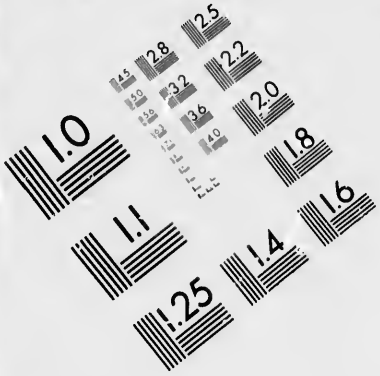


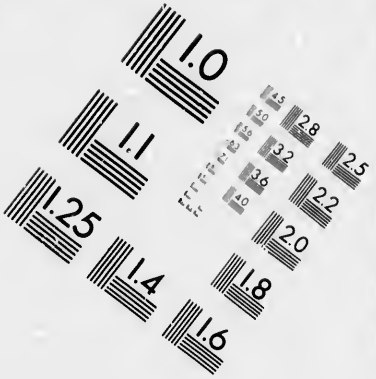
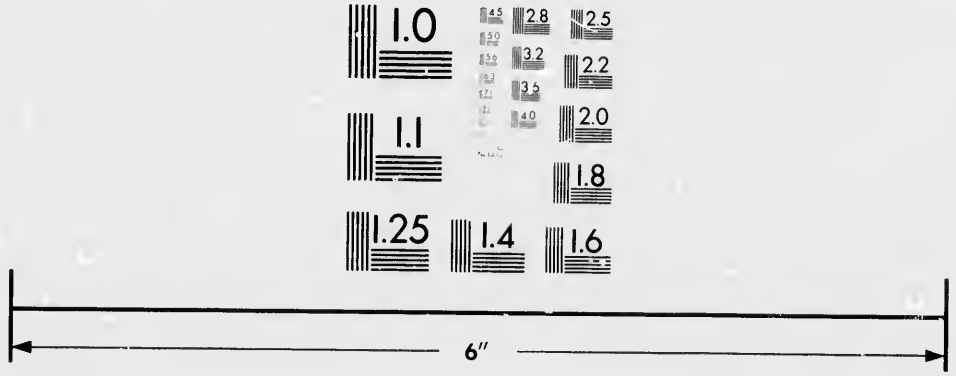
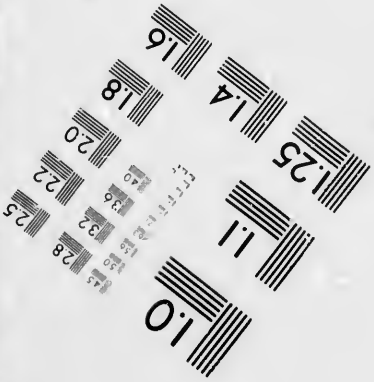
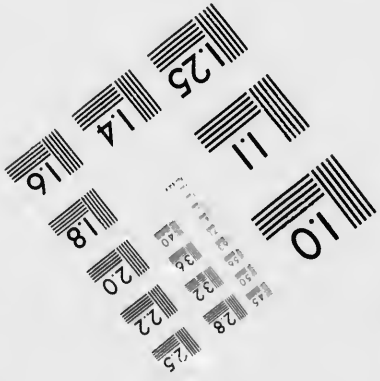


IMAGE EVALUATION TEST TARGET (MT-3)







Photographic Sciences Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

CIHM/ICMH Microfiche Series.

CIHM/ICMH Collection de microfiches.

Canadian Institute for Historical Microreproductions

Institut canadien de microreproductions historiques

1980

Technical and Bibliographic Notes/Notes techniques et bibliographiques

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

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

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

- [ ] Coloured pages/ Pages de couleur
- [ ] Pages damaged/ Pages endommagées
- [ ] Pages restored and/or laminated/ Pages restaurées et/ou pelliculées
- [ ] Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- [ ] Pages detached/ Pages détachées
- [ ] Showthrough/ Transparence
- [ ] Quality of print varies/ Qualité inégale de l'impression
- [ ] Includes supplementary material/ Comprend du matériel supplémentaire
- [ ] Only edition available/ Seule édition disponible
- [ ] Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image/ Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.

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

10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
							✓				

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

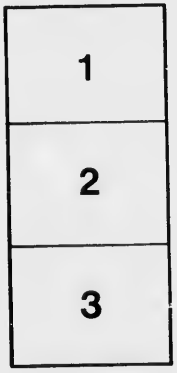
National Library of Canada

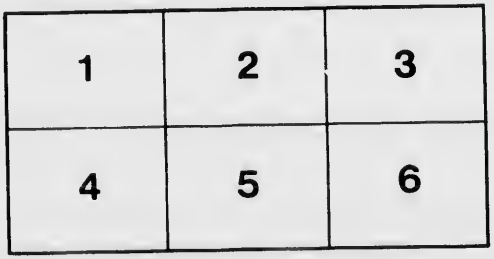
The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

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

The last recorded frame on each microfiche shall contain the symbol → (meaning "CONTINUED"), or the symbol ▽ (meaning "END"), whichever applies.

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





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

Bibliothèque nationale du Canada

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

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

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

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

32X

REPORT

OF

MR. W. T. JENNINGS, C.E.

ON

ROUTES TO THE YUKON

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST EXCELLENT MAJESTY
1898

1

REPORT

OF

MR. W. T. JENNINGS, C.E.

ON

ROUTES TO THE YUKON

PRINTED BY ORDER OF PARLIAMENT

Duplicate in Sessional Paper 30
for 1898 Vol XXXII No. 13

OTTAWA
PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST
EXCELLENT MAJESTY
1898

REPORT ON ROUTES TO THE YUKON.

Toronto, 11th January, 1898.

The Honourable Clifford Sifton,
Minister of the Interior,
Ottawa.

Sir,—I have the honour to transmit herewith the following papers relating to the exploratory work undertaken at your command by myself and assistants late in the season of last year, over that section of the country north of the Stikine River, B.C., to the Yukon, and to say that, until Mr. A. B. Ross, C.E., returns, I will not be able to report further on the portion of the Stikine route lying between the head of the Sheslay River and the Stikine valley via the Clearwater River:—

Papers, &c.:

(1.) Statement of route followed by myself and party via the Stikine to Teslin Lake, dated 15th December, 1897.
(2.) Report on the Stikine River and routes therefrom to Teslin Lake —with plans, sections and estimate of cost.
(3.) Report on Teslin Lake and the Hootalinqua River by Saint-Cyr.
(4.) Report on the McClintock Portage between the Hootalinqua River and Marsh Lake.
(5.) Including remarks on Taku Arm and route from it via Toosliai Lakes to White Pass, with plans.
(6.) Report on route from Chilkat Pass to Yukon via Nordenskiold River (with plans by McArthur) and approximate estimate of cost.
(7.) Report on route from Dyea through Chilkoot Pass to Lake Bennet, and thence to Tagish Lake and Hootalinqua River, with approximate estimate of cost.
(8.) Report on route from Skagway via White Pass, thence to Lake Bennett and above route to Hootalinqua River, with approximate estimate of cost; also, on an alternate plan to a point on Lewes River below White Horse Rapids.
(9.) Report on route from Taku Inlet to Teslin Lake, with approximate estimate of cost.
(10.) Memorandum of cost of prospectors' outfit.
(11.) do electric railway, Stikine to Teslin Lake.
(12.) do wagon road do
(13.) do packing, by mule service.

In making out approximate estimates of cost of lines over country which I personally have not seen, I wish it to be fullly understood that I do so from information as to character of country given me by the gentlemen named, and therefore by comparison and my general knowledge of British Columbia.

I remain, sir, your obedient servant,

W. T. JENNINGS,
M. Inst. C. E.

Toronto, 15th December, 1897.

The Hon. Clifford Sifton,
Minister of the Interior,
Ottawa.

Sir,—In accordance with your desire for an interim report, covering the examination of country made by me for a highway or railway route between the Stikine River and Teslin Lake, B.C., I have the honour to report that I proceeded from Ottawa to Vancouver, thence up the coast in the Government steamer "Quadra" to Wrangel, Alaska, and by a small steamer from the latter point, via the River Stikine to Glenora, and on by canoe for ten miles to Telegraph Creek at the head of steam navigation, and distant from Wrangel 150 miles, and at an elevation of 540 feet above sea level.

Some ten days' delay was here occasioned through various unavoidable causes arising out of the hurried nature of the trip and the consequent want of a prearranged plan for transport. However, the assistants and outfit having arrived, and pack animals secured, I directed Mr. A. B. Ross to proceed to Glenora and seek a pass to the north by way of Shakes Creek or by the Clearwater River, in the hope of finding a shorter and more direct route with a lower summit than that via Telegraph Creek.

On the 25th September, accompanied by Messrs. Saint-Cyr and Morley Ogilvie as assistants, the journey to Teslin Lake was commenced, the course for the first 15 miles being up the Stikine trail over a series of high gravel benches and easy sloping and lightly wooded country to the Tahltan River, where a descent was made and the river crossed (at an elevation of 600 feet), near its confluence with the Stikine, which occurs in a canyon with almost vertical walls of basalt. A sharp climb of 200 feet again brought us to the top level of the escarpment, thence we continued over an old (Hudson's Bay Company's) trail along the slopes on the left side of the Tahltan valley for 28 miles, to the forks of the river, the ground passed over being generally irregular and indicating in many places that clay and gravel slides were of frequent occurrence, particularly about the lower portion of the valley; on the contrary, the right slope, while not so flat, is more regular and the benches are of firmer material. From the forks to the divide between this stream and the Koketsi River the valley expands, having a bottom width of from ¼ to 1 mile, with pine and spruce-clad hills to the south, and easy hillocks and broken benches to the crest of Level Mountain, a high, gravel-covered basaltic plateau extending to the north. Some seven miles from the forks the course of this branch of the Tahltan turns to the north and north-west, terminating in Level Mountain, and where it enters the valley occurs the divide between the Tahltan and Koketsi formed by the detritus brought down from Level Mountain during the flood periods. This divide is almost imperceptible and that it is apparent at no distant date water flowed from the North Tahltan in both directions. The valley hereabouts is at an elevation of 2,200 feet and is covered with a healthy growth of small pine, poplar and spruce.

Immediately after passing the divide, Koketsi Lake or Taku headwater is reached; it is some two miles in length and one in width, the shores at the eastern and western extremities of the lake being marshy; on the south a mountain with easy foot slopes extends to the lakeside,

while the north side is bordered by small rock bluffs and the gravelly slopes of Level Mountain.

For the next four miles the valley is from a half to one mile in width (excepting at one point where a 60 feet cascade occurs in the stream) with a marshy area and a small round lake in the middle of it; here the valley now contracts somewhat and the hills descend with steeper yet easy slopes. At ten miles from the divide a valley opens to the south and appears a likely course to the Clearwater River. Three miles beyond, and in the same general N.W.W. course, a level area about one and a half mile square, and timbered principally with cottonwood of good size is reached. Here the Koketsi stream and Engalls Creek join the Sheslay, which apparently heads some fifteen miles south in snow and ice-capped mountains, but its most easterly branch, as far as could be seen, appeared to extend through low timbered country; and it is by this valley I hope that my assistant, Mr. Ross, will find a way to the Stikine River.

The Sheslay is a formidable stream even at this point and flows north through an open valley for fifty miles to the Inklin or Taku River, and is flanked on the west by snow mountains. The elevation of the flat land at the junction of the Sheslay and Koketsi rivers is about 1,900 feet, and here the built trail terminates, at an old Hudson's Bay Co. post called "Engalls," from thence a course (not yet worthy of the name of a trail) and made by miners and others, ascends Engalls Mountain to the north of the flats until an elevation of some 1,200 feet (or 4,000 feet above sea level) is reached, thence northerly it winds about for two or three miles in a series of marshy depressions until open rolling country some 300 feet lower is reached. From the high ground on Engalls Mountain a good view of the head valleys of the Sheslay and Doo-de-dontooya rivers was obtained and if a route by the former proves practicable to the Stikine, a shorter route to the north will result. From this high vantage point it was observed that the Doo-de-dontooya headed in Level Mountain, and near that of the north fork of the Tahltan, in a country favourable for a route via Telegraph Creek, and undoubtedly the shortest course to Teslin Lake if the Clearwater proves unfavourable.

From Engalls Mountain the character of the country changes, the valley is from three to eight miles wide and lies in view for many miles, but while it is a valley in comparison with the high flanking terrace of Level Mountain on the east and Heart Mountain valley to the west, it has many isolated hills and dunes breaking the general plane of its surface. At a distance it appears open and grasslike, but on approaching one finds the surface covered with loose turf and moss, very wet and unpleasant to travel through, but all on a hard bottom of gravel and detritus formed by glacial and volcanic action. Three streams head in this valley, viz., the Doo-de-dontooya, Matsa-tuya and the Koshin, which are fed principally by streams rising in Level and Heart Mountains. At thirty miles north from Engalls, Koshin Lake is situated under a high wooded hill which continues in easy undulations to the Nahlin. To the east of Koshin Lake a fine open flat extends for at least three miles to the foot of the long, regular timbered slope of Level Mountain.

From Koshin Lake to the Nahlin, the course of travel continues for some thirty-three miles along the slope on the right bank of the Koshin River, through an easy country, generally wooded with a small growth of spruce, black pine, poplar, alder and willow, and at a general eleva-

tion (falling towards the Nahlin), of from 3,600 to 300 feet in the above distance.

The Nahlin is a rapid river (150 feet by 6 feet at flood) flowing in a defined, gravel-sloped valley some 1,200 feet wide and 225 feet deep. Its direction from the source, in Level Mountain, is generally west for thirty-six miles, when it turns abruptly to the south and so continues for eight miles, then again curves to the west. In its course it is fed by streams from a large lake area to the north; it also receives the waters of the Koshin, Doo-de-dontooya and the Sheslay rivers, and, from its confluence with the latter it is lost in name, and onward to a junction with the Nakina River, it is called the Inklin; thereafter, to a point of discharge in Taku Inlet, it is called the Taku River.

From the Nahlin River northward for 48 miles the valley contracts from 20 to 8 miles in width and has in its central section a continuous stretch of rounded hills all heavily timbered with spruce and pine, while on either side in the low grounds, are many lakes and marshes; the valley to the eastward being the widest and best for railway purposes. The watershed of Teslin Lake and Taku River basins occurs only some four miles from the Nahlin River, in the middle of a prairie dividing a large lake in the eastern valley, and at an elevation of about 3,600 feet above sea level.

In this area the water courses observed on the slopes of the high land to the east are lost in a succession of lakes and marshes extending northward for 25 miles, when finally the waters unite at the foot of Hoot-so-gola Lake and thence, after tumbling over "White Swan" cascades, form in a defined channel (200 feet by 5 feet at flood), flowing north for eight miles (between gravel banks nearly 100 feet in height) to the south end of Teslin Lake. Teslin Lake is from two to four miles wide and 2,400 feet above sea level, and extends in a north-westerly direction for 60 miles, thence discharges by a navigable river of the same name into the Lewes River at a point some 100 miles beyond the lake.

While the country over which the so-called trail extends between the Nahlin River and Teslin Lake is not suited for railway purposes owing to its undulating and elevated character, still, a good route for a trail, wagon road, or railway may be had on either side of the valley proper (and preferably by the east side) over an easy country (with light undulating gradients) all the way from the head of the Doo-de-dontooya River.

While the whole country is covered with tufty grass, moss and occasionally mire, and unpleasant to travel over in unseasonable weather, yet a road can be inexpensively made, as the soil is good for the purpose and would be dry if relieved of its heavy blanket of moss.

From the Nahlin River northward and to the east of the valley the high ground continues in a more abrupt form and should not there be called Level Mountain as some of the peaks are rugged and snow-capped, while to the west the same chain of snowy peaks continues from the head of the Sheslay River to Teslin Lake with only one break, where the Inklin River passes through it.

Immediately at the south end of Teslin Lake and for many miles down its eastern side extends an easy, gently sloping bench; therefore, a terminus can be selected at any one of various favourable points. The lake for the first ten miles is river-like, with two prominent narrows, the water was found (on the 15th October) to be 4' feet in depth, with soft

bottom; while high water mark indicated 11½ feet above the level then taken, and 8 feet above an observation made in June last.

At Teslin Lake an Indian trail from Taku Inlet terminates. One 7 feet by 9 feet log shanty dignified by the name of the "post" was the only evidence of the advance of civilization in the locality, and it contained but a meagre quantity of supplies.

Teslin Lake was reached on 13th October. I was fortunate in being able to at once obtain a "scow" boat, 22 feet long, and a "skiff" boat of smaller size, and in these boats I despatched Messrs. Saint-Cyr, D.L.S., and Morley Ogilvie, B.A.Sc., with three men to survey Teslin Lake and its outflowing river, of the same name, to its confluence with the Lewes River, with instructions to Mr. Ogilvie to part company with Mr. Saint-Cyr at the portage leading to McClintock River and Lake Marsh (on the Skagway route) and from the point of separation to make a track survey with copious notes of the elevations, and physical features of the country passed over, also from Lake Marsh to proceed south to Taku Arm of Tagish Lake, and continue his survey and notes from a point where terminated by Dr. Dawson in 1887, on the supposed good route for a road to Skagway, via White Pass, and where I proposed to rejoin him, my intention being to return to the sea at Juneau by Taku trail and inlet (or by Taku and Kattine rivers to Atlin Lake, &c.) as I learned that engineers, under orders from a private company were examining that route to Teslin Lake; however, in this I was disappointed, as neither white or Indian packers were available, and it being impracticable to take horses over the mountains so late in the season, I was thus forced to return to the Stikine River.

As Mr. Saint-Cyr's survey of Teslin Lake and river, and Mr. Ogilvie's work, as mentioned above, will form the subject of a later report, I will now only mention that Teslin Lake was found to be 60 miles long and from 2 to 4 wide, generally straight and with good depth of water, and teeming with magnificent trout. Teslin or Hootalinqua River, from the north end of lake continues for 25 miles (to McClintock Portage) in a generally direct N.N.W. course, and I learn by wire from Mr. Saint-Cyr that it is wide and of ample depth for passage of steamers to the Lewes River.

The return journey was commenced on October 14th, over the same route to the Koketsi and Tahltan divide, thence up the hillside and through a valley to the main or south fork of the Tahltan, a rapid stream 80 feet wide and two feet deep, and evidently draining a considerable area of the high land to the south. From the trail crossing, the valley of this stream extends in a south-westerly direction and is flanked by rolling ridge-like hills lying in a north-western direction and all densely clad with a small growth of spruce and pine.

From the crossing of the Tahltan the route continues in a south-easterly direction in the valley of a small stream and over easy ground slopes and benches to Telegraph Creek divide, which is an open, straight gladelike pass from 150 to 300 yards wide, covered in the bottom, and for a few hundred feet up the slopes with a coarse description of tufty grass and scrub willows, growing in a west surface soil.

The elevation of the summit of this pass is 3,600 feet above sea level, or 3,100 feet higher than the Stikine River at the mouth of Telegraph Creek. The flanking mountains rise some 2,000 feet higher and are covered with an open growth of small spruce and willow trees, gradually decreasing in density and size as the timber limit is reached.

Some 8 inches of snow had fallen in the pass, and the two small lakes were frozen over. From the summit the course of Telegraph Creek is south-east, straight and gradual. About seven miles from the summit the higher slopes on the north side of the Stikine valley terminate in a wide bench (with isolated hills dotting its general surface), which extends up the Stikine valley towards the mouth of the Tahltan and down to Glenora or beyond.

Telegraph Creek was reached on the 22nd October, after a continuous journey of at least 350 miles. The weather was fine for the time of year. Light rain fell on several days and two snowfalls of about 5 inches each occurred, but strong "Chinook" winds soon caused it to disappear. The temperature during night hours almost invariably fell below freezing point, but not more than 22 degrees of frost was observed at any time.

On the 23rd October I took passage in a canoe for Wrangel, with the intention of proceeding to Skagway, and on nearing the Clearwater River was fortunate in meeting Mr. Ross, who had just returned from the exploration of a route up Shakes Creek and over to the Sh. Tahltan head. A pass 3,850 feet high and distant 40 miles from the Stikine River was found, but it is higher and the route much longer than that by Telegraph Creek.

Mr. Ross had finished a plan and report of his operations thus far and was then ready to work up the Clearwater valley to the Sheslay River, as directed.

I requested him to get through as soon as possible, and, if a favourable route was found, to continue down the Sheslay or send a competent man to examine the slopes of that river north to the Inklin. I have since learned from Mr. Ross that, owing to the low stage of water and other disturbing influences, due to the lateness of the season, he was only able to advance some ten miles up the Clearwater, when he decided to retrace his steps and proceed by Telegraph Creek trail to Engalls, and from that point endeavour to ascend the Sheslay valley and over into that of the Clearwater, thence to the Stikine and home.

The Stikine River and its branching head waters rise in the Cassair Mountains between latitudes 56° 20′ and 59° 20′ N. and longitudes 128° and 131½° W. The main stream and its upper feeders, the Tanzilla, Tooya and Tahltan, gradually converge and eventually unite in one grand watercourse within a distance of from 10 to 26 miles above Telegraph Creek, which is at the extreme head of steamboat navigation, and distant from the sea, at Fort Wrangel, Alaska, 150 miles.

The feeders (excepting the Tooya) and main river run as a rule in deep, and more or less contracted valleys, with occasional canyon walls and generally steep lower slopes, while high undulating and mountainous country form the surroundings.

From Telegraph Creek southward for some 30 miles, or to the inland border of the Coast Range, high gravel terraces or "benches" of a fairly regular level and outline are noticeable especially on the east side of the valley, while near the water level low benches are of more frequent occurrence, greater extent and with few rocky projections on the river sides.

About 116 miles from the sea the Clearwater River, a large tributary flowing through an open valley enters from the north-west.

Below the Clearwater and to within 20 miles of the sea, the general course of the valley is south, and it is from one to three miles in width,

but the river makes many bends and swings from side to side of it, and the bottom lands are more frequently divided by sloughs or by-channels cut (during freshet seasons) through the silty and loose formation. The Klootchman and Little Canyons being almost exceptional points where there is only one channel, confined between rugged but receding rock walls, respectively 300 to 400 feet apart and one-third of a mile in length at the former, and 100 to 150 feet apart for three-fifths of a mile at the latter. In both cases the direction of the river between the rocky shores is straight.

Below the Little Canyon and on to the sea the flat lands increase in extent and the by-channels in number and capacity.

The Och-sa-Kieen, Scud, Porcupine and Iskoot Rivers flow into the Stikine River from the east at varying intervals, also many small streams from glaciers and mountain clefts on both sides. The Iskoot River, which is the largest of the tributaries named, enters 35 miles from the sea, and ten miles below it the Stikine changes direction to the west, passes out through the main range of mountains and on through an expansive valley to its wide delta-like mouth on the coast line, some 12 miles north of Wrangel and in latitude 56° 40′ N. and longitude 132° 20′ W. The range of mountains cleft by this river valley is principally of granite rock and grand to look upon, as the peaks are lofty, rugged and irregular, and some five or six large and many small glaciers are yet to be seen, but with few exceptions they are "dead." The whole valley and slopes to the timber limit are clothed with cotton-wood, spruce and alder trees, which decrease in size and quantity as the interior country is reached.

The Stikine River is usually navigable for powerful steamboats of suitable design to Glenora or Telegraph Creek (a distance of 150 miles) between the 1st of May and a date sometimes well on in October, dependent, of course, on the openness of the season and the amount of rain and snowfall. Its width varies from half a mile on the lower river to 500 feet at Telegraph Creek. The depth is generally good and the channel is remarkably free from snags, sunken rocks or boulders. At Little and Klootchman Canyons (respectively 96 and 106 miles from the sea) during high water periods when many drift trees are running, it is with considerable risk that the passage through these contracted reaches are made, and delays are common, as the drift-wood is liable to become foul of the rudders or wheel. The first 50 miles from the sea, or to the Great glacier, is very good water with a moderate current not exceeding three miles per hour, while from this point upwards the channel becomes somewhat more tortuous and contracted, with an increasing general rate of current varying from three to eight miles per hour; however, the exceptionally swift sections are few and usually not over a half mile in length.

A powerful river steamer should be able to make the Little Canyon in one day's run from the mouth of the river, and the Glenora or Telegraph Creek on the second day.

The sum of $5,000 could be advantageously spent in removing snags and boulders, and in placing permanent cables for use in the heavy water, principally above the Little Canyon.

I reached Wrangel on the 25th October, where I had the unexpected pleasure, Sir, of meeting you, and as you deemed it inadvisable for me to attempt an examination of the Dyea and White Passes at such a date, I returned with you on the "Quadra" to Vancouver, where we arrived on the 1st November.

The next day I proceeded to Victoria and obtained from the Surveyor General of British Columbia some data which I thought might be useful in this connection, and at once left for home.

I inclose report on the routes examined, accompanied by the following plans and sections :—

Plan from Wrangel up Stikine River to the Tahltan River.

Plan of the country from the Stikine River to Teslin Lake.

Sections on the various projected routes.

A package of photgraphs, taken by me, showing the general character of the Stikine River and country traversed.

All of which are respectfully submitted.

I remain, Sir,

Your obedient servant,

W. T. JENNINGS,
M. Inst. C. E.

REPORT OF A RAILWAY ROUTE BETWEEN THE STIKINE RIVER AND TESLIN LAKE, B.C.

Sir,—In reporting on the result of my observations for a railway route between Stikine River and Teslin Lake, B.C., I would, however, first refer to the means of communication between the sea and a suggested point of debarkation on the river, by mentioning that the Stikine has been navigated by steamers to Glenora and Telegraph Creek (a distance of from 140 to 150 miles from the sea) since the early seventies, when the Dease Lake and Cassair mining excitement was at its height, but while so navigated during the open season, usually between May 1st and October 20th, the journey has almost invariably been considered slow, tedious and not without danger, partly owing to the inferior class of steamers used and partly to the fluctuating state of the water. At times the river is too low for speed with a reasonable cargo, or the stream may be very high and the riffles difficult to make headway against, with the additional danger of drift trees or snags getting foul of the steering gear or wheel. The latter danger is most to be feared where the channel is contracted such as in Little and Klootchman's Canyons where, if any mishap occurred to the vessel's machinery, she would at once be carried against the rugged rock walls by the swift, swirling, disturbed waters, and sunk by having her planking either torn out or stove in. The distance of 96 miles between Wrangel and Little Canyon can be made by a powerful steamer in one day, whereas by reason of the swift and difficult water above it will take two *days more to reach Telegraph Creek a further distance of only 54 miles or 150 miles from the sea, therefore, with these facts before one, it seems reasonable that a route where safe and speedy transit is contemplated it is advisable to commence the railway well down the valley at a point to be determined on below the Little Canyon, and on the left bank of the river 96 miles from the sea.

The route from a point below the Little Canyon, where suitable dock and siding accommodation is to be had, on for thirty miles to a crossing of the river near Shakes Creek, has been laid down on the left side of the river, as being the least subject to snow slides, owing to the mountain slopes being more distant and less precipitous, and to enable the line to be carried through a depression between the eastern termina-

* Morning of second day, running in daylight only.

tion of the granite spur through which the Little Canyon extends (in a straight cleft) and the mountain side, thence across the Ok-So-Kieen, a rather formidable mountain stream which will require a pile bridge of at least 100 feet in length, also protection cribwork; from here to the Klootchman Canyon, some 10 miles from the Little Canyon, the course will be generally over flat lands, and occasional short ragged and sloping points of grainte and changed rocks, avoiding as far as practicable by-channels or sloughs, some of which will require to be closed by the introduction of rough cribwork.

At the Klootchman Canyon it is advisable to carry the line at somewhat higher level than ordinary to ease the curvature and avoid filling in the water where short, sharp indentations in the shore line exist.

From the latter point broken flats and occasional rocky points will have to be crossed to reach the left shore at the Grand Rapid (a particularly swift section of the river) where the foot slope of the last spur of the Coast Range proper comes in close proximity to the river, here a short, strong shed will be required, as it is evident that snow slides annually; passing this spur, a gravel bench will have to be cut into, thence the line will continue over the Doch-da-on, a stream very similar to the one before referred to, and on over bottom lands and along the river's side of an almost isolated ridge of granitic or altered rock facing the Clearwater valley, thence continuing on gravel benches and short irregular rocky projections and across several minor streams to a point where the river may be crossed by a bridge about 775 feet in length, placed at such an elevation as will ensure its safety during high water periods, when the water level is fully 15 feet above its lowest mark.

I would here mention that should it be desirable at a later date to continue a railway to the vicinity of Dease Lake or to meet a line from the Skeena or Nasse Rivers the ground ahead is favourable for construction at moderate cost.

Again, should a route, now being examined by one of my assistants (via the Clearwater) be found practicable, the Stikine would likely be more advantageously crossed lower down the river; however, of the Clearwater route I am unable at present to say more than that the valley of that river appears open and easy, as viewed from the Stikine River.

From the crossing of the Stikine to the divide between the Tahltan and the Koketsi streams there is a choice of routes. The first by an immediate and steep ascent along the right slope of the Stikine valley, over rock and gravel formation and through an indentation in the range where Telegraph Creek has its rise in a regular glade-like pass at an elevation of 3100 feet above the river level (at crossing) and distant 27 miles therefrom; thence down the easy, pine-clad slope of Arthur Creek to the South Tahltan and on over flats and light rolling ground to Koketsi divide, a distance of 10 miles from the pass or 46 from the crossings.

The grades on this section (particularly on the Stikine slope) will be severe, and reaching, in places, to 4 per cent, to ensure moderate construction cost.

The second route follows the right slope of the Stikine with a gradual rise, over better ground than to be had on the Telegraph Creek route, to the eastern or tongue-like end of the range terminating at the confluence of the Tahltan and Stikine rivers and where the mountains gradually fall away to high rolling, lightly timbered hills.

The ascent to this point (some 1,200 feet) would be reached in 30 miles, over moderately inexpensive country with gradients which need not exceed 2 per cent.

From this point the route continues along the right slope of the Tahltan, in places over steep and rocky ground, with only such light undulations in the grade line, as local circumstances may economically demand, to near the Forks of the Sh. Tahltan, where the stream should be crossed and the line continued over easy clay and gravel slopes and benches to the Koketsi divide, or to the same point as described for the first or Telegraph Creek route, a total distance of 59 miles from the Stikine crossing and 12 miles longer than by Telegraph Creek.

I would here point out that route No. 2, although longer, has several advantages over the other to which due consideration should be given, viz.: The gradients are lighter so that with the same engine power in about equal time heavier tonnage could be transported to Koketsi.

The work of construction would be less per mile.

It would approach 12 miles nearer the Dease Lake district and Tooya River basin than that via Telegraph Creek, therefore more favourably situated for future extension eastward to Dease Lake, or to meet a line from that district, or the sea coast via the Naas or Skeena River valleys.

It is also possible that a route from here to Teslin Lake via the Tooya River is to be found and, as it may be inquired why that country was not fully examined, I would state that the time or means at my disposal was not sufficient to enable me to cover, personally, or by assistants available, more country than was examined.

At Koketsi (1,700 feet above the Stikine crossing) there apparently occurs another choice of route, for a short distance, and to which I again refer to as numbers 1 and 2.

Number one extends from Koketsi up the valley of the north fork of the Tahltan River to its head (distant say 6 miles), in Level Mountain (a vast basaltic and gravel-covered plateau extending northward to the Nahlin River, a distance of 70 miles) and at an altitude of about 1,600 feet above Koketsi, thence descending (200 feet) slightly for 8 miles through a broken, lumpy and irregular looking valley (bounded on the north by the escarpment and slope of Level Mountain) to the head of theDo-de-dontooya River and Me-a-de-le Lake, a total distance of 14 miles.

The route from the Koketsi divide, is through an open valley as far as seen by me (2 miles), but I am informed by an assistant who examined it that towards the head it is a series of canyons and broken, irregular masses of rock intermixed with gravel on the slopes; however, by commencing to rise with a heavy gradient some distance back on the last section it is probable that a line may be obtained above the "canyon" portion, the walls of which are not usually very high in this section.

The summit once reached, the descent (as viewed by me from an elevation of 4,000 feet at Engalls Mountains) would be made through a section of country apparently composed of broken and disconnected hills, as above described.

Number two, or the alternate route, would be a distance of 15 miles from Koketsi to the head of the east branch of Engalls Creek, with a rise of 1,400 feet, thence in 7 miles a descent of say 150 feet to Me-a-de-le Lake, in all 22 miles from Koketsi, or 8 miles longer than No. 1 route by the north fork.

It is evident that with a distance of 15 miles in which to make the rise of 1,400 feet a much easier grade can be had than by way of the north fork, but I cannot advise such a course unless the whole of route number two be adopted, when it would be an object to incur the expenditure for additional mileage, for the sake of obtaining easier gradients; again, within the limits of this part of the route are several alternative plans.

1st. To keep on easy ground to the right of the Tahltan to Koketsi divide, thence along the southern margin of the lakes of same name, and crossing the stream at Profile rock and there commencing an ascent for 9 miles, along the side hill to the summit of Engalls Creek, with a 3 per cent grade, easy curvature and comparatively light work; thence from this point descending to Me-a-de-le Lake over the ground before referred to.

2nd. A line should be tried through a high depression north of Profile rock by commencing the ascent east of the north fork crossing.

3rd. A minute examination should be made up Quartz Creek ravine, as it appears open to the north.

Only by an instrumental survey, with measured distances, can the proper route in this vicinity be determined, and the base of operations should be established by running up the north fork and over the summit to Me-a-de-le Lake and returning by Engalls Creek and the Koketsi to place of beginning.

From Me-a-de-le Lake, for the next 118 miles, one line is common to both routes, and extends northward in a very direct course for 57 miles to the Nahlin River over flats, glades and gentle slopes in the valley near the base of the western shed of Level Mountain with a small percentage of curvature, easy gradients and light work. For a considerable proportion of the distance the country is timbered with a small growth of spruce, pine, scrub willow and alder, the spruce, however, predominating. The surface of the ground through the whole valley is covered with a deep growth of moss and, in places, "bunch" and coarse tufty grass.

The soil consists of light clay, sand and gravel, with drift boulders and occasional masses of basalt and limestone.

The seven or eight streams passed over are small and unimportant; a short pile trestle being sufficient for each. The names of the largest being the Doo-de-dontooya, Massatooya, Kakatooya and Ka-hak.

The Nahlin River, where crossed on the trail, is at least 150 x 6, with 1 per cent fall at flood, and runs in a valley about 1,200 feet wide, 250 feet deep and with 1½ to 1 slopes, but where the line is projected, at a point some 4 miles above the trail crossing, it runs in a much contracted V-shaped trough, about 100 deep and 350 wide.

At the Nahlin River, Level Mountain or plateau terminates, but the high ground continues northward, in a more elevated, irregular and mountainous form; and it is at the foot of its western slope and bordering the eastern edge of an extensive marsh and lake district called "Grand Valley" that the line is projected in a northerly course to a regular, easy, rolling bench area reaching from the cascades of "White Swan" River to and along the margin of Teslin Lake.

On the section of 67 miles between the Nahlin and Teslin Lake several streams are crossed, but none of such importance as to require more than an ordinary pile structure. The soil is principally of a sandy gravel nature, and very little rock will be met with on the location line.

From the "Cascades," and to the end of a river (which I have named White Swan) flowing into the extreme south end of Teslin Lake, northward for many miles, the slightly undulating gravel bench land, covered with small spruce, &c., continues; therefore, the point for a terminus need not now be defined, beyond the statement that it should be situated north of the shallow narrows and on the open portion of Teslin Lake, at least 10 miles beyond where "White Swan" river enters its estuary-like southern end, thereby ensuring a longer season of navigation, as the shallow contracted portion doubtless freezes over some weeks before the lake. As Teslin Lake and its outflowing river of the same name will form the subject of another section of this report, I will only say that both lake and river are favourable, during the open season, for navigation by steam and other craft.

Should the Clearwater valley prove favourable for railway or road construction, a very considerable saving in distance will be effected to Engalls Mountain, where the line may be united with any one of the routes above described, or it can be carried down the Sheslay River, some ten miles, and through a gap near the north end of Heart Mountains to the Doo-de-dontooya River, thence to a junction with the first line.

In conclusion, I may state that provided all arrangements are made and the location determined upon by April next, the line of railway by either route shown on the plan can be completed and in operation by September following, at a cost of four million dollars, that portion situated on the Stikine River below the crossing, including the bridge, costing $746,000 of the total amount.

I remain, Sir,

Your obedient servant,

W. T. JENNINGS.

M. Inst. C. E.

Toronto, 17th December, 1897.

EXAMINATION OF TESLIN LAKE AND HOOTALINQUA OR TESLIN RIVER—200 MILES.

By the attached report from Mr. Arthur Saint-Cyr, D.L.S., who I detailed to make a track survey and examination of Teslin Lake and the Hootalinqua River, it will be seen that these waters are navigable during the open season between the 20th of May and possibly the 1st of November, for such steam and other craft as are suitable for the purpose, and that no doubt need be entertained as to the depth and soft bottom in the various narrows near the south end of Teslin Lake, as the water (which was in the middle of October eleven feet below H.W.M.) keeps up to a good level until the heavy frosts of October check the outflow from its watershed.

From a miner who spent the winter of 1896-97 on its shores, I learned that Teslin Lake was frozen over on the 27th October, 1896, and opened on the 18th of May, 1897, also that the lake is well stocked with trout, white ("Dagolly") pike, and "Inconnu" fish, of which I had evidence when there. This is also reported as a good district for moose and cariboo, also for bears, foxes, beaver and other fur-bearing animals.

There are very few Indians living in the district, which is apparently hunted over by and under the control of a tribe whose headquarters are on the Nakinah River at head of canoe navigation on the Taku River and distant about 70 miles from Teslin Lake.

The result of the chase is thus lost to Canada, as these Indians trade exclusively in Juneau, now an American town.

I may be allowed to mention that our investigations amply corroborate the statement made by Dr. C. W. Hayes, who traversed Teslin Lake and the Hootalinqua River in 1891, and whose report thereon is to be found in Vol. IV. of the National Geographic Magazine, Washington.

January 6th, 1898.

W. T. Jennings, Esq., C.E.

Sir,—After receiving the Surveyor General's message and letter dated Ottawa, August the 18th, requesting me to place myself under your orders for the rest of the season and make such surveys as you might require, in connection with a proposed railway line to the waters of the Yukon River, I discontinued the exploration of the Tooya River valley at which I was at the time engaged, and nearly through with for the season, and reported to you at Telegraph Creek, on September 20th.

After giving you all the information that I had been able to gather during the summer exploration of the country between Teslin Lake and Telegraph Creek, I accompanied you on your trip to the lake. There I received your instructions for the survey of Teslin Lake and Hootalinqua River and proceeded at once to carry them out.

I now transmit to you my report on both lake and river, and the country in their immediate vicinity.

This survey commenced on October the 14th and was completed thirteen days later, on October 27th.

Whenever the weather was favourable, observation for latitude were taken with a pocket sextant, and, after being reduced, afforded a good check on the work.

The distances, I find, are as follows:—

Length of Teslin Lake	60½	miles.
From Teslin Lake (foot) to Lewes River	139½	"
Total distance	200	miles.

Distance between the foot of Teslin Lake and McClintock Portage by the river..... 42 miles.

Both lake and river lie in a wide and partly timbered valley, the general trend of which is in a north-westerly direction. Along the lake, the valley averages about two miles in width, and along the river one mile.

The water level of the lake was found to be 11 feet below high-water mark.

At two miles from its head the lake contracts, forming narrows which extend fully a mile in length.

Soundings taken in these narrows revealed a depth of four feet of water, with muddy bottom.

From the end of the first narrows the channel runs along the mouth of a shallow bay lying on the west side of the lake. The mouth of the

bay is about one mile wide. Immediately beyond the bay the channel is obstructed by a bar with only five feet of water.

From this point for a distance of four miles the lake is comparatively narrow (about 600 yards in width). Then another large bay (about two miles across the mouth) extends one and a quarter mile to the south-west where it receives a large stream which drains a considerable area of country.

The last narrows (Moose) occur after passing the second bay. The width of the lake is here reduced to about two hundred yards. A good sized stream empties into the lake on the east side, immediately beyond Moose Narrows, and has deposited a large body of silt, forming an area extending nearly to the west side of the lake, and leaving a channel only about thirty yards wide. This narrow channel runs along the west shore for a distance of nearly half a mile from the narrows.

Here commences the lake proper, and for fifty miles is plain sailing, with a good depth of water until the foot of the lake is reached, where the channel is again reduced in depth by a bar with only six feet of water over it.

Lake Teslin is bounded by mountains of from three to four thousand feet in height, and at some distance in the interior detached snow-clad peaks, rising to an altitude of six thousand feet, are often to be seen.

Two deep indentations were noticed along the east shore of the lake; the first one, occurring thirty-six miles from its head, receives a good-sized stream which flows in from a south-westerly direction.

The other one, which is the deepest, is three miles further on and receives the Ne-Sutlin-ni River, which is the largest stream entering the lake on that side.

Besides these two rivers there is another one which enters the lake only a short distance below the Moose Narrows. It heads from the south-east and at its mouth the Taku Indians have established a fishing station.

Of the three principal streams which enter the lake on the west side, one was particularly noticed, nearly opposite Ne-Sutlin-ni Bay, on account of its valley, which is very wide. This valley extends in a southerly direction, and may possibly connect with the Nakinah valley and leading towards the Taku River, in which case it would afford a pass from that direction to Teslin Lake.

In the lake are several small islands. They generally lie close to the shore and at some anterior period were undoubtedly part of the mainland. Their sides are formed by high bluffs and escarpments. As a rule the water is very deep close to them.

The Hootalinqua River which flows out of Teslin Lake is quite a large stream. It varies greatly in width at different parts of its course, expanding sometimes to half a mile, in which case it is partly obstructed by large bars which, however, leave a deep though sinuous channel; again, in places it divides into several channels, thus forming large islands, where timber of good size and quality is generally to be found; while in other parts it narrows down to a single channel a few chains in width.

The current, which is rather slack for a short distance below the foot of the lake, increases gradually till it reaches a velocity of nearly five miles an hour near the confluence of the Hootalinqua with the Lewes River. Only in a few places, in bends, and for very short distances, was a velocity of six miles an hour recorded.

The prominent feature of the valley in the immediate vicinity of the river is the high benches which skirt it on either side.

From McClintock Portage down to its confluence with the Lewes, the river is very crooked, and where close to the foot of these benches it has caused extensive land slides which have left bare the face of the hills, thus forming high cut banks of clay and gravel. These alternate with flats formed from the materials carried down by the stream during the season of high water.

Further inland the benches gradually change to rough hills, mostly timbered, and culminating in high mountain ranges of four thousand feet above sea level.

Eleven miles below McClintock Portage the river divides into two wide channels. The left-hand channel is the principal one. It runs close to the left bank which is here formed by a sut bank three hundred feet high. This channel is narrow and the water runs swiftly. The other, although the shorter of the two, is full of bars and is obstructed by snags. It is separated from the main channel by a large island.

A careful examination was made of the confluence of the Hootalinqua with the Lewes River for bars which are likely to occur at a point where two streams meet. Such a bar here exists and is situated in the Lewes River, some distance above the mouth of the Hootalinqua and spreads southerly into a large island, of which more later on.

This bar divides the Lewes River into two channels. The main channel follows close to the left bank, while the other deviates towards the Hootalinqua River which it actually enters, forcing by its own velocity a passage for itself through the comparatively sluggish waters of the Hootalinqua after which it again re-enters the main Lewes River.

The bifurcation of the Lewes at this point and the presence of an island covering the Hootalinqua mouth has frequently caused boat parties of miners intending to winter there to be carried so far down stream before discovering their error as to determine them to go on rather than return against the stream.

So said a party of American miners whom I met on the Hootalinqua some six miles above its mouth, and no doubt accounted for the absence of a number of their friends who were a short distance ahead of them, and who promised to stop at the Hootalinqua for the winter. They further explained that they had nearly made the same blunder, mistaking the waters of the Hootalinqua, which are a dirty brown colour, for those of a slough or of marshy water.

At the confluence of the Hootalinqua with the Lewes River there is a large island, the sides of which are constantly wearing away under the action of both streams.

The materials thus eroded are carried down and deposited under the island, causing a serious obstacle in the form of a bar with only fourteen feet of water on it, in a channel at one and a half chain from the east bank of the river, but it must be kept in mind that the water was then very low, being ten feet below high water mark.

Timber of good quality was seen at several places along the Hootalinqua River. It is mostly spruce of 18 inches to 24 inches diameter. It grows on the islands and the flats adjoining the stream. Some pines and cottonwoods of large size were also noticed.

The permanent streams flowing into the Hootalinqua from the high lands on each side of it are not numerous and are generally of small size.

Only one fair-sized stream entering from the east was noticed. It is fifty feet wide from bank to bank, with a very swift current. The water was two feet deep and running over large boulders and I infer, from the colour of the water, which is of a bluish tint, that it heads in a lake in the interior.

Up to November 10th, the day on which I left the river, ice had not formed along its margin, nor did I see any floating down, although the thermometer for several days registered as low as 44 below zero, but a steady falling of the water, averaging two inches a day had, however, been observed.

I remain, Sir,

Your obedient servant,

ARTHUR SAINT-CYR,

D.L.S.

McCLINTOCK RIVER PORTAGE.

BETWEEN THE HOOTALINQUA RIVER AND FOOT OF MARSH LAKE—29 MILES.

Feeling reasonably sure that the correctness of former reports of the navigability of the Hootalinqua River would be established by the exploration party under my charge, I deemed it advisable to have this link between the two great sources of the Yukon examined that, in the event of the development of the district by the construction of a rail or wagon road, the department would be fully conversant with the locality. I therefore detailed Mr. Morley Ogilvie to assist Mr. Saint-Cyr in the survey of Teslin Lake and the Hootalinqua River to the point where the Indian portage trail commences, then to "track survey" the country to Marsh Lake and, thereafter, continue the same work southward on Taku Arm of Tagish Lake and, returning along the western margin of the lake, to explore to the White Pass by way of Too-tshai River and lakes, that course having been much referred to of late as a more suitable route between White Pass and Tagish Lake than the one in use.

The work having been accomplished, I am able to report that the Portage trail ending on the Hootalinqua was found at a point some 42 miles by river from Teslin Lake (Lat. N. 60° 50′ 14″) at an abrupt turn in the river where Mary's Creek, a stream flowing almost parallel to the Hootalinqua, enters from the west.

The western side of Mary's Creek was followed for some 6 miles to a flat bench (600 feet above the Hootalinqua and 900 feet above the Marsh Lake) forming the divide between its waters and those of the McClintock River which, from this point, extend in a south-westerly direction for some 29 miles, to where discharged in Lake Marsh near its outlet. The McClintock is a small stream which passes through an open valley flanked by high rolling hills and an almost continuous line of gravel and sand beaches, with a bottom area consisting of numerous swamps and hay meadows, the latter predominating, especially near its mouth.

The higher slopes of the valley and the bench lands are covered with a growth of small size black pine, while spruce of fair dimensions was observed in secluded damp spots, and the swampy bottom lands support a growth of scrub willow.

From the information obtained it is evident that this section of the country affords a very inexpensive route for a railway, wagon road or trail to the Hootalinqua, thereby avoiding the canyon and rapid waters of the Lewes River.

I might here point out that there exists another trail through the low open valley between the foot of Teslin Lake and the outlet of Tagish Lake (near the military post), but time would not permit of its examination.

The shore line of Taku Arm was defined to a point some miles beyond the outlet of Toot-shai Lake and the latter river and lakes of same name were surveyed and noted to White Pass, with the result that the course from White Pass to navigable waters on Tagish Lake was found to be much longer, and through a very much rougher country than that traversed by the present trail to Lake Bennett.

RAILWAY ROUTE FROM CHILKAT PASS TO THE YUKON RIVER, VIA NORDENSKIOLD RIVER—245 MILES.

A railway covering the above-named district may be commenced at a suitable harbour and town site on either Chilkat or Dyea Inlet at head of Lynn Canal; thence up the valley of the Chilkat River for a distance of 20 miles to near the Indian village of Klookwan at the confluence of the Klaheena and Chilkat Rivers, where an elevation of 115 feet above sea level is gained.

The course on this section would be generally straight between the points mentioned, and principally over bottom lands of alluvial deposit, covered with a growth of scrub spruce and alders.

If the west side, or from Pyramid Harbour, is selected, the line will cross the Kat-se-ka-hin, Tah-kin and Tisku, glacier-fed rivers, thence up the valley of a slough of the Klaheena River, whereas on the opposite side of the valley there are no entering streams, but a large slough of the Chilkat extends close to the base of the mountains for a great part of the distance, leaving but little room for a road-bed clear of the foot slopes, which would, however, have to be used on either side, for short distances, at unavoidable points.

From the 20th to the 50th miles the valley of the Klaheena is followed in easy bottom country somewhat similar to that first described, at the 38th miles where the Klaheena River is crossed, the ascent to the summit (3,280′) becomes steeper, necessitating a gradient of 4 per cent for 12 miles to overcome it; but this gradient can be reduced by a more gradual rise, on a 2½ per cent grade, commencing at the 28th miles (480′) and using the mountain slopes formed of broken rock and gravel benches; or, another modification is suggested by commencing a 1½ per cent gradient at the 28th mile and using the lower slope to reach a gravel bench at the 42nd mile (1,500′) thence continuing in the bottom for the next eight (8) miles, with a 4 per cent gradient to the summit. However, all the engineering features above expressed can only be fully determined after a careful location survey has been made on each route.

From the summit (3,280′) at the 50th mile on to the 71½ mile (3,200′) at the "height of land," the course is projected over easy, grass and heather-covered country with springy slopes, and composed principally of earthy soils intermixed with loose masses of rock and boulders.

A branch of the Chilkat is crossed at the 58th mile, and the line carried to the back of a knob at the 59th mile, thence with a slight descent in the next 1½ miles a small lake is reached, and from this point to the "height of land" the line is, with light gradients and few curves, projected over easy, prairie-like country, which continues to the 73rd mile, where the Alseek River is crossed (3,200′) and the right side of the valley taken at the foot of heavy undulating gravelly country to the 81st mile, where the second crossing (100 ft.) of the Alseek is made (3,150′).

From this point on to Dalton's House, situated at the 96th mile, and where the north and south branches of the Alseek River unite (2,520′), the country is heavier than the last section, the valley more contracted, and with bluff canyon-like walls of clay and silt, and it is a question which an instrumental survey can alone determine as to whether it would not be more advisable to keep out of the bottom and upon the slopes above the bluffs, to a point 7 miles beyond Dalton's.

At the crossing of the Alseek a bridge of say 150 feet in length will be required.

From Dalton's, for seven miles up the north branch of the Alseek River, the same clay canyon-like side slopes continue, then the valley broadens out, with flat side hills containing many springs and wet spots, to Kluk-shu Lake (2,625′) at the 112th mile.

The stream having been crossed at the 103rd mile the line is thus on the east side of the valley, and so continues past Kluk-shu Lake over an easy, lightly-wooded bench-like country to Des-a-deash Lake (2,625′) at the 117th mile, and whose waters flow in both directions; from here northward for the next 20 miles the line continues over timbered, sandy side hills, and with light undulating gradients until the Klu-hina River is crossed at the 137th mile (2,725′) thence for the next five miles a sharp ascent (2 per cent grades) over sandy ground is made to reach the altitude of a depression (3,295′) between a bluff-faced knob and the mountain proper.

The line from this point descends with light gradients and over open, grass-covered clay and sand benches and flats to the 162nd mile (2,600′) where the Kas-ka-wulsh River turns abruptly to the west; here an ascent of 500 feet in 5 miles is made through lightly-wooded undulating sand hills to the divide (3,100′) of the Alseek and Yukon waters.

From the divide, at the 167th mile (3,100′) for the next 8 miles, the line passes through a valley about a quarter of a mile wide, with alluvial bottom, thence along the east side of valley on gravel slopes and benches extending along the Hootchei Lakes to the Indian village of Hootchei, and continuing to the foot of the lake, crosses its outflowing stream at the 190th mile (2,500′), thence along the west bank of the Nordenskiold River to its forks, about the 230th mile, where a crossing is made and, in the course of the next two miles, the branch stream is passed, thence continuing on the right bank almost to its mouth, the Nordkenskiold is crossed (1,600′) for the last time, and the valley slope of the Yukon gained at a point 5 miles below "Five Finger Rapids" at an elevation of (1,600′ above sea level) and distant from Lynn Inlet 245 miles.

The country traversed from Hootchei Lakes down the Nordenskiold River is of an open, gravelly bench and flat character, covered with a sparse growth of small spruce and pine. The rivers and streams crossed are unimportant and may be readily bridged.

From the terminal point on the Yukon River to Fort Selkirk is a distance of 57 miles. The country is easy and open, and the river is wide and good for steamboat navigation.

I am indebted to Mr. McArthur, D.L.S. (who examined the district), for all verbal information and photographs used to enable me to furnish this report.

From the said information and a general personal knowledge of British Columbia, I conclude that a single track railway extending from the sea to the Yukon River, with all appliances for business will cost, approximately, $5,635,000 or $23,000 per mile.

RAILWAY ROUTE.

DYEA VIA CHILKOOT PASS TO TAGISH LAKE AND THENCE TO HOOTALINQUA RIVER IN CANADA—111 MILES.

The town of Dyea is situated at the extreme northerly end of Dyea Inlet of Lynn Canal, in Lat. N. 59° 30′, and Long. W. 135° 22′.

There is a good depth of water in the harbour for the largest ocean-going vessels, but to make a suitable landing-place considerable expense would be entailed owing to the high tides and shallow water immediately at the head of the inlet.

The distance from Dyea to the summit of Chilkoot Pass is fifteen (15) miles and the altitude of the latter point 3,562 feet above sea level, therefore it will be seen that the average rate of gradient, after allowing for loops and curvature will be 4 per cent, and this is only to be obtained by commencing the ascent at the sea and continuing along the eastern side of the valley, on the mountain side in heavy rock and earthwork (with occasional snow sheds) throughout the whole distance.

Any modification in the amount of work or cost of construction can only be made by continuing in the valley bottom for so many miles, more or less, and finally ascending to the summit with such heavier gradients as the ground and distance will permit, and about as follows, for a distance of 12¼ miles, the first 8½ miles of which would be on a gradient of ½ per cent followed by 2½ miles of 3¼ per cent and 1¼ mile of 4½ per cent. From the latter point to the summit, a distance of 2½ miles the ascent would be 2,512 feet, or at an average rate of 17 per cent, so steep as only to be overcome by a cable line or the use of a rack rail.

The cost of a bottom line would not be as great as the one projected along the mountain side and, of course, would not have its capacity on an equal power basis.

From the summit to Lake Lindeman, a distance of 8½ miles, a descent of 1,397 feet, or say 3 per cent, average gradient can be had, with heavy work in rock, and a considerable amount of curvature.

The next section of 30 miles along the shore of Lakes Lindeman and Bennett to Caribou crossing at Nares Lake would, for the 15 miles, be almost entirely over rugged, irregular points and hummocks of glaciated granite rock, with about one mile of light work on a sandy ridge between the two lakes mentioned, and the remainder of the distance, along the easterly shore of Bennett Lake would be over mixed country, rock and gravel, not heavy, and with undulating surface. The crossing at Caribou Narrows (600 feet) is unimportant, a sixty foot span with trestle approaches being ample.

From the latter point, for a distance of 18 miles, to the outlet of Tagish Lake, good ground for a moderately inexpensive line may possibly be had by following a fairly direct course, between the points mentioned, with a very low summit to overcome and thereafter a slight descent to the crossing point (2,150′) near Tagish village, where the river between Tagish and Marsh Lake is about 460 feet wide and 12 feet deep, with a silty bottom of unknown depth.

The next section of 33 miles, extending from the Tagish houses in a north-westerly direction through an open valley and over a low divide to the Hootalinqua River (2,350′) would, as far as known, be of moderate cost, with light curves and gradients, as the country is not abrupt and rocky, there being gravelly hills and terraces, as observed on the McClintock River route between the foot of Marsh Lake and the Hootalinqua River.

With the exception of a few miles about the summit of Chilkoot Pass, the country through which this projected line passes is covered with a growth of small pine, spruce and poplar, and the streams crossed, other than these referred to, are small and unimportant.

The total length of the line over the route described would be approximately 111 miles and the cost probably $27,318 per mile, or a total of $3,030,000.

I am indebted to Wm. Ogilvie, D.L.S., for the information given regarding this route, and on which I have formed the above approximate estimate of cost.

It is just possible that from Caribou crossing northward 42 miles by the Watson River valley (to a point below "White Horse Rapids" on the Lewes River) a favourable route may be had (with likely a small saving in distance of railway mileage and water transport, to a common point at the mouth of the Hootalinqua), but the waters of the Lewes River (here called Thirty Mile River), are much swifter and less suitable for navigation than those of the Hootalinqua, therefore, no appreciable gain would be made by adopting such a course. Indeed, a line to the Hootalinqua would, according to present knowledge of the country, appear to be of greater value as the country to the east of that river and Teslin Lake is looked upon as likely to develop in a very favourable manner.

RAILWAY ROUTE.

SKAGWAY VIA WHITE PASS TO TAGISH LAKE, THENCE TO THE HOOTALINQUA RIVER—123 MILES.

Skagway is situated some 2 miles from the north end of Dyea Inlet, Lynn Canal (Long. 135° 22′ W., Lat. N. 59° 28′) and may be safely reached from the open sea by vessels of any class, but as shallow water extends for some distance from the shore, long wharfs or landing-stages will be necessary to facilitate transfer of cargo and passengers from and to ships and the shore. There is ample room for a town on the low lands formed by the detritus brought down from the mountains by the Skagway River.

The valley of this river is open and very suitable for railway construction for nearly 4 miles, when it becomes contracted, with canyon walls in places, and of steep gradient. At the 12th mile a large branch

enters from the left, or easterly side, after which the valley contracts gradually to a bald canyony gulch in the mountain rock.

The bottom of the valley may be followed for ten (10) miles with such moderate gradients as it affords, and thereafter, in the next six miles to the summit with an ascent of 1,770 feet (or about 5½ per cent). However, this course would not be practicable unless under special power conditions and at an enormous expense for protection from sliding rock and snow.

The only feasible way of passing through this rugged defile appears to be by commencing to ascend, with an average 4 per cent gradient, at a point about three (3) miles from the sea, and continuing along the mountain side to the left where, high above the valley, the slopes are flatter than near the base.

In this way the summit (2,600') may be reached in a distance of 16 miles, with heavy rock work, and somewhat costly snow sheds, in short lengths, at several places.

The next section of 24¾ miles would be through a broken, hummocky, uneven but generally level and rocky country, passing near a number of small lakes, and eventually reaching Lake Bennett; thence, continuing on the same route as projected from Dyea to the Hootalinqua River, a total distance of 123 miles from the sea.

The streams crossed on this section are small and may be effectively bridged at small cost.

About the summit level and for some distance on each side the country is devoid of timber; elsewhere the usual growth of small spruce, pine and willows is to be found.

From information furnished by Messrs. W. Ogilvie and McArthur, D.L.S., I have been enabled to furnish this statement, with approximate cost of construction and equipment at $28,309 per mile, or a total of $3,236,000.

RAILWAY ROUTE VIA TAKU INLET AND NAKINAH RIVER TO TESLIN LAKE—145 MILES.

Juneau, one of the principal seacoast towns of the district, is situated on the main shore near the head of Gastineau Inlet, in Lat. 58° 18' N., and Long. 134° 23' W., and is the business centre for Taku Inlet and the mountain country to the east of it.

The shore line from Juneau S.E. for 12 miles to Bishop's Point, and thence northerly up Taku Inlet, for 38 miles, is very irregular, and the mountain slopes are steep, rocky and rugged, with several "live" glaciers discharging large masses of ice therefrom annually, thus making this part of the route impracticable for railway construction.

The south shore of the inlet is free from glaciers, but it is rough and irregular, and therefore too costly.

The inlet is reported as a very unsafe place for navigation owing to the very high winds and consequent rough water which prevail here at all seasons, coupled with the additional dangers due to masses of ice discharged from glaciers fronting on the Inlet which, floating about, frequently pack in the various narrows.

However, conceding that during the open season, between May and October, the inlet is navigable, especially for vessels of moderate draft, to a point 33 miles by water from Juneau, or 21 miles from the entrance to the inlet, it appears to me that the railway may here be commenced

on flat land immediately to the west of "Twin" glaciers, and continued along the bottom lands and foot slopes forming the north or right-hand side of the Taku valley, to the confluence of the Slocah and Nakinah rivers at head of canoe and, possibly, light draft steam, navigation, a distance of 51 miles.

The valley proper is from ¾ to 1½ miles wide, with almost continuous bottom lands, timbered with spruce, poplar, aspen and Canada balsam, but frequently cut into by sloughs or by-channels of the river proper, which in places lie close to the mountain foot slopes. The entering streams are not numerous or important, the largest being the Tallaskaway at the 21st mile, and Salmon River at the 31st mile. The structures for these streams should be of span work, as a considerable quantity of drift wood and ice, no doubt, passes down during freshet periods.

From the opposite side of the valley three streams enter, viz. :—the Wright, a glacier stream, at the 11th mile, the Quorn at the 37th, and the Inklin at the 43½ mile. The latter being the largest feeder to the Taku, and draining a vast area, extending eastward 80 miles and including the watershed of the Nahlin River, heading in the Level Mountain near Tooya Lake, and southward 60 miles to the head waters of the Koketsi and Sheslay Rivers, near the Stikine.

The Inklin, Sheslay and Koketsi Rivers form a continuous salmon run to Koketsi Lake. The Nahlin, being broken and steep beyond the confluence of the Sheslay, is impassable by salmon to where the Teslin-Stikine route crosses it.

The Nakinah River, which is 200 feet wide at its mouth and 150 feet above sea level should, owing to passage of drift material at freshet times, be bridged with ample openings.

From the confluence of the Slocoh and Nakinah, at the 51st mile (E. 250 ft.) on to the summit (4,100 ft.) at the 111th mile (or a rise of 3,850 feet in 60 miles, 1¼ per cent average gradient), the ground found would likely be generally broken, with moderately heavy work in earth and rock for 75 per cent of the distance. The summit section of from 10 to 15 miles in extent, and called "Ptarmigan flat," is open, moss-covered and light for construction.

From the summit at 111th mile, to the south end of Teslin Lake, at the 126th mile, the descent would be 1,700 feet (or to the lake level of 2,400 feet above the sea), giving an average gradient of say 2¼ per cent, over sloping earthy side-hill ground, timbered with spruce, pine, alder and poplar.

An easier gradient may be obtained by extending the line from the summit to almost any point on the west shore of Teslin Lake beyond its estuary-like southern terminus, but especially on to a terminus near the centre of the lake, as the ground for a railway is alike favourable, and a terminus on the lake proper would afford at least two weeks more communication than if placed at the first-mentioned point. Thus including distance for an easy gradient, the total length of the railway line from the head of Taku Inlet to Teslin Lake would be 145 miles.

Such a line may be operated all the year, but in conjunction with a service on Teslin Lake and the Hootalinqua only between June 1st and November 1st, and would cost, approximately, say $3,485,000, or $24,034 per mile.

A wagon road starting from the same point and extending 120 miles to Teslin Lake can be built over this country at a cost of from $1,200

to $1,500 per mile, and a trail at from $100 to $250 per mile. The road and trail can be operated free from snow during the period above mentioned.

Food for pack animals is scarce on the lower river, but in fair quantity from the summit plateau to near Teslin Lake.

I am indebted to Wm. Ogilvie, D.L.S., and C. W. Hayes for information obtained from their reports regarding the route described as far as the divide, and from my own observations of the sloping ground near that point to Teslin Lake.

TRAIL—STIKINE RIVER TO TESLIN LAKE, B.C.

Should it be considered advisable to construct a trail from the Stikine River, a short and good route, with few undulations, and over which fast time may be made, would be to start from Shakes Creek or Glenora, on the Stikine River, and up the right side of the Stikine valley to the higher benches, thence through Telegraph Creek Pass and down the slopes of Arthur Creek to a crossing point on the Tahltan, below the present ford, where a bridge 100 feet long (in short spans and on piles or bents) will be ample; I do not think that ice or logs run to any extent in this stream, which is too deep and swift to ford during several months of the open season.

From the Tahltan crossing the trail should be carried with as light ascent to gravel benches and sloping ground and, again descending, continue for eight miles along base of hills to the Koketsi divide, thence up the north fork to its head, in Level Mountain, and over a low summit to the head waters of Doo-de-doutooya, thence along foot of slopes of Level Mountain (and on the east side of Mosquito and Koshin valleys) to the Nahlin River, which would no doubt require to be bridged in a manner as described for the Tahltan. From the Nahlin River the route should continue along the east side of the valley to Teslin Lake, thus securing firm gravelly ground with slight undulations, and crossing the few streams encountered, where small and in defined courses. It would pass through and near good grazing grounds.

A trail constructed on the above course will be about 175 miles in length, and will cost from $100 to $250 per mile, according to its completeness and capacity to stand the wear and tear incidental to a large amount of travel, and as it is likely that the travel will be heavy, with many more animals passing over than the local "feed" to be found by the way will sustain, "cache" houses should be erected at reasonable intervals in which packers doing business on the route may store feed and grain. The trail should also be constructed in a substantial manner.

In bush or scrubby land the clearing should be at least ten feet in width, and the moss and turf removed for the entire width, that the sun's rays, light and air may the more rapidly dry up the moisture, and thus help to preserve the road.

The base of the trail should be at least four feet wide on level or gently sloping ground, and formed, as far as possible, on a natural foundation from cuttings, and the material removed, if not required for embankments near by, should be "wasted" clear of and below the elevation of base. A trail so constructed will ensure good footing on ground so compact as not to be churned into holes, ruts and mire, in

wet weather, or so loose and friable that the water discharged from the clouds or the hill side above will wash it out, or form guttering channels in its line.

Soft, marshy ground or swales should be logged, brushed and top-dressed with coarse, gravelly material or broken stone, care being taken to make ample provision for the passage of water, with ditches above leading to the openings and an off-take ditch to carry the water away from them. Streams should be sufficiently bridged as their dimensions demand. Smaller streams can be economically spanned by structures formed of round logs, which are to be found where required. They should be finished with a path of coarse gravel or broken stone, held in place by side timbers, securely fastened to the cross pieces below.

Where fords are practicable they should be adopted (as the pack animals require water) and care should be taken to see that they have easy and firm approaches, such crossing places should be freed from boulders and other obstructions to the safe passage of animals, and flatted side logs should be provided for the passage of pedestrians.

A trail as above described can be built in two months or less from time of commencement, provided that arrangements are made at an early date for men, supplies and transport.

Various other routes might be referred to, but as the country generally has the same characteristics it seems unnecessary to describe them, and as developments occur and localities demand, so trails, as above described, may be built in a rapid manner.

WAGON ROAD—STIKINE RIVER TO TESLIN LAKE, B.C.

A wagon road may be constructed on the general course referred to for a trail, but with a slight addition in length due to the fact that it should be carefully located with gradients not exceeding 5 per cent, and these only at unavoidable points.

The clearing should be made at least 25 feet in width, and the moss, &c., removed from the area to be occupied by embankments, and from the slope above side hill cuttings.

The road should have a base of at least 12 feet, and, where made on ground sloping transversely, be formed two-thirds in cutting. Passing places should be provided.

To thoroughly sustain heavily loaded wagons the bridges should be designed and built on a more substantial plan than suggested for a trail.

In other respects, where applicable, the mode advised for trail construction may be followed.

A substantial road can be built on the above route between the points mentioned in 90 days from time of commencement, for a sum not exceeding $1,400 per mile.

Cost and maintenance of a mule train on route between Stikine River and Teslin Lake; also estimate of season's results in packing a round trip distance of, say 300 miles, light one way, and allowing that the beasts be well fed and cared for :

Cost of pack train consisting of 50 animals, large, young and strong with "rigging," &c., complete. Delivered at Telegraph Creek.	$	3,750 00
Interest on and depreciation of outfit at 15 p.c. per annum		562 50
Feed—75 tons chopped stuff at $40		3,000 00
" 40 tons hay at $15		600 00
1 herder and general man, per annum		600 00
1 " " man's food, per annum		150 00
1 foreman packer, 7 months at $150 (rates paid in 1897)		1,050 00
3 ordinary " 7 " 75 (")		1,575 00
1 cook for " 6 " 60 (")		360 00
Food for 5 men 6 " season		400 00
Repairs to rigging, shoes, &c.		300 00
Total	$	8,597 50

RESULTS.

Allowing four animals for packers' use, two out of service, one carrying kitchen and food for packers, and three distributing food along trail, &c., leaving forty paying pack animals.

Estimating that eight round trips be made in the season, each animal carrying 300 lbs. paying cargo.

300 x 40 — 12,000 x 8 — 96,000 lbs. at 9c. per lb. or net cost	$	8,640 00
Season's profit at 12c. per pound	$	2,880 00

The above mule train would thus only be able to convey one year's food supplies and outfit for 48 prospectors; therefore, if a large number pass over this route, more animals will be required to transport them than can find food along the trail, therefore it is obvious that a supply of grain, &c., will have to be distributed along the trail and cached, in readiness for feeding when the grass gives out or is destroyed by fire or frost.

Assuming that one person consumes 4 lbs. of food per day and the charges therefor are as under:

1½ lbs. bacon at 13⅓ cts.	20 cts.	
1½ " flour at 3¼ cts.	5 "	
½ " beans	2 "	
½ " sugar, tea, apples, &c.	10 "	
		37 cts.
Freighting from Victoria or Vancouver to Stikine River		4 "
" Stikine to Teslin, 12 cts.		48 "
Cost of one day's supplies for one man at Teslin		89 cts.

PERMANENT WAY.

Materials, &c., required for one mile of railway track, &c., in position on formation:

		$ cts.
Steel rails, 56 lbs. per l. yd., 88 tons, $30		2,640 00
Angle plates, 2 ft. long, 18 lbs. each, 176 joints, 4 bolt holes, 704 plates at 18 lbs., 12,600 lbs. at 2 cts		252 00
Bolts, ¾-in., round, oval neck, 1 lb. each, 1,408 lbs. at 3½ cts.		49 28
Spikes, 5½ x $\frac{9}{16}$ in., 6,000 lbs. at 2½c		150 00
Ties, spaced, 2 ft., centre to centre, 3 ft. 6 in. by 8 in. face, 2,640 at 25 cts.		660 00
Washers, vulcanite		25 00
		3,776 28
Tracklaying, per mile	$ 250 00	
Ballasting, per mile, 2,000 cubic yds. at 40c	800 00	
		1,050 00
Total		4,826 28
Steel rails, 70 lbs., 110 tons at $30		3,300 00
Angle plates, 30 lbs., 704 plates, 21,120 lbs. at 2 cts		422 40
Bolts (6 bolts) 1 lb. each, 2,108 lbs. at 3½ cts		73 98
Spikes, 5½ x $\frac{9}{16}$ in., 6,500 lbs. at 2½ cts.		162 50
Ties, 2,640 at 25 cts		660 00
Washers		25 00
		4,643 88
Tracklaying, per mile	$ 250 00	
Ballasting, 2,000 cubic yds. at 40 cts	800 00	
		1,050 00
Total		5,693 88

Cost of constructing one mile of roadbed.

LIGHT WORK.

	$ cts.
Clearing, 9 acres at $25	225 00
Close cutting, 2 acres at $35	70 00
Grubbing, 2 acres at $50	100 00
Earthwork, 15,000 yds. at 25 cts	3,750 00
Rockwork, 1,000 yds. at $1	1,000 00
Structures	800 00
Engineering, $600; stations, &c., $150; water supply, $150; telegraph line, $110	1,010 00
Sidings	350 00
	7,305 00
Contingencies 10 per cent	730 50
	8,033 50
Permanent way (light rails, 56 lbs.)	4,826 28
Total	12,861 78

Cost of constructing one mile of railway.

MEDIUM WORK.

	$ cts.
Clearing, 9 acres at $20	180 00
Close cutting, 2 acres at $30	60 00
Grubbing, ½ acre at $50	25 00
Earthwork, 20,000 cubic yards at 25cts.	5,000 00
Rock work, 20,000 do $1	20,000 00
Structures	1,000 00
Engineer, $700; telegraph, $110; stations, &c., $150; water supply, $150	1,110 00
Sidings	400 00
	27,775 00
Contingencies 10 per cent	2,777 50
	30,552 50
Permanent way (heavy rails, 70 lbs.)	5,693 50
Total	36,246 00

HEAVY WORK.

	$ cts.
Clearing, 9 acres at $25	225 00
Close cutting, 3 acres at $35	105 00
Grubbing, 2 acres at $60	120 00
Earthwork, 4 ft. bank, 15 ft. base, 3,000 ft., 9,330 c. y. at 25c	2,332 50
Rock work, 5 ft. cut, 22 ft. base by ¼ to 1 slope, 2,300 ft., 10,350 c. y. at $1	10,350 00
Structures	1,000 00
Engineering, $700; telegraph lines, $110; stations, &c., $150	1,110 00
Water supply, $150	400 00
Sidings	
	15,642 50
Contingencies, 10 per cent	1,564 25
	17,206 75
Permanent way (light rails, 56 lbs.)	4,826 28
Total	22,033 03

Stikine River Section—30 miles.

CLASSED AS MEDIUM.

	$ cts.
30 miles of railway line complete at $22,000	660,000 00
Dock siding and freight house	6,000 00
Bridge over river	80,000 00
Total	746,000 00

Whole section, Stikine River to Teslin Lake.

	$ cts
30 miles as above	746,000 00
125 " light at $13,000	1,625,000 00
30 " heavy at $36,000	1,080,000 00
23 " medium at $22,000	606,000 00
208 " say $19,000 per mile—	
Grand total	3,957,000 00
Rolling stock as per list.	

STIKINE RIVER AND TESLIN LAKE, B.C.

ESTIMATE FOR ELECTRIC RAILWAY.

Length—165 miles.

Five power stations complete with hydraulic plant, &c. Twenty large cars, fitted with 4 motors each Railway line fitted with feed and other wires, &c. Dynamos and "boosters" Railway line-light rail Wharf at each end, also freight houses Two construction engines and 40 cars		$ 2,850,000 00

ANNUAL COST OF OPERATION.

For six months	$ 55,000 00	
Interest and depreciation on $2,850,000 at 10 per cent	285,000 00	
Total		$ 340,000 00

Say 3 steamers plying on Stikine, bringing on average 100 prospectors per day for 4 months—12,000 passengers— 165 miles rail haul at 5 cents per mile—$8.25	$ 99,000 00	
And ¾ of a ton of freight per man—9,000 tons at $50 per ton	450,000 00	
		$ 549,000 00
Expenses as above		340,000 00
Profit and loss		$ 209,000 00

STIKINE-TESLIN LAKE ROUTE, B.C.

As the cost of freighting is of interest in this connection, the undernoted statement may be of value, but it must be borne in mind that it is based on the assumption that the animals are supplied with food for the greater part of the year, whereas it is likely that those working on this route would be removed at the end of the season to a locality where they could be kept in the open and without expense except for the wages and keep of a herder.

Calculated cost of mules, wagons, &c., delivered at, say, Glenora, food and expense, for a season's work of six months, teaming between above points—150 miles each way, returning light :

Ten large team mules, delivered, $100 each	$ 1,000 00	
Ten sets harness, &c., $25 each	250 00	
Wagons, tent, kitchen, &c	500 00	
Total cost of plant	$ 1,750 00	
Interest and depreciation, 15 per cent		$ 262 50
Keep of animals, 6 months=180 days; each animal 16 pounds hay and 10 pounds oats per day; 10 x 16=160 x 180=28,000 pounds hay $40 per ton*	$ 576 00	
10 x 10=100 x 180=18,000 pounds oats at $40 per ton	360 00	
Teamster, 6 months, at $75	450 00	
" " food at $15	90 00	
" boy and food	125 00	
Repairs and shoes, &c	150 00	
		1,751 00
Total		$ 2,013 50

Say, 10 trips in season, each of 3 tons net=30 tons=$2,013.50÷30=$67.12 per ton.

Cost per ton	$	67 12
Government toll on, say, road=one-half cent per pound		10 00
Total, per ton	$	67 12

=3·856 cent per pound.

*As a considerable quantity of green "feed" is to be had en route during the greater part of the season, the amount of hay may not be required.

Food and other supplies required by one man for one year's maintenance in the Yukon District:

FOOD SUPPLIES.

400 lbs.	flour (Hungarian), at 3½c	$ 13 00
500 "	bacon at 13½c	67 50
50 "	oatmeal	1 80
50 "	pilot bread	2 00
100 "	beans (Bayo) at 3	3 00
40 "	evaporated apples at 6½c	2 60
10 "	" onions at 40c	4 00
40 "	" potatoes at 25c	10 00
10 "	tomatoes	2 50
40 "	split peas at 2½c	1 00
40 "	rolled oats at 3½c	1 30
50 "	sugar (granulated) at 5½c	2 63
13 "	tea at 25c	3 25
10 "	green coffee at 25c	2 50
20 "	salt at 1c	0 20
1 "	pepper	0 40
½ "	mustard at 40c	0 20
½ "	spices at 60c	0 30
2 "	baking soda	0 40
1 doz.	Johnson's Extract of Beef, 4 oz., at $4.50 per doz	4 50
3 lbs.	soup vegetables at 33c	1 00
3 "	lime juice tablets at 30c	0 90
1 tin	matches	1 00
1 box	candles	1 75
	Baking powders in tins	10 00
10 bars	soap at 50c., 4 at 50c	1 00
½ doz.	condensed milk at $2 per doz	1 00
10 lbs.	currants and raisins	0 80
	Gross weight, say 1,600 lbs	$ 140 53

In packing food or other supplies, boxes should, as far as possible, be avoided, and sugar, flour, beans, &c., in addition to the ordinary sacking, be placed in canvas bags. Packages should not be over 30

inches in length, and 14 to 16 inches in diameter, and not more than 50 lbs. in weight.

I also add a list, with cost, of articles which one prospector should take with him to ensure comfort, and the means of making his venture a success in paying ground.

If prospectors form parties, a saving in articles, cost and transport charges may be made per man proportionate with the numerical strength of each party.

Articles required for boat, sluice and house building; also for prospecting and placer mining:

1 pocket (magnetic) compass	$ 1 00
2 lbs. quicksilver	1 25
2 gold pans	1 50
1 shovel (round point, solid back)	1 25
1 pick (steel points, medium weight, two handles)	1 50
1 hammer (3 lbs. and one handle)	0 70
*1 chopping axe (3½ in., 2 handles)	1 00
*1 " (2½ or 3 inches)	1 00
*1 hand axe with claw handle	0 50
*1 small handle—each for x cut and rip	2 00
*1 single x cut saw, 4 feet	2 00
*1 single whip saw and handle light	3 50
*1 eye augur, each ½, ¾, 1½ and 2 inches	3 00
*1 jack plane	0 75
*1 spoke shave, round and flat	0 50
*1 doz. awls—assorted sizes	0 15
*½ " gimlets	0 25
*¼ " pack needles	0 15
*½ lb. twine (pack)	0 15
*1 ball heavy twine	0 50
*200 ft. ½-in. rope	0 75
*100 ft. ½-in. rope	1 00
	$ 24 40

The articles marked thus * in above list are sufficient for a party of six.

ARTICLES required for Boat, Sluice and House Building; also for Prospecting and Placer Mining—*Continued.*

6 lbs. wire nails, each 2-inch and 3-inch	$ 0 60
2 " " 1-inch and 1½-inch	0 40
1 file for each kind of saw (4)	0 60
2 mill saw files, 12-inch, for sharpening axes, &c.	0 25
1 small whetstone	0 15
1 sheet emery cloth each, medium and fine	0 12
1 chisel each ½-inch, 1-inch, and 1½-inch	1 25
1 common rule	0 20
1 lead pencil	0 05
1 drawknife	0 50
3 lbs. caulking cotton for boat	0 75
3 " pitch, mixed, for boat	0 50
2 pairs rowlocks for boat	0 75
1 sheet iron stove with oven and pipes	7 00
1 nest of tin kettles	1 75
1 tin teapot	0 40
2 bread pans	0 60
2 wash basins (1 for bread)	0 30
1 butcher knife, 9-inch	0 25
1 coffee mill	0 75
2 frying pans, 10-inch	0 40
1 iron fork	0 10
3 iron spoons, long ladle, 12-inch	0 25
6 tin plates	0 25
3 " bowls	0 21
1 " cup	0 10
3 " teaspoons	0 05
3 " table spoons	0 10
3 pairs knives and forks	0 75
6 yards cotton for dish cloths, &c.	0 50
2 canvas buckets, 2-gallon	3 00
	$ 22 88

The tools enumerated above, also tin kettles and buckets, ample for a party of six—spoons, plates, &c., for a party of three.

PERSONAL EFFECTS.

1 pair gum boots		$ 5 00
1 " long, 12 leather boots		3 50
1 " heavy laced boots		3 50
1 " " slippers		1 00
1 " rubbers		1 00
1 " " gloves		1 25
1 " woollen mitts		0 50
1 " goggles, smoked glass		0 50
1 " snowshoes and thongs		5 00
1 " moccasins		1 25
2 suits woollen clothes		30 00
1 heavy overcoat		10 00
2 drill shirts		3 00
2 pairs canvas and blue jean trousers		3 00
3 " heavy woollen socks		1 00
2 " medium "		1 00
2 " knickerbocker stockings		1 20
2 suits heavy woollen underclothes		4 00
2 " medium "		4 00
1 felt (soft) hat		1 50
1 heavy knit cap with ear banflap for winter use		0 50
1 necktie		0 50
1 woollen comforter		0 50
1 pair woollen mitts		0 50
1 " braces		0 50
2 skeins black linen thread		0 10
2 " white "		0 10
2 " light drab linen thread		0 10
2 papers needles to suit		0 10
2 darning needles		0 06
1 hank each black and white yarn		0 20
An assortment of buttons		0 10
1 buckskin		1 00
1 pound babiche for snowshoes		0 25
		$ 87 21

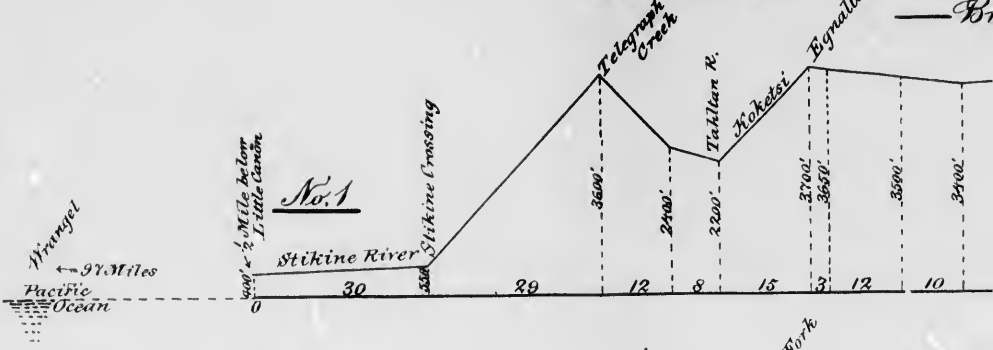
PERSONAL.

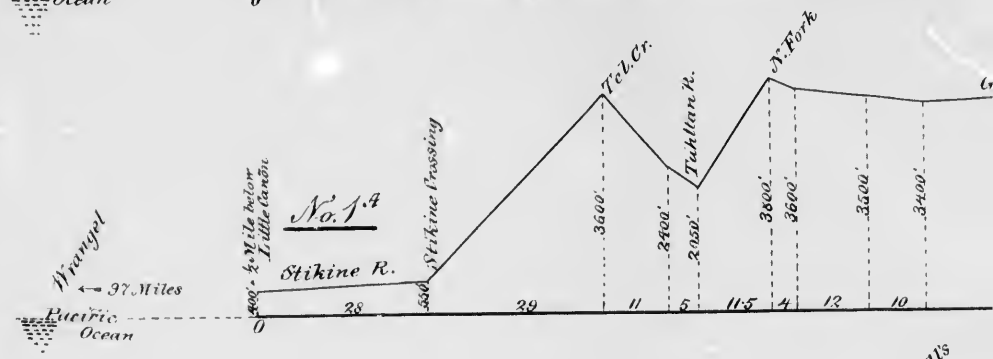
1 tent, 6 ft. x 8 ft., 10 oz. duck with 2 ft. wall (good for two men)		$ 10 00
1 dunnage bag, 30-in. x 16-in. diameter, canvas		1 00
1 " " oiled		1 25
1 tarpaulin (10 oz.) 6 ft. x 8 ft. (do for boat sail and for bed)		3 00
1 oiled cotton tarpaulin, 6 ft. x 6 ft		1 50
2 pairs blankets, 4 points and bag for ditto		18 00
1 small looking glass		0 15
2 towels		0 50
1 towel, bath		0 50
1 comb		0 10
1 brush, each, teeth, 25c. ; hair, 75c		1 00
1 doz. (3 grs.) quinine pills		0 25
1 box anti-billious pills		0 25
1 small roll sticking plaster tape		0 25
1 " lint		0 10
2 bottles painkiller		0 40
2 " Jamaica ginger	Good for a party of six	0 30
1 small bottle chlorodyne		0 25
1 pot vaseline		0 25
1 scissors, ordinary		0 25
		$ 39 30

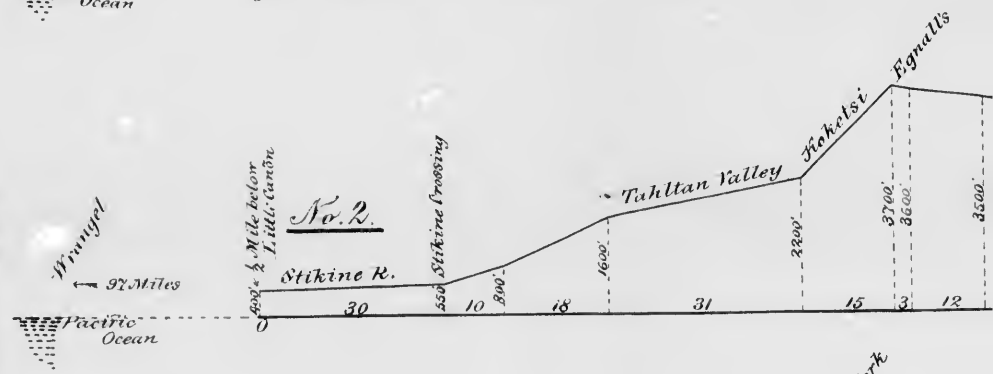
1 gill-net, 3 lbs., say 50 ft. long, 3-in. or 3½-in. mesh when stretched	$ 3 00
150 ft. deep sea line for ditto	0 50
3 doz. assorted eye fish hooks	0 20
3 short common fishing lines	0 10
2 trowling lines, 100 ft. each	0 60
2 " spoons	0 80
2 extra triple hooks, heavy for "gigging" fish	0 15
1 lb. sheet lead	0 07
1 lb. buckshot	0 07
1 rifle, light, say 44	15 00
50 " cartridges, ballet	1 50
50 " " shot	1 50
1 straight knife, wooden handle, blade 6-in. long	0 25
1 light belt and sheath for knife	0 50
	$ 24 24
Total	$ 338 65

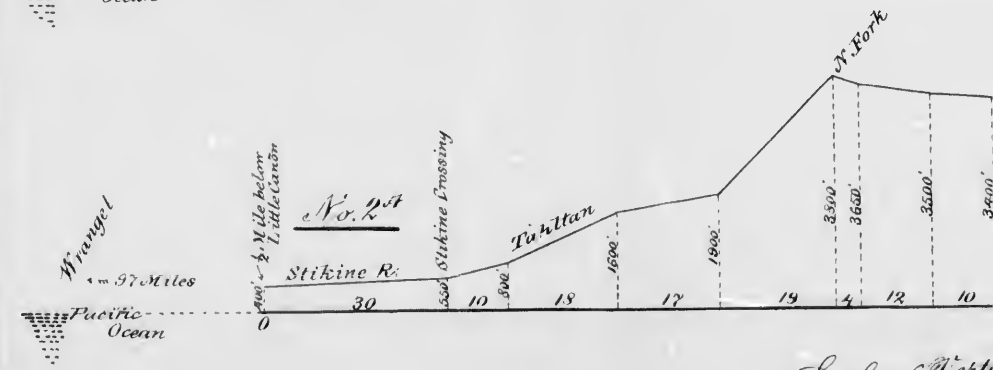
The above articles are sufficient for a party of six.

Sections
Accompanying R
of
W. T. Jenning
On Stikine — Teslin
— Br









Scales of Verti
Horiz

0 1000' 2000'
0 10 m. 20 m.

Sections

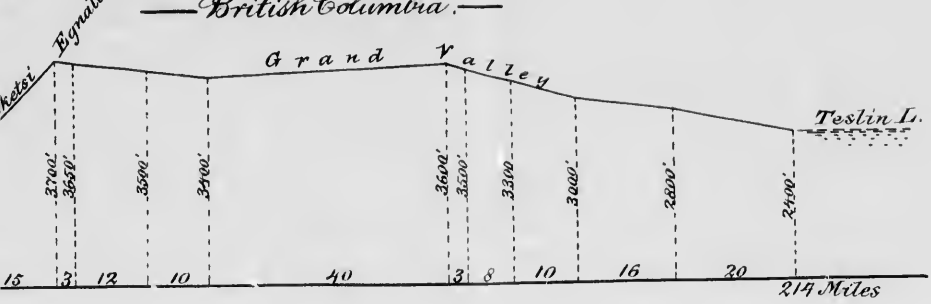
mpanying Report

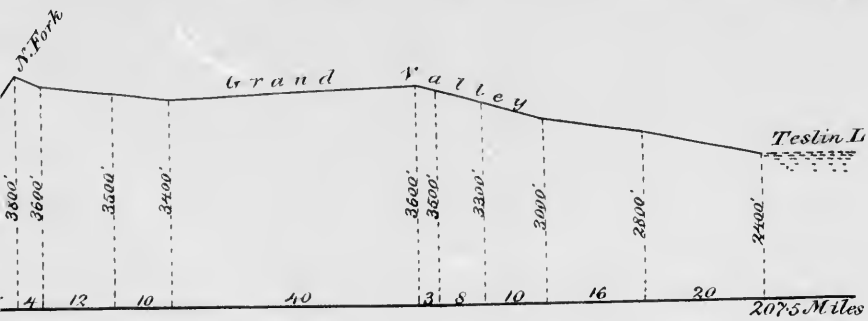
of

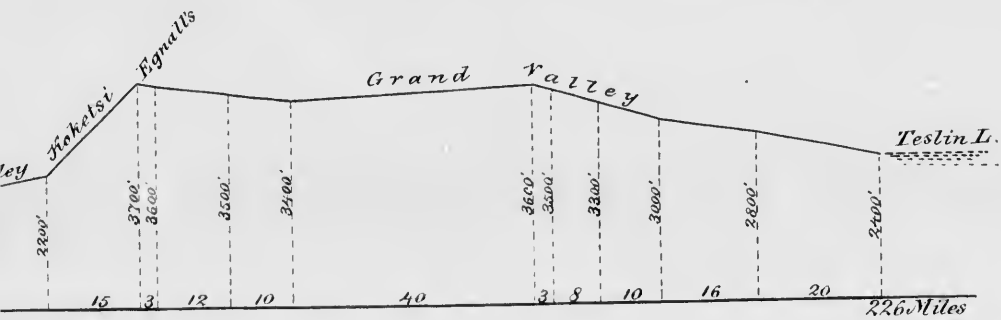
W. T. Jennings

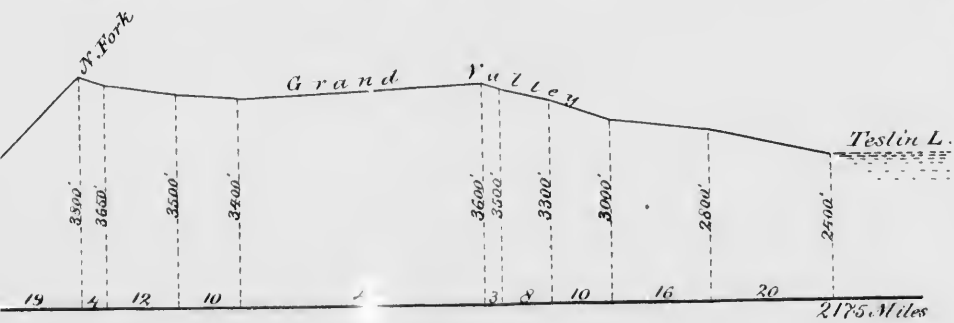
aine — Teslin Route

— British Columbia.

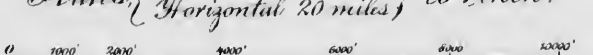




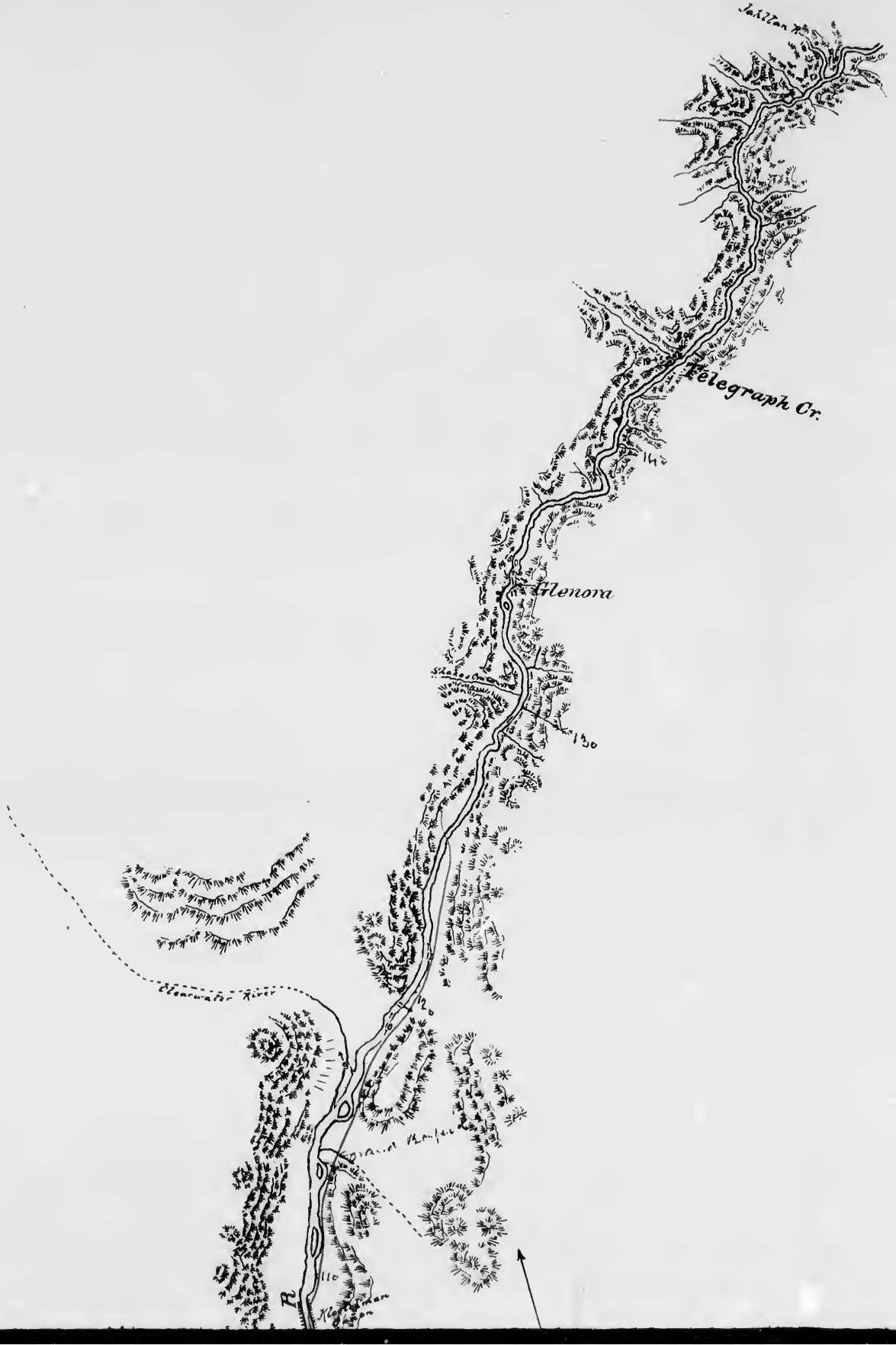




Scales { Vertical 2000 feet / Horizontal 20 miles } to 1 inch.



W. T. Jennings


Telegraph Cr.
Glenora
150
Clearwater River
120
110

TESLIN LAKE
Mountains
Small Pine and Spruce
Trading Post
2400
2450
Cascade Falls
2550
Cone Hill
Valley
Spruce & Pine Timber with Deep Moss
Marsh
Cheesmina L.
Lakes and Marshes
Lakes
Timbered
Snow cap

Sketch Plan

of country between

Stikine River and Gestin Lake

Accompanying Report of W. J. Jennings, M.I.C.E.

1897

From Track Survey Notes by A. H. Cyr, D.L.S. & W. J. Jennings, C.E.
and N. B. Garvereau, D.L.S.

Course of Stikine River from Survey by Geological Department of Canada.

Scale, 4 miles to 1 inch

0 4 8 12

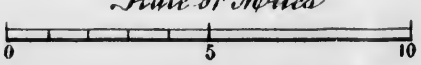
Railway Routes

W. J. Jennings

Plan
of
Stikine River
From
The Pacific Ocean to Telegraph Cr. B.C.

From U.S. Chart & Geological Survey of Canada.

Scale of Miles



W. J. Fleming


Sawbuck Range
Jane Mtn.
Berdoshine Mtn.
Saddle Mts
Flood Glacier
Dirt Glacier

Br. B.C.

da.

Spruce and Pine on Slopes
Small Poplar
Deep Moss
Low Land Timbered
Lakes
Covered with Deep of Spruce and Pine
Indian trail to Nahlin Ba.
Deep Moss
Deep Moss
Koshin R.
Malsatuya R.
Open Valleys
Spruce
Doo-De-Don-Tooya R.
Slopes wooded small Spruce and Pine
Spruce & Pine on Slopes
Needle L.
Level Mt
Heart Mountains
Sheslay R.
Timbered Slopes
Mountain Range
Mountain Range
Mt Clifford
Mt Roebuck
Inklin R.
Open
capped Mountains
Prairie L.
3200
2900
2875
3250
2890
2925

Plateau
(Open)
5000'
Arthurs Seat
3200
2900
2875'
2800 water
To Tooya
Deep Moss
Spruce and Pine on Slopes
Wedge Hill
3250'
2890'
30°
Mag.
Sparse growth of small Poplar
Level Mountain
about 4000'
Lava
3900'
3700
Tooya R.
2800' Stream
3200' Top of Bank
Banks of Tooya R.
300 high
Brule
3850'
Lava
3550'
Rough hills
Moose Trail
3780
3630' Stream
Bench 300 above Stream
4360'
4150'
4300'
Timbered
4100'
2800' Bench
Stream
2340 Bench
3000'
3100'
3200'


Dry I.
Farm I
Pt. Rodney
SAND FLATS
EXPOSED AT LOW TIDE
Pacific Ocean
Pt. Wrangel


GREAT GLACIER
True North
Ridge or Little Glacier
Mt. Rollroy
Wrangle Pk. 3000'
Ft. Wrangel
Magnetic Variation East 29°-30'
Scale
Miles
0 1 2 3 4 5 10


Level Mt
Divide
Mts 2000' above Cr.
Bottom Land
Spurs
Klootchman Canon
96 miles
From Ft Wrangel
96 Miles From Ft. Wrangel

3000'
3100'
3200'
3230'
3350'
3680'
Prairie
3630'
Divide
Bench
Hill
Telegraph Mtn
Spruce
TELEGRAPH CR. VILLAGE
Mt Gordon
Flat Table Ld