and concession. An eagerness was manifested on all sides to establish some fixed rules by which the rightful powers of Congress might be judged. At the commencement of the present administration, the present head of the Executive furnished, by way of opinions expressed to both branches of the Legislature, a constitutional vocabulary, which was supposed to be based upon the literal grants of the constitution; the terms which it embraced were intended to afford a criterion by which every individual case might be judged in deciding upon its constitutionality. Those opinions were contained in the annual message of the 7th of December, 1830; on examining which, it will be found that, so far as an object is designed for commercial purposes, it must have a connexion with the foreign commerce of the country. That this was the criterion which was attempted to be established in the message, is abundantly evident from the following short extracts.

After alluding to the uniform practice of the Government in defraying from the public treasure the expense of building light-houses, light-boats, buoys, beacons, and public piers, on all the bays and harbors, as objects connected with the revenue and foreign commerce, it adds:

"As our foreign commerce increased, and was extended into the interior of the country, by the establishment of ports of entry and delivery upon our navigable rivers, the sphere of their expenditures received a correspondent enlargement. Light-houses, beacons, buoys, public piers, and the removal of sand-bars, sawyers, and other partial or temporary impediments in the navigable rivers and harbors, which were embraced in the revenue districts from time to time established by law, were authorized upon the same principle, and the expense defrayed in the same manner."

The same sentiment was expressed more in detail in the veto message of 1832, on the bill making appropriations for the construction of harbors and the improvement of rivers. From this bill the Executive had withheld his signature, for the reason that some of the objects were of a local character. In the message he mentions the classes of cases which he deemed national, and therefore constitutional:

1. Harbors on the seaboard.
2. Navigable rivers below a port of entry.
3. Harbors on navigable rivers and great navigable lakes.

In this classification, a paramount regard is had to the foreign commerce of the country, as ports of entry and delivery are made the ultimate limits to which the navigation of a river may be improved at the expense of the General Government. As the great chain of fresh water seas which separate the territorial possessions of Great Britain and the
United States are frontier waters, and are used as the common highway of both nations for military, naval, and commercial operations; and as upon these lakes and their connecting rivers (which are little less than straits) are constructed, at the expense of the General Government, harbors, custom-houses, ports of entry and delivery, it requires not the effort of argument to establish all the lake improvements as identical in principle with those on the seacoast—at least, in relation to their connexion with foreign commerce; nor can there be any plausible reason assigned why these short connecting rivers, at whose extremes are built, at the public expense, forts, harbors, ship yards, naval depots, ports of entry, and custom-houses, for the public defence and the public revenue, are not as much the objects of national regard as navigable rivers below ports of entry, straits, and bays, upon the Atlantic.

The ultimate utility of this canal is the next proposition which claims consideration, and the committee conceive that it may be established, from every aspect in which it can be presented. Its importance to the Government, in subserving the purposes of military operations both in peace and in war, is a point so universally conceded, that to detail all the uses to which it might be converted would indicate a doubt of its utility.

The Niagara river, around whose stupendous cataract the canal is proposed to be made, is thirty-six miles in length, twenty-seven of which are now navigable for ships of the largest class on the lakes; leaving but nine miles of obstructions in the whole length of the river. The length of the canal required, however, is only seven miles and a half in the shortest route proposed. The river, in its whole length, forms the boundary between the peninsula of Upper Canada and the State of New York. By the construction of the Niagara canal, an uninterrupted line of ship navigation is opened from Detroit to Ogdensburg; and when the Oswego and Hudson ship canal shall have been completed—an event which the vigorous exertions and unparalleled enterprise of the citizens of New York have rendered all but certain—the communication will be extended to the port of New York.

On the banks of the Niagara river, and in the neighborhood of these interesting scenes, were concentrated the military operations of both nations during the late war with Great Britain. At the mouth of the river, on the American side, stands the once impregnable Fort Niagara; on the other side, and opposite extreme of the river, stands the British Fort Erie; near the cataract lies the battle field of Lundy's lane; while, at the foot of the rapids, and opposite the point where the canal is intended to debouch, stand the memorable heights of Queenstown. This section of country formed the principal theatre of the war, and, although many other portions of the frontier were the scenes of brilliant achievements, the centre of action and accumulated strength was established here: here the contending armies, selected from the bravest troops in the world, contended for supremacy; and here, no doubt, in the event of another war, would be concentrated the greatest amount of force and military stores.

A ship communication on the American side, connecting the two lakes, would greatly facilitate and expedite the transportation of soldiers and munitions of war. The efficiency and strength which it would impart to the fleet upon the lakes, form an item of no inconsiderable importance in the estimation of its advantages. The convenience it would extend to the naval operations of the United States in concentrating, in a measure, the strength of both lakes at one point, in case of attack or defence, affords an
advantage of which the American fleet would have eagerly availed itself during the late war. The history of the naval operations on Lake Ontario during that contest, affords a striking proof of the vast importance of the proposed work in a military point of view; and it cannot be doubted, that if a communication between the lakes had then existed, by which the naval force of the United States upon the two lakes could have been concentrated on Lake Ontario, the skill, prowess, and valor of the American fleet would have been conspicuously displayed there, under the command of the gallant officer who was assigned to that important station.

Such a work is the more especially needed since the construction, by the Government of Upper Canada, of the Welland canal, through which ships of one hundred and twenty tons can pass; thus securing to it all the advantages contemplated from the construction of the Niagara canal. The important change which the system of national defence is about to experience, in the substitution of steam batteries and steam ships for the seacoast and lakes, and roads and canals for the land defence, will add greatly to the importance of a more extended system of lake improvements.

A report was submitted to both branches of the Legislature, at their last session, recommending, in a very clear and convincing argument, the expediency of discontinuing, in a measure, the unwieldy and extravagant system of defence by multiplying the number of forts, and of substituting therefor the cheaper and more expeditious mode of defending the country by a more enlarged system of internal navigation. The general efficiency which the use of roads and canals gives to a land force, by increasing the rapidity of movement, is one of the principal reasons assigned by the head of the War Department for recommending the change. Should such a substitution be realized, as is most confidently anticipated, it will form a new era in the military and commercial policy of this country, and especially as it regards the interior and lake frontier.

The extent of frontier, both maritime and inland, is too great to warrant the hope that the United States will ever be able to defend them by a system of fortification. To guard every point on our frontier with the guns of a regularly constructed fortification, would swell the military expenses of the Government to an inconceivable amount; besides that, it would require the constant service of more troops to man them than would be compatible with the pacific and wise policy of the Government. Such is the rapidity with which an army, with their munitions, can be transported along the Atlantic coast, under the present state of the system of internal navigation and intercourse, imperfect as it is, that it requires but one-fourth of the time to transfer an army from one point to another, upon the line of the seacoast, that it did in former times.

In the same report of the Secretary, it is strongly intimated that no further expense will be incurred in the construction or repairs of forts upon the lake frontier. This report has thus far received the sanction of the Government, and its recommendation acquiesced in. So far, then, as acquiescence is indicative of adoption, the system may be considered as having commenced, and the Government is therefore called upon to provide the substitute; and no project could better answer that end than the one under consideration.

A more able and detailed account of the numerous advantages which the Government would derive from the construction of this canal will be
found in the annexed report of the engineer (marked C) which has already
been referred to. As this is from the pen of one skilled in the science of
strategy, it will command more implicit confidence. The committee, there-
fore, beg leave to adopt it as a part of their report. But, besides the mili-
tary and naval advantages to be secured to the General Government by
the construction of this canal, the internal commerce of the country, the
arts of peace, civilization, and the quiet and harmony of the Federal
Union, are among its most prominent objects.

That internal commerce may flourish in a manner commensurate with
the enterprise and intelligence of the age, it is requisite to establish a cor-
responding system of intercommunication. The important facilities which
a well regulated system of internal navigation will afford to the various
operations of domestic commerce, and of every species of industry, are too
generally known at the present time to require the aid of argument or a
labored illustration; still, in recommending a project of this magnitude,
it will be expected that something will be urged in its defence.

Internal commerce, while it is the fruit of domestic industry, is at the
same time one of its most efficient supporters. By it, the superabundant
products of one climate or section of country may be exchanged for those
of another, whereby the comforts and luxuries of one portion may be
extended to and divided among all.

One of the first and most obvious advantages of a system of internal
navigation is to be found in the advance in value of real estate. The
value of real property is in the compound ratio of its productiveness and
facilities to market. If an agricultural community has cultivated its lands
to a state capable of supplying the home demands, the improvements of
the actual products will become stationary, unless the district is made ac-
cessible to a foreign demand; when this is the case, cultivation may ad-
advance to an indefinite extent, until it arrives at its maximum of improva-
bility, or the foreign demand is supplied.

It is a grand feature in the topography of the United States, that its ter-
ritories are so extensive as to embrace almost every characteristic of cli-
mate, surface, soil, and natural productions. As yet, a small portion of its
vast agricultural surface (a point in comparison to its extended area) has
been brought to its highest state of cultivation. Until within a very few
years, comparatively speaking, agriculture in the United States has been
prosecuted as a means of subsistence, not as a source of luxury and wealth.
It has been practised as an art—a mere occupation—and seldom studied
as a science. This has been, in a great measure (probably wholly) owing
to the want of a ready and profitable market, or convenient avenues for
transportation.

Let the Government once traverse their vast inland agricultural regions
by roads and canals, and an impulse is at once given to agricultural pur-
suits, and a value added by the motive which is created for advancing the
productiveness of the land. In this case, one of the elements of value is
increased by the introduction of the other; accessibility to market gives a
spring to improvement in agriculture, and the latter gives value to the land.
Not only is the value of land advanced, but every kind of produce, whether
of raw or manufactured materials.

The history of the political economy and the improvements in England
and America, for the last sixty years, furnishes an astounding proof of this
proposition. That the construction of artificial roads and canals is the only means of developing the entire wealth and energies of a nation, may be abundantly established by comparing England, as she now is, with what she was seventy years ago; and by contemplating, for a moment, the rapid and unparalleled advances which the United States has made in population, wealth, and every species of industry. The Hudson and Erie canal, in New York, and the Erie and Ohio canal, in Ohio, have done more to advance the population, wealth, and enterprise of the western States than all other causes combined; nor will it be doubted that they have been the efficient cause of not only increasing the value of the public lands, but of contributing to the unparalleled rapidity of sales. This result has been produced in two ways: by rendering the means of emigration cheap and convenient, and by opening a market for the exportation of produce.

It is the first duty of every nation, as well as for its interest, to afford its citizens, by every means in its power, the facilities for the acquisition of the conveniences of life, and even the means of acquiring wealth; for the wealth and happiness of every nation are but the aggregate wealth and happiness of its people: so that every measure which is calculated to promote the welfare and happiness of individual communities, a wise Government will be willing and ready to adopt. The intelligence, the enterprise, and the industry of the American people, and the success and permanence of their happy form of government, require the provision of every possible facility for domestic intercourse, and a liberal and extended system of intercommunication. The opportunity afforded by an efficient internal commerce, for a reciprocal interchange of interest, sympathy, and good offices, and the amalgamation of habits, purposes, and moral feeling among all and every class of its citizens, afford the greatest security to the harmony and constitution of the Federal Union, and the moral elevation of the character of the people. By such a policy, every State, and every portion of country or climate, is made productive, whether hill or vale, mountain or glen; all are made subservient to human comfort and enterprise. It opens new resources of individual and national wealth; by it, the granite mountains of the east may exchange their bulky products for the gold of the south; and the grazing summits of the north may exchange commodities with the cotton flats of the gulf; while the alluvial valleys of the lakes and the Mississippi can furnish all with their rich abundance of bread-stuffs; and the whole Union can appeal to the tops of its mountains for lumber, and to their bowels for ores.

There are vast regions of unimproved lands, even in the immediate neighborhood of the most populous cities, which are now considered unproductive and valueless; from which, if there were proper avenues of exportation, they would become inexhaustible treasures of wealth. The mighty chain of the Appalachian range, the Green mountains of Vermont, the snowy peaks of New Hampshire, and the lesser elevations of the Ozark, are all so many depositories of wealth: all abound, more or less, in minerals, marble, and granite; articles which will increase in value, according to their accessibility to market.

There is no project, of equal magnitude, that would produce equal results with the one under consideration. The region of country which immediately contributes to the commerce of the lakes and their tributaries, embraces an area of nearly 170,000 square miles. The face of the country, the quality of
the soil, and the character of the climate, are such as to render it capable of sustaining a population, agricultural and manufacturing, as dense as that of any other equal portion of the globe. While this area numbers less than two millions of inhabitants, by comparing it with equal and similar sections of Europe, or other parts of the globe, it is capable of sustaining a population of 25,000,000. With a surface that offers but few obstructions to the pursuits of agriculture, a climate temperate and healthy, and a soil fitted for the most abundant growth of every species of produce common to the climate, with an hydraulic power ample for the most improved state of its manufacturing interests, add to these its own internal avenues of intercommunication in its lakes, roads, creeks, and bays, and it needs nothing but an outlet to a more extensive natural navigation to make it an empire of itself.

Let it not be objected to the construction of this canal, that the Erie canal affords every facility for the exportation of all the surplus productions of this valley. In the present imperfect state of cultivation, that country furnishes nearly the quantum of produce which that canal is capable of admitting through its limited channel. It was stated in a official report of the commissioners of that canal, in 1834, that from the 20th of April to the 1st of September of that year, about 13,000 boats and floats passed Alexander's dock, west of Schenectady, which would make a lockage of every fifteen minutes, day and night, including Sundays; and that after the 1st of September to the close of the navigation, a boat had passed every twelve minutes. If, therefore, in the infancy of western commerce and western improvement, there is such a mighty rush of produce as almost to block up the passage, what may be expected in a more advanced stage?

Hitherto, the valley of these lakes, and indeed all the northwestern States, have improved and progressed in cultivation, only as the necessity for domestic comforts has propelled them forward; at least, such has been the fact until within the last ten years. Agriculture has been hurried and superficial, aiming to attain no higher office than a preservation of the natural productions of the soil; and the system of manufacturing can hardly be said to have had a beginning. Without any aid by means of extending the avenue of navigation to domestic commerce, within ten years, or less, if their growth in population and wealth increases and flourishes in the same simple ratio as it has for the last ten years, to say nothing of the rapidly swelling commerce of the single State of New York, the Erie canal will be wholly inadequate to the conveyance of this immense wealth.

It is unnecessary to indulge the eye of fancy in tracing the vista of future times, for the purpose of speculating upon the increase of population in the older States, from circumstances as yet undeveloped. If this were permitted, we might gratify the imagination with the most splendid results of new schemes and new developments of wealth and national grandeur, in those very regions where enterprise and the arts have for years appeared stationary. We should see that those States are at an immeasurable distance from their maximum density in population. It is sufficient for the present object to measure the immediate and magic growth in population and resources of that interesting country, with which this work is more directly connected.

It has been said that the country, comprising properly the valley of the lakes, contains an area of 170,000 square miles. By a comparative view,
it is found to contain 50,000 square miles more than all the British possessions in Europe, while its population is 22,000,000 less. Of the 24,000,000 English, Irish, Scotch, Manks, and natives of her other islands, two-thirds are said to be engaged in manufactures and commerce, leaving 9,000,000 to till the earth.

It is but reasonable to compute the number of like inhabitants which this valley might sustain, after deducting the water surface, at 8,000,000—the least estimate, admitting the increase in productions to equal that of population—and it gives the amount of four times the quantity of raw material for exportation. In the year 1832, the European island of Britain exported the enormous sum of $304,000,000 of raw material and fabrics, of which $260,000,000 were of domestic manufactures, making all allowance for the superior advantages of British commerce and manufactures over interior America, from their Atlantic frontier, and her greater accessibility to her continental consumers, and we might set the amount of domestic articles of export of this valley at the sum of $170,000,000 that might be produced, if every facility of navigation were afforded. It is manifest that this enormous amount of domestic produce must require greater facilities for exportation than can be afforded by the canals and railroads already in existence, or any that could be constructed on their present limited scale.

The above estimates and calculations have been confined to that section of the United States which may be denominated the valley proper of the lakes. But this is but a portion, perhaps the smaller, of the immense territory of country which owes tribute to its commerce. When every section of country which, by natural and artificial communication, is now and must eventually be interested in its commerce, not incidentally but directly, is included, they will swell the area already stated to 290,000 square miles—an area equaling that of France and the island of Great Britain, which, together, sustain a population of upwards of 50,000,000.

The communication already effected between the Ohio river and Lake Erie, by the Ohio canal, and the one in successful progress of completion between the same lake and the navigable waters of the Wabash, as, also, the one commenced to connect Lake Michigan with the Mississippi, through the Illinois, will open to the commerce of the lakes the extensive alluvial regions of the Ohio, Missouri, and Mississippi, and, by the last mentioned river, the cotton and sugar plantations of the southern States, and the rich mines of the upper Mississippi. In short, there is no section of the Union that is not directly interested in the commerce of these internal seas; and a cursory view of the geography of this vast expanse of interior America must convince every reflecting mind of the primary importance of a ship communication from the lakes to the ocean, not only for the exportation of the agricultural productions of the country, but to develop the new and untold resources that have not yet caught the vigilant eye of the American operator.

It is to the extensive system of internal communication, so wisely planned and faithfully supported, that Great Britain is indebted for her unparalleled prosperity and unrivalled system of home industry. Notwithstanding the greater island of Britain, comprised in an area of 81,000 square miles, is surrounded on every side by the broad expanse of the Atlantic, indented with bays and harbors, and intersected by numerous natural avenues of internal navigation, she has already constructed 1,500 miles of canals, and 400
miles of rail-roads. By these natural and artificial means, she has rendered accessible, both to her foreign and domestic commerce, all her agricultural and manufacturing districts, as well as all the important localities of her rich and valuable mines, rocks, and earths, all of which contribute their share to the industry and wealth of the country. In this consists, mainly, the wisdom of her policy. There is nothing a Government can do, that can so readily and effectually develop the entire wealth of a country, natural and artificial, as creating and supporting a liberal scheme of internal improvement. A great portion of the northwestern States are underlaid with rich mineral ores and, perhaps, earths, which, from their bulk and weight, cannot be brought into market; they must, therefore, be unproductive until facilities are afforded for exportation. When this shall be done, much employment will be provided for the American operator, and an incalculable amount added to the capital and wealth of the nation. Surely, such considerations and motives should stimulate to greater efficiency in the scheme of internal improvements. Were it permitted here to indulge in the language of prophecy, it would require no stretch of fancy to summon to the ports of Oswego, Lewiston, Buffalo, Cleaveland, Detroit, and Chicago, at no distant period, the ships of foreign nations laden with the rich products of Asia and Europe.

Let the Government establish a system of navigation commensurate with the growing importance of the lake commerce, and what might now appear the fabrications of fancy, would, and must, soon prove a sublime reality. That Great Britain does not consider this a mere vision, may be gathered from her gigantic scheme of navigation already projected, and nearly completed, which will give her a ship navigation from the Gulf of St. Lawrence to the mouth of the Thames, in the upper province. The Canadians have already constructed the Welland canal, which completes a ship navigation from Malden to Kingston; and the Rideau canal, which connects the Ontario with the Ottawa river; and they have now under contemplation, and will certainly complete, the entire communication with the impregnable city of Quebec.

The Canadas have not unimproved the favorable opportunities which peace and plenty have afforded them to prepare for war; nor have they failed to avail themselves of every means, physical and moral, so to improve their own navigation as to intercept, in a measure, the commerce of the western States, and draw it into their own ports of Montreal and Quebec. For a more minute and able account of the Canadian improvements and commerce, reference may be had to the annexed document (marked C.) The construction of this canal is a matter of especial interest to the commerce of the western and northwestern States, in the actual saving of expense of transportation.

Both theory and experiment have long since established the fact, that, in canal navigation, the expense of transportation is in the inverse ratio of the capacity of the vessel in which the commodity is transported. It is matter of economy, therefore, in the construction of canals, to give them that width and depth which will enable them to float the largest vessels the nature of the case will admit. A statistical account of the comparative cost of transporting merchandise from Syracuse to Detroit, by the way of Oswego and the Welland canal, and by the way of the canal through Buffalo, is sufficient to establish the truth of this proposition. In transporting goods
from New York to Detroit, the Oswego route cuts off nearly two hundred miles of the Erie canal route, and substitutes the lake vessels for the canal boat.

During the year 1835 about 25,000 tons of merchandise were shipped for the west from the city of New York, which passed through the ports of Buffalo and Oswego; of this amount, 20,000 tons passed Buffalo, and 5,000 tons Oswego. An estimate is made by a gentleman who furnished the information as follows: "Suppose the whole to have passed either port, it is ascertained that the different rates, charged from the different ports, would have left the result in favor of the port of Oswego, as copied from that report, as follows:

| Freight of 25,000 tons via Buffalo | - | - | $600,000 |
| Freight of 25,000 tons via Oswego | - | - | 335,000 |

Amount saved by the Oswego route - - - 265,000

in the transportation of merchandise from New York to Cleaveland, Ohio, in one year."

The contemplated dimensions of this splendid work are thus set forth by Captain Williams:

"The project under consideration contemplates a ship or steamboat canal; and we assume, for dimensions of locks and breadth of canal, proportions to render the work a means of transportation for the largest class of steamboats or sail vessels navigating, or that may navigate, Lakes Erie and Ontario.

"We assume, for the length of lock, two hundred feet, breadth fifty feet, the width of canal one hundred and ten feet at the surface of the water, and depth ten feet. The locks will have a lift varying with circumstances, and generally not exceeding ten feet. It is obvious that the waters to supply the exigencies of lockage, &c. will be drawn from the Niagara river; the plane of the bottom of canal at its summit-level intersecting it at ten feet below its minimum elevation."

The cost of construction will vary from two million to four million dollars, according to the location and manner of extending the works; this, however, is but a small sum compared with the importance of the work: it would save to the western States annually, on the transportation of merchandise alone, more than half its cost, and the benefits resulting from the increased value of public and private lands would be immense. In the manner of constructing this canal, the committee have adopted the plan recommended by the Honorable John C. Calhoun while Secretary of War, leaving its execution to the War Department, under the direction of the President. Upon this subject, Mr. Calhoun uses the following language: "Should Congress think proper to commence a system of roads and canals, for the more complete defence of the United States, the disbursements of the sums appropriated for this purpose might be made by the Department of War, under the direction of the President. Where incorporated companies are already formed, or the road commenced under the superintendence of a State, it would be, perhaps, advisable to direct a subscription on the part of the United States, on such terms and conditions as might be thought proper. In other cases, and where the army cannot be made to execute it, the work ought to be done by contract, under the superinten-
dence and inspection of officers of the engineer corps, to be detailed for that purpose.”

In all the considerations and motives which have occurred to the committee, some of which they have attempted briefly to set forth, they have felt a hearty concurrence in the frequent recommendations of this project, and would, therefore, respectfully ask leave to report a bill.

A.

War Department, April 14, 1836.

Sir: I transmit, herewith, a report of the Topographical Bureau, prepared in obedience to a resolution of the House of Representatives of the 3d ultimo, calling for information respecting the construction of a ship canal, to connect the waters of Lake Erie and Lake Ontario.

Very respectfully, your most obedient servant,

LEWIS CASS.

Hon. James K. Polk,
Speaker of the House of Representatives.

Topographical Bureau,
Washington, April 13, 1836.

Sir: I have the honor to submit, herewith, a copy of the report, plan, and estimates for the construction of a ship canal, to connect the waters of Lake Erie and Lake Ontario, made during the year 1835, under the direction of Captain W. G. Williams, United States topographical engineer, and called for by a resolution of the House of Representatives of the 3d of February last.

I am, very respectfully, sir, your obedient servant,

JOHN J. ABERT,
Lieut. Col. Top. Engineers.

Hon. Lewis Cass,
Secretary of War.

Report of a survey around the falls of Niagara, with a view to the construction of a ship canal, made during the year 1835, under the direction of Captain W. G. Williams, of the United States topographical engineers.

Washington, March 17, 1836.

Lieut. Col. J. J. Abert,
United States Topographical Engineer:

Sir: By the letter from the Topographical Bureau, under date of the 14th of April, 1835, I was ordered to repair to Utica, in the State of New York, and advise with the Honorable Mr. Beardsley, on the subject of a projected ship canal around the falls of Niagara; for a survey of which, application had been made to the department by certain gentlemen of influence in the State of New York.
My instructions require that my maps and report, relating to a survey on Delaware river, should previously be submitted to the bureau; this accomplished, I repaired to Utica, and presented myself to Mr. Beardsley, who referred me to the honorable Judge Turrill, of Oswego, for information in regard to the project contemplated. From Oswego, I was accompanied by the latter gentleman and Mr. McWhorter, also of that place, to Lewiston, where arrangements in regard to the expenditures incidental to the survey were concluded.

Lieutenants Drayton and Reed having reported to me, according to instructions, with the instruments necessary to accomplish the objects of the survey, I immediately commenced operations; the details of which, with results, and all that relate thereto, are embraced in the following report:

In order that the mind may be more prepared to comprehend, at a glance, the various details in regard to several lines of survey therein referred to, I think it proper to premise a cursory topographical sketch of the vicinity in which our operations were conducted.

**Topographical sketch.**

The section of country to which the project of the Niagara ship canal relates, is perhaps the most interesting on the American continent, whether we consider its geological formation, the incidents of a frontier war, still fresh in the memory of every American, or its peculiar and magnificent characteristic, the cataract, whose fame has reached the uttermost bounds of the civilized world.

The great waters of our northwestern possessions, covering an area of 150,000 square miles, bounded by a development of coast, belonging to the United States, of 3,294 miles, and of the British colonial possessions, of 2,425 miles, are at length discharged through the narrow channel of the Niagara. It is from the head of this river, at the outlet of Lake Erie, to its termination on Lake Ontario, that the question of an artificial navigation arises, and forms the subject of the present report; and, if only to achieve a conquest over the mightiest of nature's works involves a sentiment of sublimity, the feeling will not be impaired by the reflection that the conquest may be easily wrought; and, when achieved, shall be the means of extending civilization, and promoting the social happiness of a large proportion of our country.

Indeed, it cannot fail to excite astonishment, when the reflection is once led to the subject, that, up to this epoch of an age resplendent with improvements in all that relates to the melioration of commerce and the advancement of civilization, this work, upon our own soil, and on a scale commensurate with its importance, should still remain to be executed. It needs not the aid of demonstration to prove its utility. It is one of those objects that strike us with instinctive conviction, and we are intuitively impelled to the belief of its comprehensive usefulness, even if abstraction be made of every thing but the general position; that it would connect two bodies of water, leading to the most remote regions, and capable of bearing upon their deep and expansive bosoms the navies of the world, in five seas, which are yet essentially separated, by reference to the scale of commercial enterprise that legitimately belongs to such a vast extent of geographical limit.

The Niagara river flows out of Lake Erie, in a direction nearly north,
and separates in its whole course the United States from the Canadian provinces. It is about three-fourths of a mile wide, at its outlet; between which and Black Rock there are rapids having a current for a short distance of seven miles an hour. The river widens below Black Rock, and continues of an average width of one mile, until it reaches the great falls. The river embraces several islands in its course, the principal of which is Grand island; the rapids commence about one mile above the falls, in which distance is a descent of about fifty-two feet. The great falls are divided by Goat island, and another small island intermediate to this and the American shore. The perpendicular descent is 164 feet on the Canada side, and a few feet more on the American; but the great mass of water passes over the Horse-shoe falls on the Canada side. It has been estimated by Dr. Dwight, that the volume of water descending at this point amounts to 90,000,000 tons per hour.

The development of the curve formed by the edge of the precipice is estimated between three-fourths of a mile and one mile. The distance from the outlet of Lake Erie to the great falls is about twenty-two miles. From this point to Lewiston, about seven miles, the river rushes through a chasm in the Lewiston ridge, whose edges are about 350 feet above the surface of the water; the fall in this distance is about 1031 feet, and thence to Lake Ontario two feet. Just above Lewiston the high ground suddenly ceases, and a descent of 216 feet occurs in a horizontal distance of 1,000 feet, measured on the projection of the line of greatest acclivity to the ridge. This brings us to the plateau of land on which the village is situated; hence a gradual slope characterizes the ground to the edge of Lake Ontario, about six miles, comprising a fall of 121 feet. The features of topography on the opposite side of the Niagara are very similar, from the crest of the mountain at Queenstown heights to the lake.

The ridge appears to have been formerly continuous, and to have formed the southern edge of Lake Ontario, from which the waters have, at distant intervals, receded. This is shown by three distinct berms, generally parallel to the shores of the lake, but which eventually converge towards the Niagara river, between Lewiston and Fort Niagara.

It is evident, also, from the conformation of ground both at the falls and about Lewiston, that the waters of the upper lakes first burst their barriers at this point, and have since receded by degrees, breaking off large fragments from the edge of the precipice over which they have fallen. Even within the memory of man, it is asserted that a sensible difference exists in its configuration; and the fall of the Table Rock in the years 1818 and 1823, may be regarded as an illustration of the process by which this change is being gradually effected. If we may be allowed to speculate on the changes of a remote future, we may imagine prospective eyes to witness a gradual recession of the cataract towards the lake; the crest over which it falls assuming a lower plane, until it eventually sinks to, and becomes an element of, a general slope, over which the great volume of the upper lakes shall flow. The waters of Lake Erie would recede from their existing limits, and their intermediate future outlines would be only indicated by successive berms converging towards the outlet of the Niagara. This convergency of the several berms to the Niagara river, on the southern shore of Ontario, is, I think, a conclusive evidence that this lake once occupied a higher level, and at different periods has occupied different elevations. In tracing these changes, we are insensibly led to the conclusion,
from analogous reasoning, that the levels of the whole chain of lakes will eventually and successively change; that the St. Lawrence river may, in remote ages, have possessed a peculiarity similar to that which characterizes the Niagara; and that a point of time may exist in the vista of futurity when the strait between Erie and Huron, and finally between Huron and Superior, may boast a like phenomenon. In a word, that this will, at length, be worn away by the irresistible waters, and Superior find its way over one continuous and inclined plane to the broad bosom of the Atlantic. At the outlet of the Niagara, at the northeast extremity of Lake Erie, is situated Buffalo. This city, which a few years since might have been regarded as an insignificant village, has now become the principal emporium of the northwestern lakes, and cannot fail to retain its ascendency over any other point upon the lake. Here the Hudson and Erie canal, which has been the source of its prosperity, has its outlet. The growth of Buffalo is an illustration of the advantages of this project, that every comprehension may realize. When we see a flourishing and refined community spring suddenly from the wilderness, we are made sensible, without reference to statistical records, of the amelioration that must be operating in a vast extent of country dependant upon it. It is a monument to art and commerce, that eloquently speaks of extended social happiness, of fields reclaimed from the desert, of industry and talent usefully employed, and of a thousand undefinable benefits to the human race.

The Hudson and Erie canal is conducted from Buffalo, along the margin of the Niagara river, to its intersection with the Tonnewanta creek, a little above its mouth, the creek being raised to the necessary level by means of a dam. The channel of the Tonnewanta is made use of during a distance of eleven miles to Pendleton village; thence to Lockport, about seven miles, the canal passes through deep cutting. At Lockport a fall of sixty feet occurs, which is overcome by five double consecutive locks to the long level; from this point it proceeds in an easterly direction to Troy and Albany, where it debouches into the Hudson river. From Lockport, the line upon which a portion of our survey was conducted diverges northwardly to its termination at the mouth of Eighteen Mile creek.

The great descent at Lockport is occasioned by the Lewiston ridge, which intersects the canal at this point. This steep declivity runs from the Niagara river, above Lewiston, to Lockport, without any intermediate depression worthy of notice. It continues its course thence, in a direction nearly parallel to the lake.

The ridge, as it becomes more remote from the Niagara river, generally becomes more elevated, to the limits to which my survey extended. The whole of this district of country is based upon nearly horizontal strata of lime and sand stone alternating; this exhibits itself most conspicuously in the chasm through which the Niagara flows; although it must be remarked, that localities exhibit discrepancies in regard to this rule, and that on the line of canal from Lockport, west, there is some slight inclination of the strata beneath the horizontal. The first proposition, however, holds as a general geological feature. The slope below the ridge, down to the lakes, appears to consist of an alluvial formation, with a substratum of sand and lime stone. From the foot of the combined locks, at Lockport, to the mouth of the Eighteen Mile creek, which has its rise at this point, the ground is very uneven: at first a considerable descent takes place through
a precipitous gorge for about two miles; thence, a valley with low banks on either side for about five miles and a half; the intermediate distance between this and the mouth of the creek would be a work of considerable difficulty, as there is a rocky bar which circumscribes the outlet. From this point to the mouth of Niagara river, is eighteen miles; from which circumstance the creek derives its name.

From Port Niagara, at the east side of the outlet of Niagara river into the lake, to the head of navigation, is about 7½ miles; the banks of the river in this distance are high and precipitous. The river, from Lewiston to its outlet into the lake, has a rapid current, but is accessible to every description of vessels navigating the lakes. This description comprises the area to which my report will refer. In its agricultural properties, it partakes of the character of this section of the country generally, possessing a rich alluvial soil, favorable to the growth of wheat and every product to which the climate is congenial; but there is one point of view in which this district offers advantages in a peculiar degree—namely, its manufacturing facilities. By way of illustration, we may regard the lake as being dammed by the Lewiston ridge, presenting a head of water of three hundred and twenty feet. This may be made available at almost any point of the ridge, and along the margin of the Niagara river, at a comparatively inconsiderable expense, by reference to the hydraulic power it would afford. My views in this respect will be further elucidated in the course of my report. I now proceed to details immediately referring to the plans and estimates of our survey.

Plan of canal.

The project under consideration contemplates a ship or steamboat canal; and we assume, for dimensions of locks and breadth of canal, proportions to render the work a means of transportation for the larger class of steamboats or sail vessels navigating, or that may navigate, Lakes Erie and Ontario.

We assume for the length oflock two hundred feet, breadth fifty feet, the width of canal one hundred and ten feet at the surface of the water, and depth ten feet. The locks will have a lift varying with circumstances, and generally not exceeding ten feet. It is obvious that the waters to supply the exigencies of lockage, &c., will be drawn from the Niagara river; the plane of the bottom of canal at its summit-level intersecting it at ten feet below its minimum elevation.

My plan principally refers to a system of double locks to make the descent at Lewiston ridge; but an estimate for single locks for that object is embraced in my report. Map No. 2 will exhibit, on a horizontal scale of thirty-six inches to one mile, the descent by double locks, comprising an artificial harbor at Lewiston.

From the harbor to the outlet of canal on Niagara river, two modifications are shown on the map: one terminating at the steamboat wharf, and the other at the ferry. Their expense may be regarded in a general estimate as nearly alike.

The line A B, debouching at a lower point of the river, although of greater development, would more generally be approved of, as avoiding an ascent against the current, for ascending vessels, of eleven hundred yards. I have roughly estimated also the cost of a plan to descend the ridge by
single locks, having an intermediate basin between each lock. It is found to be more expensive than the descent by double locks, by reference to their respective properties of speedy transit. This arises from the great cost of the outer or sustaining wall, and the advantage to economy of diminishing the length of line in its application to the side slope of the mountain; as this must be obvious, I have not introduced the estimate into my report.

In regard to the route of the contemplated canal, there have been different opinions; and several have been designated, having at least as much reference to local interest as to the general advantage of the project. Above the rest, and such as appear deserving of notice, are:

A line beginning at Porter's store-house, near old Fort Schlosser, passing by Fort Grey, descending the ridge at that point, and debouching at Lewiston: this is the shortest line surveyed.

A line beginning as above, passing by Manchester village, and intersecting the preceding line: this has least deep cutting.

A line up the valley of Gill creek, descending the ridge through a depression at the head of Fish creek, and terminating on Lake Ontario, at the mouth of Mill creek: this location possesses advantages of a military character, by reference to the contiguity of the shore of a foreign power.

Local modifications of the above lines.

A line ascending the Cayuga creek, crossing the Lewiston ridge near Pekin, and debouching at the mouth of Twelve Mile creek.

A line debouching at the mouth of Tonnewanta creek, ascending the same to Pendleton village, descending at Lockport into Eighteen Mile creek, and keeping the valley to its mouth.

For the present, however, we shall confine ourselves to the investigation of the project by its shortest route, and eventually compare it with others to be hereafter referred to.

General description of route line No. 1.

Beginning at a point on the Niagara river denominated Porter's store-house, and near old Fort Schlosser, the line of levels crosses Gill creek at a distance of half a mile above its mouth, and is carried nearly in a straight line to the head of Bloody run; the ground over which they pass, after the first mile, is generally swampy, although somewhat elevated; and for the first four miles, as determined by careful borings, no rock worthy of mention will occur, excepting a small portion at Gill creek; the soil is, however, by no means easy of excavation, being, as illustrated by the profiles, in some parts of a tenacious character; the ground is swampy, covered with a heavy growth of timber, and will require draining.

From this point, the valley of Bloody run is pursued to within a short distance of the point where the run falls over the precipice into the Niagara river, at a small distance from the chasm known as the Devil's hole, three and a half miles below the great falls.

The levels now pass over unequal ground, but slightly elevated, however, until they reach the brow of the Lewiston ridge. This portion of the line was run very near the precipitous brink of the Niagara river, and only involves a prism of rock cutting of inconsiderable depth.

Until we arrive at Fort Grey, no obstacle of importance intervenes; in-
deed, none but the most commonplace circumstances of canal construction present themselves. It is from this point to the debouch of the project into the Niagara river that difficulties of a serious character may be apprehended.

From the brow of the ridge the lines of level were carried obliquely to the line of greatest acclivity of the ascent, falling in such proportion to the measured horizontal distance, as to render them conformable to the projected dimensions of the locks and basins, with the required lift for each lock. These data furnish the means of projecting a flight of double consecutive locks to the foot of the ridge, or a line of single locks, with intermediate basins; involving in either case a descent of $319 \frac{1}{2}$ feet from the bottom of the canal at Fort Grey to the corresponding surface at its intersection, ten feet below the surface in Niagara river.

As the slope of the mountain may, in a general view, be regarded as uniform, and under an angle too great to admit of the location of the locks on a line approximating to that of greatest acclivity, it would be necessary, by means of excavation and embankment, to prepare a berm for their reception.

Our supposition involves a heavy mass of side cutting, so as to establish the exterior walls of the locks upon a well consolidated foundation; by this means the whole section of the locks and basins would possess a homogeneous basis, and have their stability insured.

This excavation comprehends the space to be occupied by the sustaining and interior walls; and in case the double locks should have their similar surfaces in the same horizontal plane, the breadth of their dividing walls would be comprised in the section.

In estimating the width of the berm necessary to the emplacement of the locks, we must regard as elements the strength and solidity or thickness necessary to their walls, to prevent lateral slides, or their overthrow by the pressure of water against them from within; and the space necessary to the working of the locks, which must of course occupy the upper surface of the walls. Precautions must be observed, to destroy the possibility of a thread of water from leakage or filtration, wearing itself a passage beneath the locks, throughout portions of the descent, and thereby acquiring sufficient head to act upon the foundations. In a system of consecutive locks of such extent as that before us, this principle of hydrostatics should be well considered.

Too much care cannot be observed in establishing the permanence and solidity of the work, and every applicable element of knowledge, theoretical as well as practical, must be brought to bear upon the subject, previously to a final adjustment of the plans.

In regard to experience, the realm of practical science does not exhibit a similar construction, and its light will therefore be but partially displayed. To compensate for this deficiency, abstract and general propositions of physical research must be carefully investigated, in reference to such modifications as may be involved, differing from those of works of a similar character already constructed.

This is a remark, it is true, that may be applied to every new project in some degree, but its emphasis is peculiar in regard to the one in question: in ordinary cases, great masses of water find their way to lower levels, by gradual descent; and the plans of the engineer to surmount such obstacles have followed them up and vanquished them in detail. But at Niagara,
Nature has concentrated her powers, and by one stupendous effort has seemed to bid defiance to the art of man. The records of science do not exhibit an instance in which so great a fall is overcome in so small a distance, not even in a degree that will admit of comparison, much less when it is a question of a project which, in the grandeur of its proportions, has no example.

It may be regarded as a national monument of art, from its general usefulness to the country; and although no pains be taken to render the project magnificent, in its very simplicity it will be so, and in congeniality with the stupendous obstacle it is intended to subdue.

Its effect will be grand and imposing in a vastly greater degree than in other, even more expensive, works; because it differs from them generally in possessing a concentration of human art, human industry, and physical means, applied to a single point.

As the line of levels descends to the foot of the ridge, it gradually winds round until its horizontal projection becomes nearly parallel to its location at the beginning of the descent.

In order to obtain the direction which leads it to the most favorable point of debouch on the Niagara river, for the present modification of our project I have planned a basin allowing sufficient room for the largest vessel admissible to the locks to turn and assume its change of course. At this point the flight of locks would terminate in an extensive artificial harbor, comprising an area of about 114 acres, and elevated 120 feet above the level of the Niagara river; it will be formed between the ridge on which the principal street of Lewiston is situated and the main ridge, possessing a mean depth of fourteen feet. The embankment necessary to back the water would be very inconsiderable.

It is an element forming a very important feature in our project, and would have the advantage of serving as a part of the canal, obviating a mass of expensive construction, and at the same time afford very essential accommodation to trade; indeed, a basin of this kind would be almost necessary, by reference to the very contracted space which can be made available for the purpose of commercial transactions in the vicinity of the debouch, in connexion with the precipitous banks of the river, and the violence of the current; moreover, the prism of water drawn from this reservoir, to supply the descent of the locks to the termination of the project, would be scarcely perceptible. This would render the descent from the harbor to the outlet independent, for its immediate exigencies, of the supply of water to be drawn through the upper flight of locks from the summit-level of the project.

At both extremities of the line above described, there is a navigable passage for vessels drawing even more than ten feet water into the lakes, namely, from Porter's store-house into Lake Erie, and from Lewistone to Lake Ontario.

To confirm the assurance of this fact, I ordered a reconnoissance between Schlosser's and the outlet to Lake Erie. Numerous soundings were taken by Lieutenant Drayton, from whose report I find there is no depth in the channel less than fourteen feet.

It is a matter of notoriety that there is water at the outlet of Niagara into Lake Ontario for vessels of any ordinary capacity. It was therefore deemed unnecessary to carry the investigation to that point.

On the whole extent of this route may be procured fine building mate-
rial for the locks, of every description: limestone is found in abundance, 
and hydraulic cement may be procured at a low rate.

These facts being premised, I proceed to the estimative details.

Line No. 1.—See map and profile.

For the purpose of draining the canal when necessary for repairing it, and because there is a rise and fall, dependant upon winds and seasons, in the Niagara river, a guard and regulating lock at the outlet of the canal is deemed expedient. Our observations during the time the survey was executing only detected a difference of level of five inches. By information, however, obtained on the ground, it appears to be considerably greater; and, according to the statement of Mr. Geddes, an engineer well acquainted with the topographical facts connected with this section of the country, it varies to the amount of three feet, rising during the prevalence of certain violent winds, but seldom being depressed below the ordinary surface. Our levels refer to the lowest observed plane of its surface, at a time when the level is stated to have been at a minimum.

The lock walls, therefore, must be elevated four feet above the minimum level of the river. They will have a thickness of four feet at top, and eight feet at the base. The dividing wall of lock will have a thickness of twelve feet. The estimate is as follows:

6,150.8 cubic yards of masonry for side walls, bottom of lock, &c., at 5.5 - - - - $33,829 40
For mitre sills, hollow quoins, at 14.2 - - - - 8,657 00
Lock gates, with incidental work - - - - 1,500 00
200 running feet of walling in river, 444 cubic yards, at 2.5 - - 1,110 00
Coffer-dam, to protect the foundation of the lock - - - - 6,666 00
Contingencies - - - - 5,176 24

Total - - - - $56,938 64

The plan to which this estimate refers is an element common to all the experimental lines diverging from Porter's store-house, and will be carried into the expenses of each. It embraces the idea of double locks, with such additional work as may contribute to a reasonable accommodation to trade. At a termination of this kind, many expensive additions may be suggested, not absolutely necessary to the primary object of the undertaking.

B.

Comparison of routes.

The annexed summary of cost, applied to its respective experimental location, in connexion with the statement in regard to distances, enables the mind to form, at a glance, the comparison between them, by reference to these elements. But in order that a judicious selection may be made, other considerations necessarily become involved in the question; and these, in a great measure, furnish the medium through which their properties are to be adjudged.
As a commercial scheme exclusively, with the most rigorous economy as the governing principle, even to the prejudice of convenience of trade, and barely to effect the object of connexion between the lakes, for a large class of vessels, the first plan referred to in the annexed statement, would, of course, be adopted.

If this scheme, however, involved the idea of an expenditure proportionate to the character of the enterprise, and importance of the results that may be justly ascribed to it, we would, without hesitation, recommend the second, namely: the descent by double locks; for it is evident, that in the first proposition, a great delay would frequently occur in the passage of vessels; an evil that would accumulate with the increase of trade, and result eventually in the necessity of constructing another independent flight of locks. This, by a comparison of estimates, is shown to be inexpedient.

But when the question passes beyond the limit of commercial operations merely, and enters the sphere of political expediency, new considerations are involved, tending, very generally, to embarrass a decision. It was this reflection that induced me to survey the line No. 2, as I have already explained, in presenting the estimate of its expense. In doing so, moreover, I, perhaps, have said all that is necessary, in regard to its advantage over the preceding line, No. 1, and its modification.

In discussing the merits of the modification to line No. 2, the question is resolved into the following proposition: whether it be desirable to expend an additional million of dollars, as a measure of precaution, to enable the work to reach a point E, (map No. 1.) whence it could easily be conducted, in case it should be deemed advisable, to the lower lake, and be, in its whole development, without the pale of annoyance from an enemy. It is for those who should determine to execute the work to judge of this expediency.

We would call the attention, however, to the character of permanence and durability that must belong to such a project, and suggest that the future interests of the country are to be, in a measure, dependant upon it, and that it would prove a humiliating and grievous reflection to after-times, should the work be suddenly neutralized in its advantages, at the very moment when its facilities ought to be most sensibly useful to the nation.

To develop all the considerations involved in this comparison would exactly more time than I am permitted to devote to it. It is sufficient to show, that a route possessing the property of security from insult is practicable, and at a reasonable cost to the nation.

But the comparison between the Lockport route, and the one I have just alluded to, may be referred to the common standard of military expediency.

It is seen, by reference to the foregoing statement of costs and lengths of location, that the route by line No. 2 has the advantage, in point of economy, to the amount of $296,743 over that by Lockport. We see, likewise, by reference to this statement, and the respective maps accompanying my report, that it possesses the advantage of being a shorter and less embarrassed line of communication.

Its supposed advantages have been predicated upon the belief that it offered a more retired line of communication from foreign aggression; and this is a maxim that ought not to be overlooked: but in the present instance it admits of modification, owing to the peculiar features of topography
characterizing the vicinity, to this portion of the line of contact of the two countries.

By reference to the map, it will be seen that from Porter's store-house to the end of line No. 2, on Lake Ontario, our shores are precipitous, and offer a difficult barrier in any part to the landing of a hostile force; and that with the precaution growing out, as it were, of the project, should it be executed, as explained in the accompanying memoir, the line would be rendered inaccessible.

We are impressed with the belief that we should avail ourselves of the topography of the frontier, and regarding the Niagara river, from Porter's store-house to Lake Ontario as a natural entrenchment, concentrate our resources there, as furnishing the strongest accessorial advantages to resist invasion, and at the same time enable us promptly to assume the attitude of aggression under auspicious circumstances, and to the achievement of the most important results.

By retiring the line, we abandon, in a measure, our strong ground of resistance, and throw it from beneath the shelter of our military establishment, already constructed at the mouth of the Niagara river, by which the debouch of line No. 2 would be sustained.

It is seen, also, in comparing the two routes, that one portion of navigation would be common between them, namely, that between Lake Erie and the mouth of Tonnewanta creek; and this portion is unquestionably the most accessible part of the line to a hostile descent from the opposite shore.

In addition to these considerations, the project of line No. 2 supposes an excellent harbor at its termination on Lake Ontario, while that projected at the mouth of the Eighteen Mile creek is comparatively inefficient; observing, at the same time, that the rocky bar circumscribing its mouth must ever prove an obstacle to its improvement.

Moreover, the contiguity of the inlet of the Niagara river to the mouth of Four Mile creek, our projected termination, is a great desideratum, as vessels in stress of weather may run, without apprehension, for the harbor there, in the assurance that, in case of difficulty to effect an entrance, they will be at least in the vicinity of a harbor of easy access, where they may take refuge until more seasonable weather.

It must be noticed, in regard to this subject, that any artificial harbor on this shore of the lake would be difficult of access in very heavy storms, owing to the danger of concussion against the sides of the piers; an inconvenience I have often noticed at the celebrated artificial harbor of Ramsgate, in Kent, England.

Superadded to the objections already stated, in regard to the route by Lockport, there is one important circumstance in the inconvenience and delay that the navigation on the present Erie canal would be subjected to, and we think that the loss sustained by it would scarcely be compensated by the diminution in the expense of our estimate, by the deduction we have made, in the assumption that the excavation for our present project would be diminished by the amount of that already executed for the Erie canal.

In the supposition of an entire new location, the estimate would, of course, be greatly augmented, and the difference of cost in favor of line No. 2 proportionally increased.

It is to be noticed in the line No. 2, that a portion of its development has a diminished breadth. This advantage, for the economy of excavation,
could not be adopted on the Lockport route. In the first case, business
would be divided between the two canals; but in the other, it would neces-
sarily be concentrated, and embarrass the operations of trade, unless it
should possess a breadth equal to that we have projected.
In order to fully prepare the undertaking for the contingency of a rup-
ture with our Canada neighbors, it would be necessary to pass the rapids
of Black Rock, by a short cut and a few feet of lockage on the American
shore. As the channel of the Niagara river is, in this part, on the Canada
side, this modification applies, equally, to either route compared, and
may remain as an item for future consideration, the expense being regarded
as inconsiderable.

A plan, indeed, has occurred to me by which the whole of this accessible
portion between Buffalo and the mouth of Tonnewanta creek might be
somewhat more retired and more easily protected. The expense of this
work would be, of course, somewhat greater. Let the canal commence at
Buffalo, and carry the level of the lake, as nearly as may be admissible,
along the valley of the Niagara river, as far retired from its margin as
the nature of the topography will permit, to the mouth of Gill creek, ascen-
ding the valley of this stream to the head of Fish creek, as per line
No. 2, and thence descending to Lake Ontario. By this means we save a
very considerable prism of rock excavation, and thus compensate, in some
measure, for the greater length of the canal. This prism would be propor-
tionate to the elevation that Lake Erie may possess over the level of Niagara
river, at our point of beginning, near Porter's store-house.

The plans, maps, and profiles, accompanying the present report, are as
follows:

General topographical map, Lewiston line—No. 1.
Plan of location for descent of ridge, artificial harbor, and section of
lock—No. 2.
General topographical map, Lockport line—No. 3.
Map of harbor at mouth of Eighteen Mile creek—No. 4.
Profile line, No. 1.
Profile line, No. 2.
Profile line, No. 3.
Profile line, No. 4.
Profile line, No. 5.

These comprise all the various data obtained in the course of our ex-
amination; and will, I hope, when collated with my report, satisfactorily
illustrate the subject under consideration.

In the course of my duty I have been assisted in the field, and in the
various incidental calculations connected with the survey, by Lieutenant
T. F. Drayton, and Lieutenant J. G. Reed, United States army; and I do
not regard it as an empty form to express to them, through the bureau, my
acknowledgments for the very assiduous and efficient attention they have
bestowed upon every minutia of duty intrusted to them.

Lieutenant E. B. White, United States artillery, and Mr. G. W. Feather-
stonhaugh, jr., United States civil engineers, have likewise assisted, very
essentially, in the drawings and calculations that have been involved dur-
ing the progress of my report—having been attached to my brigade since
the close of our field duties.

Of the preceding lines, we will assume the five following as the best
basis on which to institute a comparison by reference to their fitness for the proposed project.

Line No. 1.—Shortest route from Porter's store-house to steamboat wharf, or ferry, at Lewiston, by single locks
Do. by double locks

<table>
<thead>
<tr>
<th>Cost.</th>
<th>Line No.</th>
<th>Description</th>
<th>Miles. Feet.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2,568,899</td>
<td>36</td>
<td>Shortest route from Porter's store-house to steamboat wharf, or ferry, at Lewiston, by single locks</td>
<td>7 4,040</td>
</tr>
<tr>
<td>3,610,596</td>
<td>21</td>
<td>Do. by double locks</td>
<td>8 3,660</td>
</tr>
</tbody>
</table>

Modification of line No. 2, as above, and terminating at Lewiston, passing through artificial harbor

<table>
<thead>
<tr>
<th>Cost.</th>
<th>Line No.</th>
<th>Description</th>
<th>Miles. Feet.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$4,616,423</td>
<td>47</td>
<td>From Porter's store-house, by Gill creek and Four Mile creek, terminating on Lake Ontario</td>
<td>8 3,180</td>
</tr>
<tr>
<td>$4,744,982</td>
<td>88</td>
<td>Modification of line No. 2, as above, and terminating at Lewiston, passing through artificial harbor</td>
<td>14 5,000</td>
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</table>

Line No. 5.—By Eighteen Mile creek, Lockport, and Tonnewanta creek

<table>
<thead>
<tr>
<th>Cost.</th>
<th>Line No.</th>
<th>Description</th>
<th>Miles. Feet.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5,041,725</td>
<td>48</td>
<td>By Eighteen Mile creek, Lockport, and Tonnewanta creek</td>
<td>5,120</td>
</tr>
</tbody>
</table>
Military and Commercial Memoir.

In regard to general considerations involved in the project of the canal around the falls of Niagara, those relating to military defences are first, in a national point of view; scarcely less prominent, however, are those which relate to the amelioration of commercial relations between the highly productive regions of the upper lakes and the northeastern States.

Regarding it as a national military work, without adverting to the precise location of the canal, (which, by reference to the routes we have surveyed, would be matter for the locating engineer, as directed by the views of the National Government,) its advantages would be to give celerity to the movement of forces, munitions of war, shipping—in a word, the materiel of an army between the two lakes, Erie and Ontario; which, in case of war with Great Britain, would doubtless become the scene of active operations.

The efficiency imparted to military force, derived from the power of concentrating, is a principle in strategy too well understood to need illustration. In its application to our subject, we realize its value in a conspicuous manner.

It is almost certain that, in the event of hostilities between the United States and Great Britain, the naval warfare on the lakes would be extensively assisted, or, perhaps, entirely conducted, by vessels propelled by steam. In such case, their light draught of water would enable them to pass from one lake to the other with such dimensions of canal as have been projected.

This is a desideratum to which every mind must be sensible; it would impart mobility to our force, and enable us oftentimes to secure the fruits of a victory, or suddenly to repair the disasters of defeat.

By this facility, the invasion of our territory, on either lake, might be prevented, with all the concomitant, desolating effects of war. A thousand modifications of circumstances might be adduced, to show defeat and disaster to our arms as the result of the want of means of co-operation between our naval forces on the lakes; but I regard it as sufficient to lead the attention to this department of the subject, without occupying time with details, which must be obvious to every intelligence.

Neither ought our Government to flatter itself that the British and Canadian Government are insensible to the advantages to be derived, in such an event, from interior communication. The former has already constructed a steamboat canal, ostensibly for military purposes, from Montreal to Kingston, and one, for commercial and military purposes, from Lake Ontario to Lake Erie.

The advantages to be derived to the British, in case of hostility, from these facilities, would be incalculable; and a commensurate caution is called for on our side, to counteract their tendency. Under the administration of the Duke of Wellington, a chain of communication, by steamboat canals, was opened from Montreal to Kingston, a distance of 246 miles. These consist of, La Chine, Carrillon, Blondeau, and Grenville canals; but the project, to which these are only accessory, is the Rideau canal, extending from Bytown to Kingston, 126 miles, which alone has cost the British Government the sum of six millions of dollars, and boasts of some of the
finest construction in the department of civil engineering existent in any country. Yet this is only a part of the project; and a line of military works is contemplated to secure it against aggression, and render it an efficient channel of communication in the event of war with the United States.

The works on the Rideau canal were constructed under the direction of Colonel By, of the royal engineers, assisted by officers of the same corps. It remains under surveillance of the engineer department, and officers of engineers are stationed at Bytown and Kingston, and intermediately, for that object. The military works at Quebec are proceeding to completion, at great expense, and the garrisons at various points of their frontier are by no means neglected. These facts are not irrelevant, as demonstrating that the British Government, although in time of profound peace, regard the military position of the colony with marked solicitude.

In sections of our country having no immediate relations with the Canadas, nor interest in the changes that are operating there, the generality of persons refer to the lessons of their boyhood as the sources of information, and they regard it as a bleak, sterile, unpopulated country, and a burden to the parental Government which sustains it. This, to a certain extent, was true but a few years ago; but the scene has changed materially, and a reference to statistic records will show that a very small portion of our own country can boast of a more rapid amelioration than has taken place in regard to the Canadian provinces.

In 1834, by an official statement it appears that the population of Upper Canada had doubled within eight years; that it is of a peculiarly valuable character; and that the development of agricultural and commercial resources has been commensurate.

A few facts will corroborate the truth of the remark. It is stated, upon good authority, that of late years the annual emigration to Canada from England, Ireland, and Scotland, amounts to from fifty to sixty thousand souls; and a cursory visit to that country will exhibit to us, most strikingly, the advantageous difference in character of that emigration, and the one which is received in our Atlantic cities from the same source; and the cause is obvious. The industrious mechanic, the laborious pains-taking farmer, who, as the reward of their efforts, have enjoyed competency and comfort at home, when moved by the spirit of enterprise, do not wish to sever themselves entirely from those institutions under which they have derived those advantages; whilst the idle and improvident desire nothing so much as a change from a state of things under which they have suffered want and penury, and to which they, for the most part, unjustly attribute their ill fortune.

To this is to be added the great difficulty thrown in the way of the best class of emigration to this country by the British Government, with the facilities afforded to its establishment in the provinces.

It became my duty, under instructions from those to whom I was referred by the department for my guidance during my operations of the last summer, to make myself by personal observation, acquainted with the advance of improvement in this section of the continent.

Under these auspices, I was induced to diverge somewhat from the beaten track of visitors to the Canadas, and have verified, and can attest the truth of the foregoing observations; but their full illustration would be necessarily founded upon details in their relation incompatible with the
general nature of my report, but which, in their sum, have made a sensible and well defined impression upon my mind.

As belonging immediately to my profession, however, I cannot help indulging in a comment upon some of the works of civil construction on the Rideau canal. At Bytown, Jones's falls, and Kingston mills, are certainly some of the finest speciments of hydraulic architecture on the continent of America. At Bytown are eight consecutive locks, seven of 10, and one of 11 feet lift, 133 feet long and 33 broad: these, as well as the locks at Kingston mills, are worthy of the highest admiration. But it is at Jones's falls that the most remarkable work is achieved. It consists of a dam 62 feet in height, and 400 long, in solid masonry, and among the most perfect in existence; a waste weir cut through a solid rock, and a descent of 60 feet by three consecutive locks, and a fourth with an intermediate basin. The dimensions of the locks are as those above stated, with the extraordinary lift of 15 feet; yet, under the head of water consequent upon such a plan, there is scarcely the appearance of a leak, and the masonry is of the most finished and beautiful character.

I take this opportunity to express myself indebted to the frank and liberal politeness of the British officers generally, during my visit to the Canadas.

I have to thank Captain Bolton, of the royal engineers, not only for his elegant hospitality, but for the facilities he afforded me for observing many valuable modifications relating to my profession, and taking, in regard to the details of locks, &c., such memoranda and drawings as were suggested by many portions of this truly magnificent work of civil construction.

I have, perhaps, employed more emphasis than was necessary in regard to this subject; but I feel assured the work is scarcely known throughout the United States, otherwise than by name, even to professional engineers, and much less to the community generally; to whom, in reference to the subject in hand, I cannot but think it must prove interesting.

Resuming our discussion, let us now suppose a population of the kind to which I have referred, established, as it ultimately will be, in the extensive region comprised between the same parallels of latitude as Maine, New Hampshire, Massachusetts, and the southern boundary of New York, and lying between Lake Superior on the west, and St. Lawrence river on the east, with Lakes Huron, Erie, and Ontario on the south, possessing a climate tempered by the genial influence of surrounding inland seas, and we shall be made sensible, at once, of its imposing attitude, in every relation, to awaken a national solicitude.

But limiting our view, it will be sufficient for our immediate object to concentrate our reflections upon the region in the neighborhood of the St. Lawrence, and the peninsula of Upper Canada, stretching itself far into the territory of the United States. It is this section which will, in a few years, according to the present ratio, contend with any of our most flourishing States, both in population and resources, that we have just cause to regard with a jealous eye.

By the enterprise of the Canadians, a rail-road is contemplated to connect Lake Huron with Lake Ontario. This project being carried into execution, (as it certainly will be,) it becomes the great portage between the upper lakes and Lake Ontario, and will have an immediate influence in concentrating population, and developing the resources of this valuable territory.

When we contemplate the maps of this region, and notice the peninsula of Upper Canada jutting into our country, and reflect that, independently
of its local advantages, with those of soil, climate, and population, it possesses a retired and guarded line of communication, issuing from the impregnable fortress of Quebec, in the hands of so great a military power as Great Britain, we should not be insensible to such precautions as are calculated to increase the security of our frontier, whilst subserving in an eminent degree the cause of commerce, agriculture, and civil industry.

We are not so illusory as to interpose the Niagara canal as an _aegis_ against the growing power to which we have alluded; but it should be regarded as one important measure, as concentrating population, by opening the facilities of collateral avenues, by rendering available the immense hydraulic advantages of which this point is susceptible, and by thus giving strength to this exposed frontier.

Were the National Government to purchase a site for armories, and establish foundries there, it would become the nucleus of a powerful manufacturing interest, and concentrate a population which, in time of war, would be ever ready to arm in defence of its threshold, and become the most efficient guaranty against aggression.

It must not be imagined that its contiguity to the frontier would render it unsafe for such object; for, supposing it to receive the attention from Government that it deserves, in a military aspect it may be regarded as one of the strongest defensible positions on our frontier.

On the west it is entirely inaccessible, by means of the rushing waters and precipitous banks of the Niagara river. To attack from the south, the enemy would be obliged to cross a considerable distance above the falls, and descend the river on the American side, through a densely settled section of country: his line of operations would therefore be attenuated, and eventually intercepted. On the east, in the supposition that the canal be constructed, its gorge would be unassailable by the interposition of a body of water of one hundred and ten feet wide, and ten deep, which would be rendered impassable by the resistance opposed, or at least produce a delay that would be incompatible with the nature of an enterprise requiring for success the greatest celerity.

The Lewiston ridge offers a barrier on the south side, which, with a little attention, might be rendered inaccessible. The Fort Niagara, within so short a distance of the only point where a landing could be effected on the Niagara river from the opposite shore, would be a sufficient preventive to an incursion from this quarter.

A landing for such object could only be effected by the want of precaution on our side, under cover of night, and by a small number. The enterprise would certainly be cut off by a detachment from the garrison, with which this position would stand in military relation, both offensive and defensive; aided, also, by armed parties of the inhabitants, inspired by patriotism, and rendered vigilant by a sense of insecurity from the proximity of the enemy.

In the execution of the project also to which I refer, this manufacturing district would become the terminus of avenues leading to every part of the State. Thus, an enemy of the force we refer to, once upon the high ground above the Lewiston ridge, and he would be assailed from every point with a promptitude that would render success to his enterprise, nay, an escape, impossible. With great deference, we advance the opinion that a liberal policy would regard such a project as of the greatest national importance, as calculated to increase the strength of this at present assailable frontier,
by augmenting its population and resources, and by providing it with arms and all the materials for defense.

The shield of national protection would be thus interposed, with a paternal care, to shelter the inhabitants of this section from the calamities incidental to their position in time of war.

But a more enlarged view may be taken in regard to the proposed project—a view in which I cannot but think the country at large, stimulated by a sense of national pride, must take a deep interest.

In the event of a war, it is apparent, from the increasing resources of Upper Canada, and the policy by which Great Britain appears to be actuated, that the most energetic efforts would be made upon the frontier; and it would be question of invasion from one side or the other, conducted upon an extensive scale. Should we not become the aggressors, it is almost obvious that the enemy would soon place himself in the attitude to become so.

A true policy, founded upon established principles, dictates that we should prepare for the contingency under any circumstances; but the more imperiously in the present instance, where the object may be effected with considerable expenditure in ostensible military preparation, and without giving the slightest ground of complaint to a nation with whom we are at peace.

By the arts of peace, and for purposes of great commercial utility, we may prepare this section of the country to become, in case of emergency, a depot of inestimable value to the whole of our northwestern frontier.

From this point d'appui, in the event of invasion from our side, troops and munitions of war could afford ready reinforcements to lines of operation, diverging, as they would do, from this point of contact of the hostile territories. Under the influence of its strength and its contiguous resources, the passage of the Niagara river could be commanded, both at the head and foot of navigation, below and above the falls.

In the circumstances under which Canada was placed last war, it was undoubtedly the plan to have cut the enemy's line of operations on the St. Lawrence; as Canada would then have fallen into our hands for want of resources within herself.

But the face of things has changed in regard to that country, as already explained, and she would henceforward possess internal resources of no ordinary capacity. Moreover, to cut off the enemy's line of communication, which would be operated by the Rideau canal, and sustained by defensive works, would require a more extended line of operation on our part, greatly calculated to weaken our position in that quarter.

We should, therefore, be obliged to turn our attention to the invasion of Upper Canada; and, with this object in view, such a point as the one to which we refer would become a principle of energy. It would give consistency to our project of campaign, by reducing our lines of operation to their minimum; inspire confidence in the militia, by the idea of the proximity of a place of support; and enable us to improve good fortune, or recover from the effects of bad; in a word, it would enable us not only to achieve victories, but render them valuable in their results.

With such resources at hand, we should be enabled to effect that greatest of desiderata, to carry the war into the enemy's country; whilst our own soil and firesides upon this frontier should be guarantied from the horrors of invasion.
In contemplating a state of things such as this hypothesis is founded upon, I do not think my views can be deemed visionary, however tranquil may appear the horizon in this quarter at the present moment. Indeed, all history teems with the assurance that war is a state of things inseparable from the nature of man, springing from causes so light in their incipiency as to baffle the speculations or the predictions of the most profound political wisdom in assigning results to the diplomatic intercourse of nations.

But, waiving the idea of collision with the Canadas, it may be shown that the site referred to possesses many peculiar advantages as a manufacturing depot, to suit the most general emergencies; and the existing posture of affairs with a powerful maritime nation may possibly give some weight to the propositions I am about to advance.

The stupendous peculiarity of its hydraulic advantages needs no comment. I will not attempt to demonstrate what may be regarded as a proverb: it is unquestionable that a greater water power, and that too in its application to practical purposes, can there be commanded than at any other point on the surface of the globe.

It is the advantages of its local position, in conjunction with its other attributes, that I shall endeavor to illustrate. For, let us suppose a hostile fleet blockading our eastern and southern coast, and the communication on the seaboard entirely cut off between them—a case which obviously might occur—and then turn our reflections to the unprotected state of our Gulf coast, its present destitution of the materials necessary to its defence, and the aid it would always require in the exigency of war from the northern States, and the policy, even necessity, of its possessing some great military depot in secure and sheltered relation becomes impressively obvious.

The district of which it is a portion stands in bold relief, by reference both to its central position and the properties required.

If the attention be turned towards the map of the United States, with this object in view, the mind will be struck with its peculiar advantages.

The Hudson and Erie canal passes its threshold; New York is, therefore, at hand. The Susquehannah, with its outstretched arms, approaches it nearly; Philadelphia and Baltimore, the Delaware and Chesapeake, are, therefore, its neighbors. The St. Lawrence, and the avenues to Lake Champlain, and thence the branches of canal through the eastern States, form a continuous navigation. The vast empire of water of the great lakes is spread before it; but, above all, in the sense we at present regard it, New Orleans and our southern coast, through the great valley of the Mississippi and the canals either projected or already executed, stand in a relation to it that we think should render it a locality of peculiar national interest, and highly entitled to a portion of that public expenditure which belongs to a general system of precautionary and defensive measures.

By means of the Niagara ship canal, the Oswego ship canal, projected, and those above referred to, a secure, capacious, and expeditious medium of transit, by steam navigation, is opened between the chief cities of our eastern coast, and the vast unprotected territory of our southern maritime frontier.

We will now advert to the commercial advantages to be diffused by the project, so far as they are of a nature, by their generality, to call for the aid of the National Government. We regard, as paramount, the connexion of the Lakes Superior, Michigan, Huron, and Erie, with the Lake Ontario,
which, by their extent and depth, may be, severally, regarded as inland seas, and which belong not to any particular State, so far as they are within our boundary, but to the entire jurisdiction of the United States.

The rendering maritime several thousand miles of lake coast, by opening to it the only obstruction to direct commerce with the Atlantic, through the channel of the St. Lawrence, secured in equal participation by treaty to the United States; to render the coast of the United States, upon our upper lakes, in immediate commercial relation with a foreign nation bordering the lower lake and the St. Lawrence, and with our own coast on the lower lake; placing in immediate commercial relation the United States coast of the upper lakes with the great commercial depot of New York, through the medium of the Oswego and Hudson ship canal, to be executed by the State of New York, with the extraordinary dimensions given to the St. Lawrence canal, now executing, in conjunction with the projected Niagara canal, ships of three hundred tons might navigate from the Atlantic ocean to the ports on our upper lakes.

We may assume, even, that a large class of merchant ships, by a construction modified as in some mercantile nations of Europe, might be adapted to this trade.

In discussing the subject of draught in vessels, when we regard the elements which enter in assigning the burden to any particular draught, we are not struck with any difficulty in the question theoretically, inasmuch as it is determined generally by the length multiplied into the breadth into the depth, either of which factors may be changed at will; and we may, therefore, build a very flat vessel to carry a very large cargo, by increasing two of the elements, length and breadth, and yet diminishing the third. As our plan of canal, and length of locks, admit of considerable latitude in regard to the two former dimensions, no obstacle may be supposed to the adoption of a construction of vessels that shall be calculated to carry a cargo of a magnitude within any desirable limit.

But I felt desirous of knowing whether the ordinary relative draught was not prescribed by the consideration of practical benefits, and whether circumstances of sailing or general manageableness, did not, in some measure, militate against a change of model; and therefore requested information through the medium of a gentleman whose official character gave him an opportunity of procuring the data required. The following letter addressed to the Hon. J. Turrill, from a source of undoubted respectability, establishes the proposition I have advanced:

New York, March 10, 1836.

My Dear Sir: On conferring with those who are eminently skilful in the scientific, as well as those who confessedly are in the practical branches of ship building, I have gathered the following particulars, in reply to the queries of our mutual friend, McWhorter, addressed to me on the subject, with reference to the projected ship canal.

It is not necessary, in order to insure great sailing, to give a ship a great deal of dead rise, but the contrary; as may be exemplified in simultaneously launching two ships of equal dimensions, say same length, width, and depth, one with 28 inches dead rise and short floor, and the other with 14 inches with a long floor. The sharp ship will draw about three feet more than the flat one, and will require considerably more ballast; so that when
all their armament, stores, water, &c. are on board, you will perceive that
the sharp vessel is drawing about four feet more water than the flat one;
hence it is reasonable to infer, that the ship with the least dead rise will
displace less water than the other. Mr. Webb (the associate of the late Mr.
Eckford) assures me that a frigate of the largest class can be so constructed
as to have all the qualities that can well be united in one ship, and be put
in a condition for transporting, &c., and not to exceed a draught of twelve
feet. Flat and sharp vessels may, in fact, be thus contrasted; what the
one may gain by being sharp, the other acquires by extra buoyancy, losing
nothing in going to windward by the peculiar turn in the bilge. The
word peculiar I may explain by saying that great sailing may be attained
by giving half an inch dead rise to every foot in width; but ships built upon
this mode must have the middle futtocks crooked with an abrupt turn in the
bilge, straight sides; and the thinner the ends in proportion to the draught
of water, the greater the speed; and they are sure, from the abrupt turn in
the bilge, to go to windward well, and also to steer well.
Pray inform me if the foregoing particulars are sufficiently to the point,
to meet the object of your inquiries, or what other or further illustration:
you require; and I will, as far as my time and my means of obtain-
ing them admit, most cheerfully respond thereto.

Remaining, dear sir,
Yours, faithfully,
JOSEPH FOWLER.

The innovation to which our supposition refers need not excite surprise,
when we reflect that it would accomplish the object of accommodating a
development of coast, such as we have stated, and possessing a back coun-
try as rich in resources as any on the face of the globe. The advantages
of direct communication appear more striking when we reflect upon the
great increase of expense in transportation, arising from the necessity of transhipment of the objects of trade at various points of the route.

It is stated in a report of the board of directors of the Welland canal,
1835, that “merchandise from London would be conveyed to Cleve-
land for £2 10s. per ton, which now costs from £3 to £4 from Montreal to
Prescott, a distance of 130 miles only.” This, when the St. Lawrence
shall be rendered navigable by the work now constructing.

Other statements are before me, entering greatly into detail, and ex-
hibiting still more strikingly the advantages of preserving the bulk of
merchandise unbroken, from the time of its shipment until its arrival at
its ultimate destination.

These are considerations involving an amelioration to commerce, by its
extent and utility, worthy the patronage of a paternal Government. The
Niagara ship canal is a work that in its consummation would awaken into
life a thousand springs of latent resource, by the facilities it would give to
the transportation of objects of agricultural and manufacturing industry;
and referring to the broad principle of analogy for our support, we infer
that a country, such as that which borders our upper lakes, teeming with
undeveloped agricultural and mineral treasure, when brought by the facili-
ties of steam navigation within a greatly diminished distance, by reference
to time, of the emporium of New York, and other of our great mercantile
cities, will receive an increment to its population, and develop its re-
sources in a degree commensurate with the great avenues of commerce
to which we refer, and surpassing all former experience.

We have practical demonstration of the increase of population, and the
consequent development of resources, in the region of the upper lakes,
owing to the facilities afforded by the Erie canal, that through the State
of Pennsylvania, the Mississippi river, and the various other collateral
branches.

But it should be remembered, that this tide of emigration is yet in-
cipient; it has scarcely received its impulse; whilst the avenues that en-
couraged the emigrant by their facilities, are arriving at their maximum
of utility, in consequence of the increase of commerce upon them.

It is true that a new channel is opening to these fertile regions—the
outlet of the St. Lawrence. The improvements to which I have already
referred in my report, namely, the Welland and St. Lawrence canals,
will offer a ready means of bringing their products to a market; but the
emporium they will reach will be that of a foreign nation. Montreal will
enter into competition with our own markets.

It is no longer question of preventing the descent of produce from
the upper lakes to Lake Ontario. The Welland canal, executed by the
Canadians, has already achieved that object, and it has proven the fal-
lacy of the reasoning; that "produce, once afloat on Lake Ontario, will
find its way to Montreal."

It is only when the increasing amount of trade shall become more than
commensurate with the facilities afforded to deliver it at the emporium of
New York, or other of our eastern cities, that rivalry is to be apprehended.
This has been abundantly demonstrated; for, although an entire naviga-
tion exists from Lake Ontario, by means of the Rideau, Grenville, and
La Chine canals, yet does by far the greater portion of the produce of the
upper lakes and shores of Lake Ontario find its way through the Oswego
and Erie canals to New York.

The Oswego and Erie canals, in their present state, contend success-
fully against the competition of the St. Lawrence. But new facilities are
preparing by Canadian enterprise, and the St. Lawrence canal will bring
the market of Montreal nearer to the source of produce by several days,
without the necessity of intermediate transhipment; thereby effecting a
considerable diminution of the cost of transportation. How far this cir-
cumstance will deteriorate the value of our own channels of commerce,
is worthy of deep consideration.

For the sources of produce it is of course desirable to possess many
outlets. But it seems clear that the policy of the State of New York
would find it expedient to anticipate the demand for market-way; for when
its necessity shall have taught the inhabitants on the borders of the upper
lakes the facilities of the St. Lawrence canal, it would be difficult, if its
advantages are such as are in anticipation ascribed to it, to divert the
tendency of produce from Montreal.

The Hudson and Oswego ship canal is a work particularly interesting
to the city and State of New York, and the State will eventually, or per-
haps immediately, recognise it as the true line of communication, in con-
junction with the projected Niagara canal, between New York and the
northwestern States.

The simple fact that it saves a distance of artificial navigation of 120
miles, and only increases the absolute distance by 15 miles, and a few feet
of lockage, is a sufficient element to establish its great relative economy; and this hypothesis is sustained by experience: for it appears by official returns, that there is a saving of expense on the amount of goods transported between New York and Cleaveland, of upwards of 30 per cent. by this route over that by Buffalo, even under the present inauspicious circumstance of a defective channel of communication around the falls of Niagara, through the Welland canal.

It should be remarked that this work is defective, both in its location and construction; not arising, I infer, from want of judgment in the engineers, but from the desire to complete a great project with inadequate means. In its present situation, constant delays are to be apprehended in the passage of vessels; and to render it an efficient thoroughfare, would involve a very serious expenditure of money—an expense that would continually recur, unless the whole plan of the work should be remodelled.

In its present state, if the Niagara canal on our side should merely be determined on, the great efforts now making by the Canadians to give to the Welland canal a greater degree of efficiency would probably be rendered unavailing; and it would eventually sink into disuse.

This effect obviously resolves itself into a consideration of great importance, and suggests the expediency of an immediate action in regard to the measures herein recommended.

The next commercial benefit to be derived from the Niagara canal is that which relates to the northeastern portion of our country, by the Ogdensburg canal, and by the St. Lawrence and Plattsburg canal, which have been already projected, and which would doubtless be executed in the event to which we refer; the produce of our far west would be conducted to the waters of Lake Champlain, and thence by the projected La Morelle canal, Montpelier canal, Passumpsic canal, &c., to every section of New England; and, in return, a most economical outlet would be presented for the active manufacturing and productive industry of that enterprising portion of our country.

It would be impossible, without rendering our report too voluminous, to enter into detail in regard to the various ramifications of commercial enterprise, that would, in all probability, receive an impulse, should it become an object of national interest to remove the barrier in an efficient manner between Lakes Erie and Ontario, improve the harbors upon their extensive coasts, effect the communication between Lake Michigan and the Illinois river—in a word, by its paternal influence, constitute the national waters of our northern lakes a common market-way to the various States bordering upon them, or enjoying their influence in a less immediate degree.

In order to avoid enumeration of details, I have appended to the accompanying map of the survey a general map of the States to which my report has reference, showing the various canals projected or executed. It will exhibit at a glance the relative dependance of many of them for increased success upon the removal of the obstruction to navigation between the two lakes, Erie and Ontario; it will likewise illustrate certain passages of my report referring to the provinces of Upper and Lower Canada.

The various topographical data in regard to the lakes, are marked upon the map. A comparative estimate is also noted of the development of coast bordering these inland seas, and that of our Atlantic and southern coast. By this it appears that the length of the lake coast exceeds the whole ex-
tent of that of the Atlantic, from Passamaquoddy bay to Sabine river, by
two thousand miles.

Of this development of lake coast, the portion on Lake Ontario will be
united to the ocean by a ship canal on the St. Lawrence, to which I have
already referred.

The remaining portion is separated, in regard to steamboats and ships
of moderate burden, by the obstruction on the Niagara river, to which my
report refers.

The territory that would be sensibly benefited, under the hypothesis of
this removal by the plan proposed, would be, principally, New York, Ohio, 
Michigan, a portion of Pennsylvania, Virginia, Indiana, Illinois, Kentucky,
Missouri, and even, remotely, the Northwestern Territory. Moreover, the
sphere of commercial transit upon the great channel of the Mississippi will,
by the facilities of this project, be greatly enlarged. A steamboat naviga-
tion from New York to New Orleans would open a new era in the desti-
nings of the southwestern States of our confederacy. We cannot, I think,
refer with too much emphasis to the projected ship canal between Lake

The project is ably treated in a letter from the United States Chief Engi-
neer, in answer to a call for information from a member of the United
States Legislature upon that subject. The distance between New York
and New Orleans by this route, and that by sea, around Cape Florida, as
deduced from Tanner's map of the United States, is nearly the same; but
when we reflect upon the dangerous navigation, and the increased distance
by the divergency of the ship from her proper course, arising from adverse
winds, which, by reference to the going and return voyage, must be esti-
mated at one-fourth, we must be forcibly struck with the advantages that
the combined project would afford to the commercial intercourse between
New York and the great emporium of the south, and the idea it suggests of
healthful action to the commercial and agricultural relations of the
intermediate points.

The distance we have carefully measured, on the map, between New
York and New Orleans, by way of Oswego, Niagara, Maumee, and Wa-
bash canal, and it amounts to two thousand and eighty-five; whilst the
distance around the Florida coast is two thousand two hundred and fifty;
leaving a balance in favor of the lake route of one hundred and sixty-five
miles.

Another branch of my report relates to the advantages to be derived to
the General Government by the facilities given to emigration, and bring-
ing, in respect to time, a remote and unpeopled frontier in closer contiguity
with more densely inhabited and civilized regions; thereby enhancing the
value of the public domains, and procuring for them a more ready and
advantageous sale.

This consideration is of more importance than might appear from first
glance. When we reflect that the economy of a journey depends, in so
great a degree, upon its continuity and despatch, delays at points of a route,
where conveyances are changed, obliging the emigrant to incur the expen-
sive charges of cities or towns, are a barrier to emigration; because the
expenses of the whole route cannot be calculated previously to departure,
and a consequent apprehension is inspired to many of the poorer classes,
who eventually exhaust their resources in the cities where they debark, and
by compulsion of poverty, remain there; thus, instead of becoming a val
uable accession, by their labors, to the thinly populated territory of the west, they oftentimes become a burden and expense to the community which has the misfortune to receive them. The project in question, with the Oswego and Hudson canals, would afford a cheap, continuous, and rapid mode of transportation, by steam, from New York to the remote public domains of our upper lakes.

In conjunction with the St. Lawrence canal, Montreal and Quebec would stand in a similar relation; and those great recipients of European emigration would send forth, with renewed impulse, their thousands, to render many a tract of wilderness the abodes of industry, social happiness, and refinement.

A consideration of very great importance, and of a character calling for an amelioration, is that which relates to the shipping interests of the lakes, under existing circumstances. The vessels navigating the lakes are, during the rigors of winter, blocked in their harbors by the ice; by this means, a large amount of capital, invested in shipping, employed on the lakes, is neutralized for several months of the year. A deterioration of property, proportionate thereto, ensues; and the deprivation of employment of a valuable class of citizens, in the seamen by whom they are navigated. This would be remedied by the proposed project, in conjunction with the Oswego and Hudson canals, or even independently of the latter, by the project of a steamboat canal, now executing on the St. Lawrence river, under the auspices of the Canadian Government. Should the Niagara ship canal be constructed, the shipping interest of the upper lakes would participate in this advantage.

This remark applies, with equal propriety, to Government vessels that, in any contingency, may be built and employed upon the lakes, when the service upon which they might have been required there shall cease.

They could, by the means we suggest, be lightened of their armament, and brought down to our eastern seaboard for other employment. The full force of this suggestion would have been felt at the expiration of the last war with Great Britain, when our naval preparations upon the lakes became entirely useless, and a dead loss to the nation.

I have now completed a cursory review of such general considerations as have appeared to merit, in my estimation, the notice of Government. In this, I have endeavored to avoid minuteness, foreseeing that they would render my report both fatiguing and voluminous. My desire has been rather to call attention to the various points upon which an argument might be based, than to take upon myself the task of development.

I have also felt, in the course of my remarks, that too much detail would but embarrass the natural course of thought, and that the subject itself, if brought to the reflection, would carry conviction in its train. If I have shown more interest in the question than is usually looked for at the hands of the engineer, it is that I have felt the strongest conviction of the grandeur, even sublimity, of the enterprise, combined with its general usefulness to the country, and the facility of its execution.

I have now the honor to submit the present memoir, with the various plans, maps, profiles, and other illustrations, connected with the survey.

I am, sir, most respectfully, your obedient servant,

W. G. WILLIAMS,
Captain U. S. Top. Engineers.
Mr. Hard, from the Committee on Roads and Canals, reported the following bill:

A BILL to provide for the construction of the Niagara ship canal.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the sum of five hundred thousand dollars be, and the same is hereby, appropriated out of any moneys in the treasury not otherwise appropriated, to be expended under the direction of the Secretary of War, towards the construction of a ship canal, to connect the navigable waters of the Lakes Erie and Ontario, on the plan recommended in the report of W. G. Williams, communicated under the order of the House of Representatives of the third of February, in the year of our Lord eighteen hundred and thirty-six: the said canal shall be constructed on such one of the routes surveyed by Captain W. G. Williams, and set forth in his report, as the Secretary of War, upon full examination shall think will best tend to promote the military defence and commercial interests of the country.