

GENERAL CORRESPONDENCE

1858

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JAMES J. HILL PAPERS

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ORIGINAL ORDER

FIRST
REPORT
OF
THE CHIEF ENGINEER
TO
THE PRESIDENT
OF THE
MINNESOTA & PACIFIC R. R. CO.
(NOW ST. PAUL, MINNEAPOLIS & MANITOBA RAILWAY CO.)

PRESENTED JANUARY 12, 1858.

SAINT PAUL:
GOODRICH, SOMERS & CO., PRINTERS.
PIONEER AND DEMOCRAT OFFICE.

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REPRINT BY PIONEER PRESS CO.
OCT. 1, 1901.

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REPORT.

OFFICE OF THE MINNESOTA AND PACIFIC RAILROAD COMPANY, }
SAINT PAUL, Jan. 9, 1858. }

TO EDMUND RICE, Esq.

President Minnesota and Pacific Railroad Company.

Sir: I have the honor to submit the following Report, exhibiting the progress of this work, together with the maps accompanying the same.

On the 11th June last, a party was organized, in charge of John Dale, Esq. to make the location between Stillwater and St. Anthony, and another, in charge of W. G. Turpin, Esq. to operate between St. Anthony and Crow Wing. A third party for reconnoissance was placed under the supervision of C. H. Allen, Esq. with instructions to examine and report upon the country lying between the Mississippi and Bois des Sioux rivers. The western half of this section lying about midway between the Minnesota River and the trail from St. Cloud to the mouth of the Bois des Sioux, was an unbroken wilderness: and a rapid examination of its general topography was necessary before commencing the more elaborate operations of an instrumental survey. The result of this reconnoissance was the discovery of an eminently practicable railroad route traversing a very fertile and beautiful region of country. Mr. Allen returned from his preliminary examination on the 17th July, and immediately organized a party to commence the instrumental survey. A fourth party, in charge of Chas. C. Smith, Esq. was formed at this time, and, with that of Mr. Allen, placed upon the location west of the Mississippi River—Mr. Smith taking the eastern, and Mr. Allen the western division. I desire, in this connection, to acknowledge the energy and skill by which the operations of these gentlemen and their associates have been characterized.

On the 12th July, a fifth party, in charge of Mr. Wm. Crooks, was placed upon the surveys between St. Anthony and St. Cloud—the party of Mr. Turpin, after reaching Crow Wing, confining its operations to the location between that place and St. Cloud. The labors of all these parties have been completed in a very

satisfactory manner. The examinations have been of the most minute character; and the location adopted will, it is believed, bear the test of the severest scrutiny. The maps of the location of that portion of the main line from Stillwater to the Bois des Sioux River, and of the branch from St. Anthony to Crow Wing, were completed and filed in the office of the Governor of the Territory, November 12th, in compliance with the terms of the Charter, and copies immediately forwarded to the Department at Washington. The measured length of the main line located is $222\frac{8}{100}$ miles, and of the branch to Crow Wing $117\frac{9.6}{100}$; or a total of $340\frac{4}{100}$ miles.

A compilation of the lines surveyed by the different parties gives a grand total of about 1580 miles of linear instrumental survey. This work was all accomplished between June 11th and October 25th, and a great part of it after July 25th. The limited time allowed for the organization of parties, and the remoteness of a considerable part of the field of operations, increased, to some extent, the magnitude and difficulty of the undertaking; and its success is due, in a great measure, to the zealous efforts of the members of the corps, without exception: as well as the enlightened policy of the Board of Directors, evinced by the liberal provision made for its rapid prosecution.

TOPOGRAPHICAL FEATURES OF THE ROUTE.

The surface of the district bordering on the main line, when viewed as a whole, may be considered as approximating a series of long and gentle undulations or swells, having a general north and south bearing. The local and minor features of this district can be better examined by dividing it into sections: the first of which,—extending from Stillwater to the south fork of Crow River, a distance of $52\frac{1}{2}$ miles,—is distinguished by a succession of low and irregular ridges and knobs, interspersed with tracts of level or gently rolling highlands, and numerous lakes, small streams and meadow marshes. The difficulties met with in this section are principally in location: requiring much labor and skill in adjusting the line and grades to the irregularities of surface. The earthwork will consist of short cut and fills, but moderately heavy.

The second section, covering the $24\frac{1}{2}$ miles next west of the south fork of the Crow, assumes a little more level character: the ridges being less in number and elevation, and easily overcome with light grades. Earthwork considerably lighter than on the first section.

The third section, embracing the next 10 miles, is more difficult. The ridges are abrupt, and in many instances reach a height of 70 to 100 feet, but are so irregular and broken as to admit of a location mostly between them, or along their slopes, with moderate grades and curvatures, involving but little loss in distance. In other respects, the topography of this section is similar to those preceding. The earthwork is heavy, averaging from 60,000 to 70,000 cubic yards per mile.

On the fourth section, which includes the next twenty-three miles, a very marked change in the surface occurs. The meadows become less frequent and the ridges subside into gentle slopes offering but slight obstacles to location or construction.

The fifth section, eight miles in length, occupying the "divide" between the waters flowing to the Mississippi and Minnesota rivers, is assimilated very closely to the second section in all respects.

The sixth section, which comprehends the last one hundred and eleven miles of the main line, consists of a succession of long planes of alternate descent and ascent, forming the eastern and western slopes of the drainage basins of the Chippewa, Pomme de Terre and Bois des Sioux rivers. With the single exception of the eastern approach to the Pomme de Terre for the distance of a mile next the river, which is slightly abrupt and broken, this section is overcome with a maximum grade of twenty-five feet per mile, and with tangents of four, six, eleven, fourteen and forty-nine and one-half miles in length, upon a surface requiring but a slight expenditure to fit it for the reception of the superstructure. The western half of this section lies in the vast plain of the eastern slope of the Bois de Sioux River, called in Owen's Geological report the "Great Savanna."

The valley of the upper Mississippi, occupied by the branch line from St. Anthony to Crow Wing, is a level plateau or bench, varying from a few rods to ten miles in width upon either side of the stream, elevated far above the reach of the highest floods and bounded by ranges of low bluffs, beyond which the face of the country becomes somewhat rolling and diversified.

It is impossible to conceive a more perfect natural route for a great highway than is found along this beautiful valley, where a line of railroad may be constructed, within the minimum cost per mile of western works, which shall have no acclivity exceeding ten feet per mile, with tangents from three to twenty miles in length, and a minimum radius of curvature of five thousand seven hundred and thirty feet.

I regret to state that my own time, as well as that of my

Principal Assistants, has been so engrossed by other duties as to preclude the possibility of making a reconnoissance of the country on the route of the Branch line between Crow Wing and Pembina, still sufficient general information has been gained from gentlemen who have frequently passed over it, to induce the opinion that a good line may be obtained, with grades not exceeding thirty feet per mile. It is proper however to receive with some allowance the observations of those who have never viewed the face of this country with particular reference to its railroad practicability, and the results finally attained may fall somewhat below my present expectations.

The distance from Crow Wing to Pembina is variously estimated at from three hundred to three hundred and fifty miles. The lesser distance is probably nearly correct.

The streams of magnitude on the main line are the Mississippi, South Fork of the Crow, Chippewa and Pomme de Terre rivers, and on the Branch, Rice and Coon creeks, and Rum, Elk, Little Rock, Platte, Nokay and Mississippi rivers. The beds of these streams are in no case depressed more than thirty feet below the grade line, and excepting the Mississippi, they can be bridged with single spans of forty to one hundred and forty feet each.

SOIL, TIMBER, WATER, &c.

The country lying along the main line between Stillwater and St. Anthony, and for a distance of ten miles west of the Mississippi, is mostly burr oak openings with a soil varying between sandy and clay loam, and a sub-soil of sand or gravel. It is fertile, well watered, and has a moderate supply of timber.

To the westward of this lie the "Big Woods," a dense forest, one hundred and fifty miles in length, by an average of fifty in breadth, and dotted with myriads of beautiful lakes and natural meadows. As crossed by the main line this forest is nearly sixty miles in breadth. The timber is very heavy, and consists of oak, maple, ash, elm, basswood, black walnut, butternut, aspen and second growth hickory. Unlike the growth of most forests, these different varieties of timber are distributed in the same proportions and reach as great perfection upon the high as the low lands, indicating an unusual degree of equality in the soil, which is a black vegetable mould from two to three feet in depth, resting on a sub-soil of clay, and, in the ordinary acceptance of the term, is inexhaustible.

Among the few scattered tracts, as yet brought under culti-

vation, are found abundant evidences of its great fertility. Winter wheat, corn, oats and potatoes, sown or planted in an opening barely large enough to admit the sun's rays, and usually not half cultivated, afford large returns. The numerous meadows yield a full supply of excellent grass for the subsistence of stock, the want of which forms a serious drawback upon the settlement of most timbered countries. It is rapidly filling up with a good class of settlers, and will soon rival any portion of the Territory in density of population and agricultural wealth.

We come now to consider a belt of country extending in its breadth from the Big Woods to the Chippewa River, a distance of seventy miles, which has been aptly termed the "Farmer's Paradise." With a surface admirably divided between rolling prairie, woodland and meadow, and watered by a thousand crystal lakes and streams, it also has an exceedingly fertile and durable soil, closely resembling that of the Big Woods.

To the emigrant who wishes to make for himself a desirable western home, surrounded by every comfort which nature can afford, where he may sow with the assurance that he will reap an hundred fold, and breathe an air untainted by the foul miasma of a more southern latitude, a region more inviting than this cannot be found in the entire public domain.

The remaining district of country lying between the Chippewa and Bois des Sioux rivers is either slightly rolling or level prairie. There are occasional small groves on the margins of the lakes and streams, but the supply is quite limited. A portion of this prairie on the east may be supplied with timber from a belt of woodland of two miles in width, which extends down the Chippewa as far as the eye can reach, and the western part from the pine region at the head of the Red River by running it down that stream to the mouth of the Bois des Sioux, where a Saw-mill is now in course of erection. This region is perhaps not as attractive to the emigrant as those to the eastward on account of this deficiency, but once supplied with railroad communication with the lumber markets of the Mississippi River, it will be brought under settlement and cultivation with wonderful rapidity. It has an alluvial soil, rich, deep and lasting, which is capable of producing in the highest perfection, every grain and root adapted to a western climate. The species of grass called red-top is indigenous and reaches frequently a height of six feet, furnishing a sure index of the productive qualities of this soil.

The surface of the upper Mississippi Valley is pretty evenly divided between prairie and oak openings with occasional marshes bearing a fine growth of tamarac, an exception to this,

however, is the western slope of the valley from St. Cloud to Crow Wing, which is principally covered with a heavy forest growth. The soil is usually of a light sandy character, though much more fertile than its surface indicates. Some portions of it have been under cultivation for many years without giving any signs of exhaustion, and an examination of the crops grown during the past season, which were excellent where they escaped the ravages of the grasshopper, is conclusive as to its capability of enduring a protracted drought. Although it cannot be called a *first rate* western soil, it is sure, easy of tillage, and produces well. The accessibility of this valley at all seasons by means of excellent roads has conduced largely to its prosperity. It already numbers many flourishing towns, among which are Anoka, St. Cloud, Sauk Rapids and Little Falls.

The region between Crow Wing and Otter Tail Lake, a distance of about sixty miles, is usually represented as possessing but little agricultural value, except in some few isolated portions, but is well timbered with pine, oak, maple, basswood and tamarac. Immediately on passing the summit between the Mississippi and Red rivers, at Otter Tail Lake, a decided improvement in the soil and general aspect of the country occurs. From Otter Tail Lake to Pembina, along the route of the trail, the surface is rolling prairie interspersed with fine groves of timber, amply sufficient for the necessities of a dense population, and well watered. Its soil is universally described as excellent, and many do not hesitate to declare it superior to any other in the Territory. There can exist no reasonable doubt of its perfect adaptation to the purposes of agriculture.

To the westward of the trail the Red River meanders through a great plain, averaging forty miles in breadth, which may properly be called the river bottoms, though elevated about forty feet above ordinary water line. To the eye this plain appears perfectly level, but doubtless like that of the Bois des Sioux, of which it is the extension northward, it has a gradual descent toward the stream. It is nearly all prairie, the timber being confined to the margins of the river and its tributaries, but of excellent quality, and the deficiency, when any shall exist, may be readily supplied from the neighboring uplands.

Portions of this plain are subject to overflow, during the spring freshets only, but not to such an extent as to render it uncultivable. In fact this periodical overflow affords the chief source of its marvelous fertility.

So much has been said and written of late concerning this truly wonderful region, that but little can be added. All agree

in assigning it a pre-eminent rank among the unsettled portions of the West, and the old and flourishing Selkirk Settlement, numbering now upwards of 6,500 souls, as well as that of a later date at Pembina, may be cited in support of its claim to this position.

It is asserted by numerous authorities that the basin of the Red River of the North is one of the finest wheat growing districts in North America. At the Selkirk Settlement thirty-five to forty bushels of wheat per acre is an average yield. Fifty and even sixty bushels is sometimes realized.

REVENUE, RESOURCES AND COMMERCIAL IMPORTANCE OF THE WORK.

Proper estimates of the probable revenue of a contemplated work are of great worth in determining its claims upon public confidence, yet even when based upon the most reliable data, the final results are generally subject to so many unforeseen contingencies that they are viewed with much distrust. Nevertheless, there are lights which guide with almost unfailing certainty to the solution of this question, and among them is not wanting that of experience, upon which the following significant facts are established.

First. The construction of railroad lines, either in course or in immediate prospect, has become an indispensable condition to the settlement and development of any country which is destitute of water communication.

Second. No railroad has as yet been constructed through a new country at a rate of progression so rapid that the influx of emigration has not kept pace with, and in most instances preceded it.

Third. Non-competing lines of railroad built through fertile and habitable portions of the West, have, with very rare exceptions, proved self-sustaining works, even when depending entirely upon the revenue actually created by their construction.

Among the land grant roads of the West the Illinois Central holds the foremost rank, and under an excellent management has advanced so far as to place beyond cavil its ultimate success as a source of profit to the stockholders. Indeed it is likely to prove by far the most profitable work as yet completed. Still it is a well known fact that 633 out of the 700 miles which make up its entire length run directly counter to all the established currents of trade. The bulk of its business must be entirely local, and will constantly seek an escape through the five great

east and west avenues by which it is tapped between its termini. Its lands are good, but poorly watered, and almost destitute of timber, while the climate is of most doubtful salubrity.

It is no disparagement of that great work to compare it with this which has a grant of lands nearly as large, and of equal value acre for acre, when all the elements that are necessary to make up a perfect agricultural country are considered, and which can be constructed at a cost per mile twenty per cent less, with proper economy; neither do we detract from its merits when we consider that it is but a *feeder* to those main arteries of commerce of which this work will form a component part.

It is unnecessary to enlarge upon this subject, when a glance at the map will exhibit the commanding position which this road will occupy with reference to the future commerce of the great North-west.

Happily the day of indiscriminate aid to improvements of this class has passed, and henceforward only those which give every promise of success will receive public attention and encouragement.

Emigration, the great moving power of the West, which in seeking favored locations has hitherto been drawn into so many different channels, will now find its field of attraction circumscribed and brought within the narrower limits of a few leading lines of inter-communication, while its volume must be largely increased by the force of existing circumstances. Of course such a concentration and increase of emigration will measurably augment the business of these few lines and speedily develop their permanent sources of revenue.

For the promotion of the prosperity of our Territory as a whole, and more especially of the interests of settlement in its western and north-western portions, the immediate construction of this road is imperatively demanded, and we find in the history of other works the most ample guarantees of its success as a pecuniary enterprise.

The construction of a Pacific Railroad in connection with the main line of this road, or the extension of the branch by British capital into the fertile valley of the Saskatchewan, and perhaps to the Pacific coast, are by no means improbable events. Among the many routes examined by Government with a view to the first object, the most northern and southern seem to be the only ones entitled to consideration. *Whether either one of these is capable of meeting all the requirements of a great National highway, and if so, which will best meet these requirements must be left for the wisdom of our National Councils to decide.

If the question be upon relative cost, without doubt the southern will take precedence, but if capacity for transportation, the distance between the Great Lakes and the Pacific, safe and commodious harborage, and supplies of timber, coal and water for the efficient and economical working of the road, are made leading considerations, then the northern route is immeasurably superior. But casting aside altogether, or viewing the prosecution of either of the extensions of this road above alluded to, as at best but remote probabilities, it still rests upon a sure and substantial basis. Its grant of lands amounting to TWO MILLIONS FOUR HUNDRED AND FIFTY-SEVEN THOUSAND SIX HUNDRED acres, estimated at an average price of eight dollars per acre, which is certainly less than a full valuation, gives a basis of \$19,660,800, or \$30,720 per mile, a sum sufficient to cover every expense incident to construction and a full equipment, and leave a large margin to apply on interest and discount accounts independent of the earnings of the road.

TEMPERATURE, SNOWS AND WINDS.

No region which at present engages the public mind, as a field for settlement, has been so grossly misrepresented in regard to peculiarities of climate as Minnesota. Fabulous accounts of its Arctic temperature, piercing winds, and accompanying snows of enormous depth, embellish the columns of the Eastern press, to the no little injury of this Territory. An examination of this subject, and especially in relation to the snows and winds of winter, as opposed to the operation of lines of railroad, seems necessary to correct existing prejudices, and fortunately the means are at hand for conducting this examination with an exactness nearly reaching mathematical precision. The data employed are compiled from the "Army Meteorological Register," and "Blodgett's Climatology of the United States," both standard authorities based upon the system of meteorological observations which have been conducted by the Surgeons of the United States Army, and other scientific gentlemen through a series of upwards of thirty years.

In the following table illustrative of the temperature of Minnesota, St. Paul is inserted in the place of Ft. Snelling, (six miles distant,) where the observations were made. The column headed "No. of years" gives the duration of the observations at each station:

TABLE OF PLACES

WHICH

COINCIDE IN MEAN TEMPERATURE WITH SAINT PAUL, DURING THE DIFFERENT SEASONS,

AND THE ENTIRE YEAR.

SPRING. MEAN TEMP'T. 45% ₁₀ deg.	No. of Years	SUMMER. MEAN TEMP'T. 70% ₁₀ deg.	No. of Years	AUTUMN. MEAN TEMP'T. 45% ₁₀ deg.	No. of Years	WINTER. MEAN TEMP'T. 16% ₁₀ deg.	No. of Years	YEAR. MEAN TEMP'T. 44% deg.	No. of Years
St. Paul, M. T.....	35½	St. Paul, M. T.....	35½	St. Paul, M. T.....	35½	St. Paul, M. T.....	35½	St. Paul, M. T.....	35½
Boston, Mass.....	20	Lowell, Mass.....	7	Portland, Me.....	31	Houlton, Me.....	17	Litchfield, Conn.....	1
Springfield, Mass.....	2	Trenton, N. J.....	5	Burlington, Vt.....	6	Hanover, N. H.....	3	Johnstown, N. Y.....	14
Worcester, Mass.....	7	Middletown, N. J.....	3	Montreal, Canada....	15	Williamstown, Vt....	13	Oxford, Chen'go Co. N.Y.	17
Kinderhook, N. Y.....	17	Flatbush, L. I. N. Y....	24	Lake Simcoe, C. W....	1	Montreal, Canada....	15	Cortland, Cortland "	18
Utica, N. Y.....	9	Newburg, N. Y.....	18	Lowville, Lewis Co. N.Y.	19	Sault St. Marie.....	31	Whitesboro, N. Y.....	7
Cooperstown, N. Y....	16	Philadelphia, Pa.....	10	Plattsburg, N. Y.....	11			Bath, Me.....	10½
Onondaga, N. Y.....	16	Mifflintown, Pa.....	3	Fairfield Academy, N.Y.	19			Concord, N. H.....	10
Lewiston, N. Y.....	18	Warren, Pa.....	1½	Mexico, Oswego Co. N.Y.	11			Smethport, Pa.....	3
Detroit, Mich.....	13	Hudson, O.....	7	Cherry Valley, N. Y..	15			Green Bay, Wis.....	21
Ann Arbor, Mich.....	3	Oberlin, O.....	5	Ebensburg, Pa.....	2¼			Portage City, Wis....	16
Battle Creek, Mich....	5½	Chicago, Ill.....	5	Smethport, Pa.....	3				
Chicago, Ill.....	5	Beloit, Wis.....	6	Green Bay, Wis.....	21				
Beloit, Wis.....	6	Portage City, Wis....	16	Manitowoc, Wis.....	21				
Portage City, Wis....	16	Pembina, M.T., lat. 49°	7-12th	Baraboo, Wis.....	1				

Taking a map of the United States and applying to it lines of mean temperature for the seasons and year, passing through the places indicated in the foregoing table, we find that while the winter temperature of St. Paul does not fall below the average of places on its parallel of latitude, its spring temperature coincides with that of Central Wisconsin, Northern Illinois, Southern Michigan, Central New York and Massachusetts, its summer with that of Central Wisconsin, Northern Illinois, Northern Ohio, Central and Southern Pennsylvania and New Jersey, its autumn with that of Central Wisconsin, Northern New York, a small part of Northern Pennsylvania, Northern Vermont and Southern Maine, and its entire year with that of Central Wisconsin, Central New York, Southern New Hampshire and Southern Maine.

Considering this subject with reference to the extremes of latitude touched by these isothermal lines, we discover that St. Paul has a temperature in spring equal to Chicago, which is two and a half degrees of latitude south, in summer equal to Philadelphia five degrees south, in autumn equal to Northern New York one and a half degrees south, and during the whole year equal to Central New York two degrees south.

These statements do not admit of the slightest doubt or question, no matter how widely they may differ from preconceived opinions, for they are founded on facts of experience which have occupied an entire generation in their development.

This condition of temperature not only obtains in Minnesota, but it is a well established fact that there extends hundreds of miles to the North-West of her an immense area of fertile and cultivable soil, possessed of a climate hardly inferior in warmth to her own. The closing chapter of Blodgett's Climatology treats so directly of the climate and resources of this vast region that it is copied nearly entire as an appendix to this report.

The obstruction opposed by snows to the rapid and regular passage of trains is among the chief difficulties of winter operation, and in order to submit in the plainest and most concise manner possible the magnitude of this obstacle as found here, in comparison with other districts, a table of mean results, compiled from the same sources with the preceding, is here introduced.

The results given in the table are all reduced to water, but in order to convert them into equivalents of snow we have only to consider the figures in the columns as representing feet and decimals of a foot. The rule adopted in the "Register" gives ten

inches of snow as equivalent to one inch of water, but the proportion of twelve to one is believed to be more correct, particularly as regards snows of our latitude.

MEAN FALL OF RAIN AND MELTED SNOW AT VARIOUS PLACES
FOR THE DIFFERENT SEASONS AND THE ENTIRE YEAR.

ALSO, THE MAXIMUM AND MINIMUM FALL DURING THE WINTER MONTHS

DEPTH IN INCHES AND DECIMALS OF AN INCH.

PLACES.	SP'ING	SUM'R.	AUT'N.	WINTER.			YEAR.	No. of Years
	Mean.	Mean.	Mean.	Mini.	Mean.	Maxi.	Mean.	
St. Paul, M. T.	6.61	10.92	5.98	0.35	1.92	3.56*	25.43	19
Montreal, Canada	11.54	11.18	16.60		7.26		47.28	2
Houlton, Me.	7.62	11.92	9.95	4.02	7.48	10.00	36.97	9½
Eastport, Me.	8.88	10.05	9.85	8.91	10.61	11.95	39.39	8½
Portsmouth, N. H.	9.03	9.21	8.95	4.44	8.38	11.08	35.57	13
Hanover, N. H.	9.90	11.40	10.50		9.10		41.00	18
Burlington, Vt.	7.41	10.83	9.82		6.02		34.11	20
Cambridge, Mass.	10.85	11.17	12.57		9.89		44.48	12
Worcester, Mass.	10.89	10.71	13.51		11.85		46.96	13
New York City	11.69	11.64	9.93	4.99	10.39	19.27	43.65	14
Plattsburg, N. Y.	8.36	10.03	10.05	2.90	4.95	9.33	33.39	10
Potsdam, N. Y.	6.20	10.15	8.38		3.90		28.63	20
Utica, N. Y.	9.26	12.83	9.76		8.72		40.57	19
Rochester, N. Y.	6.82	8.86	9.38		5.38		30.44	19
Fort Niagara, N. Y.	6.87	9.81	8.68	3.23	6.41	9.24	31.77	5½
Pittsburg, Pa.	9.38	9.87	8.23	4.39	7.48	11.97	34.96	18
Hudson, O.	9.76	8.87	6.16		8.00		32.79	7
Cincinnati, O.	12.14	13.70	9.90		11.15		46.89	20
Detroit, Mich.	8.51	9.29	7.41	2.84	4.86	6.01	30.07	12½
Sault St. Marie, Mich.	5.44	9.97	10.76	2.85	5.18	11.57	31.35	16¾
Athens, Ill.	12.20	13.30	9.20		7.10		41.80	10
Muscatine, Iowa	11.19	15.08	10.34		6.72		44.33	10
Milwaukee, Wis.	6.60	9.70	6.80		4.20		27.20	7
Green Bay, Wis.	9.00	14.45	7.84	2.90	3.36	4.80	34.65	7½
Portage City, Wis.	5.58	11.46	7.63	1.92	2.82	5.84	27.49	9
Beloit, Wis.	13.16	18.12	10.44		6.43		48.15	4

* In the Winter of 1849. The next less fall was in the Winter of 1837—2.96 inches.

Without going into a detailed review of the contents of the foregoing table, which presents the facts in a light that argument cannot strengthen, it may be well to inquire what proportion of the winter precipitation is in the form of snow, and in the absence of positive knowledge we may arrive at general conclusions by other means.

Since Houlton, Hanover, Plattsburg, Montreal and Sault St. Marie, coincide in mean winter temperature with St. Paul, we must infer that the precipitation at those places assumes the form of snow in the same proportion as here. Admitting this, and supposing the *entire* winter precipitation to be a successive accumulation of snows, the resulting depths would be as follows, viz: Average annual depth at St. Paul, 2 feet; Houlton,

7½ feet; Hanover, 9 feet; Plattsburg, 5 feet; Montreal, 7 feet; Sault St. Marie, 5 feet. Maximum depth at St. Paul, 3½ feet; Houlton, 10 feet; Plattsburg, 9½ feet; and Sault St. Marie, 11½ feet. It is hardly necessary to add that such immense depths of snow are never known, and it must follow that a great part of the fall at all these localities is dissipated during the higher fluctuations of temperature. This is confirmed by Mr. Blodgett, who estimates the average depth of snow constantly occupying the ground in winter among the *elevated and northern* districts of New England at two feet, and the experience of the present winter at St. Paul is, that out of a total fall of upwards of twenty inches of snow, the depth on the ground has at no time exceeded six inches.

Although no reliable evidence can be adduced upon this point, it seems entirely safe to assume that the average of *extreme* depths of snow in Minnesota, during the nineteen years through which the observations extend, does not exceed ten inches, and it is certain that the average here falls quite below that in Wisconsin, Illinois, Michigan or New York, and very far below that in the Eastern States.

The rapid decrease in winter precipitation north and north-west from Central Illinois is worthy of particular note in this connection. It will be seen that at Athens, Illinois, the mean fall is 7.1 inches, at Beloit, 6.43 inches; at Milwaukee, 4.2 inches; at Green Bay, 3.36 inches; at Portage City, 2.82 inches; while at St. Paul it is only 1.92 inches.

The force of the wind, which frequently converts even moderate falls of snow into formidable barriers to the passage of trains, is another element requiring attention, and resort is again had to the Army Register for the purpose of illustrating this subject. In the succeeding table will be found the mean force of the wind for a term of years, expressed in whole numbers and decimals under the classification of forces laid down in the "Register."*

* In this classification 0 signifies a calm, 1 a barely perceptible breeze, 2 a gentle breeze, 3 a moderate breeze, 4 a brisk breeze, and so on to 10, which represents a violent hurricane.

Table showing the Mean Force of the Wind at Various Places during the Months of January, February, March and December, in each Year for a Series of Years.

PLACES.	1845 Mean Force	1846 Mean Force	1847 Mean Force	1848 Mean Force	1849 Mean Force	1850 Mean Force	1851 Mean Force	1852 Mean Force	1853 Mean Force	1854 Mean Force	Whole No. of Years.	Mean force Whole Term
Fort Snelling, M. T., near St. Paul.....	1.59	1.72	1.63	1.74	1.55	2.05	2.18	2.00	1.80	2.41	10	1.87
Fort Trumbull, New London, Conn.....	2.53	2.85	.....	.....	3.41	2.98	2.31	2.45	2.16	.....	7	2.67
Fort Hamilton, New York City.....	3.28	3.43	3.18	3.08	3.40	3.14	3.40	3.14	1.90	1.66	10	2.96
Fort Niagara, New York.....	3.33	3.25	.....	.....	3.30	3.24	2.59	3.54	2.20	2.57	8	3.01
Plattsburg Barracks, Plattsburg, New York.....	2.58	1.69	.....	.....	.....	1.48	1.54	2.19	.....	.....	5	1.90
Fort Sullivan, Eastport, Maine.....	3.29	.....	.....	.....	.....	2.31	2.37	2.55	2.63	.....	5	2.63
Fort Constitution, Portsmouth, N. H.....	2.44	.....	.....	.....	.....	2.18	2.53	2.70	2.65	.....	5	2.50
Alleghany Arsenal, Pittsburg, Pa.....	2.13	1.85	2.08	1.86	2.08	2.29	2.15	2.74	2.31	2.55	10	2.20
Detroit Barracks, Detroit, Mich.....	2.52	2.46	.....	.....	1.72	2.11	2.32	.....	.....	.....	5	2.26
Fort Atkinson, Winneshiek County, Iowa.....	2.88	2.07	.....	.....	.....	.....	.....	.....	.....	.....	2	2.48
Fort Leavenworth, Kansas.....	2.30	2.19	1.70	1.99	2.55	1.45	1.61	2.03	2.07	2.30	10	2.09
Average force at all places.	2.63	2.40	2.15	2.17	2.57	2.32	2.30	2.59	2.22	2.30	.....	2.42

It appears that the mean force of the wind at Fort Snelling for the whole term is less than at any other station, and twenty-five per cent less than the average of all stations for the whole term, and that the mean force in any year is below the average at all stations for the year, except in 1854, when it slightly exceeds the average.

In concluding this subject I will state that the extracts comprised in the foregoing tables have been made at random, so far as the nature of each case would permit, and with the sole purpose of arriving at the truth; yet if further confirmation of the deductions drawn from them is desired, it may be found in the fullest measure within the volumes quoted.

I would recommend that provision be made for the completion of the location as far as the Indian title has been extinguished, and a reconnoissance of the remainder of the line to Pembina as early as possible in the coming season. It is also very desirable that the work should be completed from Stillwater to St. Anthony, and perhaps to Anoka, with the least possible delay. The trade of the Upper Valley, already large, is rapidly approaching a magnitude which will absolutely require the facilities of railroad communication, and it will be hardly possible to anticipate that period by the most vigorous action on the part of this company.

Respectfully submitted,

D. C. SHEPARD, Chief Engineer.

APPENDIX.

The assertion may at first appear unwarranted, but it is demonstrable that an area, not inferior in size to the whole United States east of the Mississippi, now almost wholly unoccupied, lies west of the 98th meridian and above the 43d parallel, which is perfectly adapted to the fullest occupation by cultivated nations. * *

By reference to the illustration of the distribution of heat, we see that the cold at the north of the great lakes does not represent the same latitude farther west, and that beyond them the thermal lines rise as high in latitude, in most cases, as at the west of Europe. Central Russia, Germany, the Baltic districts, and the British Islands, are all reproduced in the general structure, though the exceptions here fall against the advantage, while there they favor it, through the immediate influence of the Gulf Stream. * * * Climate is indisputably the decisive condition; and when we find the isothermal of 60 deg. for the summer rising on the interior American plains to the 61st parallel, or fully as high as its average position for Europe, it is impossible to doubt the existence of favorable climates over vast areas now unoccupied. This favorable comparison may be traced for the winter also, and, in the averages, for the year. The exceptional cold of the mountain plateaus, and of the coast below the 43d parallel, masks the advantage more or less to those who approach these areas from the western part of the central States and from the coast of California; but, though the distinct mountain ranges remain high at the north, the width of their base, or of the plateau from which they rise, is much less than at the 42d parallel. The elevated tracts are of less extent, and the proportion of cultivable surface is far greater. * * *

It is decisive of the general question of sufficiency of rain, to find the entire surface of the upper plains either well grassed or well wooded; and recent information on these points almost warrants the assertion that there are no barren tracts of consequence after we pass the Bad Lands, and the *Coteaus* of the Missouri. Many portions of these plains are known to be peculiarly rich in grasses, and probably the finest tracts lie along the eastern base of the mountains, in positions corresponding to the most desert-like of the plains at the south. The higher latitudes certainly differ widely from the plains which stretch from the

Platte southward to the Llano Estacado of Texas, and none of the references made to them by residents or travellers indicate desert characteristics. Buffalo are far more abundant on the northern plains, and they remain through the winter at their extreme border, taking shelter in the belts of woodland on the upper Athabasca and Peace rivers. Grassy savannas like these necessarily imply an adequate supply of rain, and there can be no doubt that the correspondence with the European plains in like geographical position—those of Eastern Germany and Russia—is quite complete in this respect. If a difference exist, it is in favor of the American plains, which have a greater proportion of surface waters, both as lakes and rivers. * * * The northwestern coast of this continent is even more profusely rainy than any part of the north-west of Europe; and the configuration is less sharply interrupted along the coast north of Puget Sound than it is south of that line. If positive evidence were wanting with regard to any part of the interior plains above the 45th parallel, it could not reasonably be inferred that they were wanting in an adequate supply of atmospheric moisture.

With these facts of climatological capacity established, as the whole tenor and significance of American research on this point clearly shows, it may be more easy to understand the descriptions of those who have travelled there, and to connect the somewhat meagre accounts yet written. It is most surprising that so little is known of the great Islands, and the long line of coast from Puget's Sound to Sitka, ample as its resources must be, even for recruiting the transient commerce of the Pacific, independent of its immense intrinsic value. To the region bordering the northern Pacific the finest maritime positions belong throughout its entire extent, and no part of the west of Europe exceeds it in the advantages of equable climate, fertile soil and commercial accessibility of the coast. The western slope of the Rocky Mountain system may be included as a part of this maritime region, embracing an immense area from the 45th to the 60th parallel and five degrees of longitude in width. The cultivable surface of this district cannot be much less than *three hundred thousand square miles*.

Next is the area of the plains east of the Rocky Mountains, not less remarkable than the first for the absence of attention heretofore given to its intrinsic value as a productive and cultivable region within easy reach of emigration. This is a wedge-shaped tract, ten degrees of longitude in width at its base along the 47th parallel, inclined northwestward to conform to the

trend of the Rocky Mountains, and terminating not far from the 60th parallel in a narrow line, which still extends along the Mackenzie for three or four degrees of latitude in a climate barely tolerable. Lord Selkirk began his efforts at colonization here as early as 1805, and, from personal knowledge, he then claimed for this tract a capacity to support thirty millions of inhabitants. All the grains of the cool temperate latitudes are produced abundantly. Indian corn may be grown on both branches of the Saskatchewan, and the grass of the plains is singularly abundant and rich. Not only in the earliest period of exploration of these plains, but now, they are the great resort for buffalo herds, which, with the domestic herds, and horses of the Indians and colonists, remain on them and at their woodland borders through the year. The simple fact of the presence of these vast herds of wild cattle on plains at so high a latitude, is ample proof of the climatological and productive capacity of the country. Of these plains and their woodland borders the valuable surface measures fully *five hundred thousand square miles*.

In various parts of the present work, references have been made to the leading incidents of natural capacity and of actual growth in the northwestern districts. It is not necessary to repeat them here, and the present purpose is only to direct attention to the development in that quarter as one offering clearly the greatest field in which natural advantages await the use of civilized nations. The reason for most of the previous and present neglect of this region lies in mistaken views of its climate, and the peculiarities of much of the Lake Superior district are such as to perpetuate the mistake. With the unusual severity of the last two or three winters there, it appears incredible that the country at the West rising toward the Rocky Mountains should be less severe. But the vast plain rises very little. Fort Union is but 2,000 feet above the sea, and Fort Benton but 2,600, though 15 deg. of longitude due west of the plain at the sources of the Mississippi at 1,500 feet. Much of it declines in altitude northwestward, indeed, toward the northern lake-basins and Hudson's Bay. The increase of temperature westward is quite as rapid as it is southward to New Mexico, and the Pacific borders at the 50th parallel are milder in winter than Santa Fe. In every condition forming the basis of national wealth, the continental mass lying westward and northwestward from Lake Superior is far more valuable than the interior in lower latitudes, of which Salt Lake and Upper New-Mexico are the prominent known districts.

The history of this northwestern district has unusual interest also, though the details are meagre. French traders ranged the fertile plains of Red River and the Saskatchewan nearly two centuries since, and the rich trade in furs and peltries has for so many years been constantly gathered from the surrounding tracts through that as a central area. This occupation was co-eval with the Spanish occupation of New Mexico and California, and but for the pernicious views entailed by the fur traffic, as to the necessity of preserving it as a wilderness, it would long since have been open to colonization. The Hudson's Bay and Northwest Companies had a gigantic contest for possession after the French had given way to British dominion in Canada; and both these Companies at last concentrated their strength in efforts to preserve the wilderness, and to crush the infant colony of Lord Selkirk.

The whole space here designated the Northwest is, however, the joint possession of the United States and Great Britain—not only in territorial title, but in all the incidents of development. Its commercial and industrial capacity is gigantic, and one which it is the highest interest of both governments to bring out at the earliest moment.

The illustration of the summer and winter climates for the country north of the 50th parallel is given—though with less fullness than could be desired, on the isothermal and rain charts—for the temperate latitudes of both continents. The allusions here made may be traced there in a general way; but a map on a more ample scale, representing the now unknown plains of the Yellowstone and the southern Saskatchewan, and the equally important Pacific districts north of Vancouver's Island, and with a full geographical detail, where so much is now vaguely placed, is much to be desired. For the small number of points observed above the 45th parallel, the statistics are very well distributed to define the climate. * * *

The conditions existing in this immense area deserve a distinct treatment, and particularly the importance of the great channel of access through Lake Superior attaches the highest interest to the definition of its peculiar climate. In severe winters the most formidable ice-barriers are interposed over a portion of its surface, as the ice remains late and in large fields and masses at the eastern end of Lake Erie in the same cases—in both lakes the western and larger portions being free from obstructions at a date much earlier.

Minnesota & Pacific R.R. January 12, 1858

First report of the Chief Engineer to the President of the Minnesota & Pacific R.R. Co. presented January 12, 1858. [Reprinted on Oct. 1, 1901. This report was found with an account of the Minnesota & Pacific R.R. by S.F.Folsom, dated 3/18/98. The two documents may have been pulled from J.J.Hill's files for Pyle at the time Pyle was gathering material for Hill's biography, and may explain why they were found together]

When the Minnesota & Pacific Railroad Company was organized in the spring of 1857, William Crooks was elected the first engineer of the Company. After the Company let the contract to Mr. Chamberlin to grade the road from St. Paul to Watab in the spring of 1858, David C. Shepard was elected chief engineer at the instance of Mr. Chamberlin, the contractor, and exercised that office for one year; he was succeeded in 1859 by William Crooks as engineer, and continued as such until the Company was finally wiped out by the sale of its franchises and land grant to the State. At the organization of the St. Paul & Pacific Railroad Company in March 1862, William Crooks was elected chief engineer of the Company and continued in such office until August 1862, when he was appointed Colonel of the 6th regiment, and he and I left for the army on the same day. He was succeeded by James D. Skinner - who was oftentimes assisted by Charles A. F. Morris, - and continued in that capacity until the 22d day of February, 1864; when the First Division of the Minnesota & Pacific Railroad was organized Mr. *Skinner* was continued as engineer of that Company until the spring of 1868. Charles A. F. Morris was City Engineer of the city of St. Paul in 1862-3. (See printed proceedings of the Common Council of the City of St. Paul for 1862-3).

In the winter of 1864-5 Mr. Rice commenced work on what we called at that time, the Winona Division of the St. Paul & Pacific Railroad Company. Colonel Crooks had returned from the war, and in the spring of 1865 was made chief engineer of that branch of the St. Paul & Pacific Railroad Co.. Mr. Morris at that time had a contract to grade on the Winona branch from St. Paul to Hastings, and was thus engaged for nearly two years; he had nothing whatever to do with the engineering department of any of the other branches of the St. Paul & Pacific Railroad.

In the winter of 1867-8 Mr. Morris had a contract to build the bridge over the Mississippi river for the city of St. Cloud, and was in the performance of that work until some time in the early summer

of 1868, when Mr. Skinner was dismissed as engineer of the First Division of the Minnesota & Pacific Railroad Company on account of charges against his moral character. At the time I came on to the railroad, in October 1868, Mr. Morris was the chief engineer, and was the man who was sent by Mr. Becker to bring me into the office; he continued in the capacity of chief engineer of the First Division Company as long as I remained with the Company, or until April 1, 1876; how much longer I am unable to state. These two gentlemen, Skinner and Morris, were both more or less employed in the engineering department at various work, a portion of which was the building of the trestle work in 1862 and the early winter of '63, under the chief engineership of Mr. Skinner. Mr. Skinner made reports of his doings as chief engineer of the First Division Company at various times from 1864 until the spring of 1867, and his last report shows that the bridge was completed across the Mississippi at St. Anthony, and the cars passed over, on the 1st day of June, 1867.

Colonel Crooks never had anything to do with the chief engineership of the First Division Company, but he was chief engineer of the Winona branch, as I have related above, and also had a contract to construct the road from Delano to Breckenridge in the year 1869. Mr. Morris was never chief engineer of the St. Paul & Pacific Railroad, nor of the First Division of the St. Paul & Pacific Railroad, until the early part of the summer of 1868, as I have related above, but had charge of the location and construction of the St. Vincent branch of the St. Paul & Pacific from St. Cloud to St. Vincent under a \$15,000,000 contract with Mr. Moorhead in the years 1871-2, which contract was managed by the First Division Company.

J. O. Holman

3/18/98

Dear Paul John "S.S."

Dear William

Your letter of the 15th inst. came
the seventeenth ult. I could find no good time and
your fertile imaginations could scarcely conceive what
an amount of pleasure I derived from it, as it was
the first epistle of William to James at St. Paul's
a long one. My surprise and pleasure in your letter
was only surpassed by my surprise about becoming
one from you after you left St. Paul's in 1841,
during the ensuing season. Still a good thing
is never too late or done too often. It gave me much
pleasure to hear that you are all well and enjoying
yourself in the good and favored (as I think) little
"Isle of Pines". I did intend to go to Cincinnati
this winter but it is such a long winter trip & though
I should like it much, I cannot. When I hope to be able
to get away, as I intend to go in the next few
months. All goes as well as I expect. Capt. M.
Barnes has written to me from Cincinnati about going
with him as first Clerk on the side wheel packet
"State" a new one about size of the "War"
The Capt. is with it, and I think I
shall go with him. I will be there for a time good
enough for the coming season on the side wheel as
a packet boat. Which is much better than a packet.

Sancti Pauli 11th 58

Dear William

Your Epistle bearing date of the seventeenth ult. came to hand in good time and your fertile imagination could scarcely conceive what an amount of pleasure I derived from it, ~~as~~ as it was the first Epistle of William to James at St Paul for a long back. My surprise on receiving your letter was only surpassed by my surprise at not receiving one from you after you left St Paul or sometime during the ensuing Season. Still a good thing is never too late or done too often. It gave me much pleasure to hear that you were all well and enjoying yourselves in the good and pious (as I learn) little town of Rockwood. I did intend to go to Canada this winter but it is such a long winter trip I thought I should defer it until summer when I hope to be able to get away as I intend to go on the river this summer if all goes well as I expect. Capt. H. Davidson wrote to me from Cincinnati about going with him as first Clerk on the side wheel packet Frank Steele a new boat about size of the War Eagle. The Capt. is Letter A. No. 1 and I think I shall go with him. I wish I had two or three good gigs for the coming season on the road beside my present beetle which is nevertheless very comfortable.

I think it mighty strange that some have not reached home as I wrote several times to my Bro Alf and I never was more surprised in my life than when old Bass handed me a letter of inquiry as to my whereabouts. But after the boats stop running our mails are carried so irregularly that whole bags of mail matter are often mislaid at way stations for weeks and some finally lost or otherwise destroyed. On the tenth of November last I was returning from the Winstow House with Charley Coffin. At 5 of the War Eagle about eleven o'clock and when we were coming down Fourth Street passing one of those low run holes two Irishmen red mouthed came out and following us asked if would not go back and take a drink. Charley said no and we were passing on when two more met us who along with the other two insisted that they meant no harm and that we should go in and drink. I told them I did not drink and generally speaking I knew what I was about we attempted to go on but they tried to have us go back so I hauled off and planted one two in Paddy's grub grinder and knocked him of the side walk about 8 feet. The remainder pitched and Charley got his arm cut open and I got a button hole cut through my left side right below the ribs. The City Police came to the noise and arrest three of them on the spot and the other next day and they turned out to be Chicago Star Cleaners a round given to midnight ruffians.

I was not Compelled to keep my bed but it was some
2 months before I was quite recovered from the effects
of the Cut. One day on the Snow I was going aboard
one of the boats and slipped on the gang plank
and sprained my knee which laid me up for
about 2 months. About a week since my pugnacious friend
who gave me this mark escaped from the penitentiary at
Sittewater along with all the rest of the prisoners confined
at the time. I am sincerely very grateful to you for your
generous offer in your letter and fully appreciate your
kindness. But notwithstanding my bad luck I have still
"a shot in the locker" about \$200— which will put me
out of any trouble until spring. Our winter here
has been very mild and open. We have scarcely had
any snow but what was altogether temporary. Several
rain storms lasting three or four days in succession.
Times have been mighty dull here this winter and
money scarce. Write to me as soon as you
receive this and give me a birds eye view of Rochester
and its inhabitants. Tell me also what you have done
all summer for. Horizontally Remember me to
R.P. and Amesty and believe me
Yours sincerely
J. J. Hill

Send me some papers



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