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Precise Levelling

BY

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PRECISE LEVELLING.

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Supervisor of Levelling.

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PRECISE LEVELLING.

This publication is the fifth one on the subject of precise levelling by the Geodetic Survey of Canada, the ones previously issued being Appendix No. 5 to the Chief Astronomer's report for 1910 and three "Publications of the Dominion Observatory", Vol. I, Nos. 2, 3 and 8. These are all by the writer with the exception of Vol. I, No. 2, which is by D. H. Nelles, D.L.S.; the levelling shown in it is in the Yukon territory—from White Pass to Dawson, etc. The present publication is arranged in the same general form as last year's, with the results of the levelling set forth in three tables. The index and map included herein are complete for all the work previously published, as well as that in the present publication; the index indicates in which publication descriptions and elevations of bench-marks published before this may be found.

Table I indicates the routes followed between terminal points and gives complete descriptions of all bench-marks established along these routes.

Table II shows in the first two columns the numbers of the bench-marks; in the third and fourth columns the approximate distance (in miles) between bench-marks, and from the initial bench-mark of the line; the fifth and sixth columns (headed "Discrepancy") give the difference (in feet) between the forward levelling and the backward levelling for each section between bench-marks and the accumulated difference from the initial bench-mark. The seventh column gives the elevations of the bench-marks shown in the second column; for convenience, these bench-marks are repeated (in the eighth column) in order that the number of any bench-mark and its elevation may be in adjoining columns. In this table are shown also the elevations determined by the Geodetic Survey for certain bench-marks established by other surveys and connected with our levelling.

Table III shows the elevations at railway stations and at crossings of intersecting railways; also on the bridges over rivers and lakes and the more important streams. Rail elevations were in all cases taken on top of the rail, in front of the telegraph office at telegraph stations and opposite the shelter or platform at flag stations.

The results are given for the following lines:—

1. Halifax, N.S., to Yarmouth, N.S.
2. Depot Harbour, Ont., to Renfrew, Ont.
3. Winnipeg, Man., to Kenora, Ont.
4. Saskatoon, Sask., to Wainwright, Alta.
5. Maple Creek, Sask., to Coutts, Alta.
6. Lethbridge, Alta., to Calgary, Alta.

Line 1—run by J. E. Ratz, 1913, and G. F. Dalton, 1914—was started at a bench-mark (a chiselled groove marked with a broad arrow) on No. 3 storehouse in the Naval Yard, Halifax. The elevation of this has been fixed by the Tidal and Current Survey, Department of the Naval Service, as 12.59 feet above mean sea level at Halifax, determined from the hourly ordinates of the tide, day and night, during nine complete years. Our elevations along line 1 are based upon the above mentioned figures and the line is terminated at Yarmouth upon another bench-mark of the same department (a broad arrow cut in the north wall of the post office); the elevation of this has been fixed by the Tidal Survey as 49.74 feet above mean sea level at Yarmouth, determined from the hourly ordinates of the tide, day and night, during one complete year. Our elevation for the above bench-mark—by precise levelling from Halifax—is 49.636, a difference of only 0.10 ft. The elevations along this line published in Table II are instrumental ones—no adjustment has been made to compensate for the small closing error at Yarmouth.

The elevations along line 2 (G. F. Dalton, 1913, and A. J. Rainboth, 1914) are based upon bench-mark No. 418 on the line from Bala to Sudbury,

which was published in 1914. By referring to the map it will be seen that, with the exception of the gap between Ottawa and Renfrew, a circuit of levels has been completed through Depot Harbour, Toronto, Kempton and Ottawa; utilizing the levelling by the Public Works Department to close up the circuit, the error of closure is found to be 0·25 ft., the distance being about 680 miles. Line 3 (N. H. Smith, 1913) was started at bench-mark MCCCCXCVII of the Public Works Department at Winnipeg. Bench-mark MCCCLXXXIV at Emerson had already been connected with our levels from Stephen, Minn., and the difference of elevation between these two bench-marks, as ascertained by the Public Works Department—namely 19·146 feet—was used to give us a datum for line 3 or, in other words, an elevation of 767·738 was assigned to bench-mark MCCCCXCVII. Line 4 (N. H. Smith, 1914) commences at bench-mark 28-D on the Regina-Prince Albert line. Line 5 (D. McMillan, 1914) is a continuation of the line from Moosejaw to Maple Creek, published in 1914. It is terminated at Coutts upon bench-mark H-12 of the United States Coast and Geodetic Survey, and exhibits a closing error of 0·26 ft., the two lines being referred to the same datum at Stephen, Minn. Line 6 (G. S. Raley, 1914) was started from bench-mark 196-C on the above mentioned line 5.

All elevations given are instrumental and have had no adjustments applied to them, consequently changes may be made in the future; it should be noted, however, that in all cases where circuits have been closed, the closing errors are quite small.

The standard bench-mark adopted consists of a copper bolt, three-quarters of an inch in diameter and four inches long, stamped on the end with the letters "G.S.C., B.M." (Geodetic Survey of Canada, Bench-mark). The bolt is sunk horizontally in rock or masonry so that only the circular end is visible; the number of the bench-mark is stamped on this end as well as the letters mentioned above, and a horizontal chisel line is cut, upon which the elevation is taken. At certain points concrete bench-mark piers have been built; these project from six inches to one foot above the ground and extend below the frost line; the copper bolt upon which the elevation is taken is placed horizontally as in other cases, and is about nine inches below the top of the pier.

TABLE I.

BENCH-MARKS BETWEEN HALIFAX AND YARMOUTH, NOVA SCOTIA,
VIA HALIFAX AND SOUTHWESTERN RAILWAY.

Note.—These descriptions are written with the assumption that the railway runs in a southwesterly direction from Halifax to Shag Harbour, thence northerly to Belleville and thence westerly to Yarmouth.

- 386-B In east face of stone footing of pilaster at southeast corner of Intercolonial station-house, corner of North and Lockman streets, Halifax.
- 387-B In fourth course of stonework below water-table course, in west end of north wall of clock tower of custom-house, Halifax.
- 388-B In north face of seat-stone of northerly girder—on east abutment—of subway by which main road from Halifax to Truro passes under Halifax and Southwestern railway at Fairview, 3 miles from Halifax.
- 389-B In northwest side of small rock cut on Halifax and Southwestern railway, 450 feet northeast of mile post 6 from Halifax.
- 390-B In exposed rock surface, 8 feet northwest of Halifax and Southwestern railway track and at seventh telegraph pole southwest of mile post 9 from Halifax.
- 391-B In southeast side of small rock cut on Halifax and Southwestern railway, at seventh telegraph pole northeast of mile post 13 from Halifax.
- 392-B In second course of stonework below bridge-seat, in south face of east retaining wall of Halifax and Southwestern railway bridge over East river, $1\frac{1}{4}$ miles northeast of French Village.
- 393-B In first course of stonework above bridge-seat, in northwest end of northeast face of retaining wall behind southwest abutment of plate-girder bridge on Halifax and Southwestern railway, $\frac{1}{2}$ mile southwest of French Village.
- 394-B In concrete bench-mark pier, 25 feet southeast of northwest line of Halifax and Southwestern railway right-of-way, 130 feet northeast of a private crossing and 0.3 mile northeast of St. Margaret station.
- 395-B In first course of stonework above bridge-seat, in northwest end of northeast face of retaining wall behind southwest abutment of Halifax and Southwestern railway bridge over Ingram river, 1 mile northeast of Ingarampt.
- 396-B In exposed rock surface in northwest side of shallow cut on Halifax and Southwestern railway, 160 feet southwest of mile post 32 from Halifax.
- 397-B In first course of stonework above bridge-seat, in northwest end of northeast face of retaining wall behind southwest abutment of Halifax and Southwestern railway bridge over Hubbards river, $\frac{1}{2}$ mile northeast of Hubbards.
- 398-B In exposed rock surface, 30 feet northwest of Halifax and Southwestern railway track, 60 feet southwest of a trestle bridge and 400 feet northeast of mile post 3 from Halifax.

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- 399-B In top course of stonework, in northwest end of northeast foundation wall of Halifax and Southwestern station-house at East River.
- 400-B In fourth course of stonework below bridge-seat, in northwest end of southwest abutment of plate-girder bridge on Halifax and Southwestern railway, 0·6 mile southwest of East River station.
- 401-B In first course of stonework above bridge-seat, in southeast end of southwest face of retaining wall behind northeast abutment of subway under Halifax and Southwestern railway, 350 feet southwest of Chester station.
- 402-B In first course of stonework above bridge-seat, in southeast end of northeast face of retaining wall behind southwest abutment of Halifax and Southwestern railway bridge over Middle river, 2 miles northeast of Chester Basin.
- 403-B In fourth course of stonework below bridge-seat, in southeast end of southwest abutment of bridge on Halifax and Southwestern railway, $\frac{1}{2}$ mile southwest of Western Shore station and at mile post 61 from Halifax.
- 404-B In first course of stonework above bridge-seat, in northwest end of northeast face of retaining wall behind southwest abutment of Halifax and Southwestern railway bridge over Martin river, 0·6 mile northeast of Martin River station.
- 405-B In southeast face of southwest abutment of stone and timber culvert under Halifax and Southwestern railway, $2\frac{1}{2}$ miles northeast of Mahone Junction and at fourth telegraph pole southwest of mile post 67 from Halifax.
- 406-B In concrete bench-mark pier, 3 feet northwest of southeast line of Halifax and Southwestern railway right-of-way and 340 feet northeast of mile post 71 from Halifax—immediately northeast of Blockhouse station.
- 407-B In southeast end of southwest stone abutment of open culvert under Halifax and Southwestern railway, 1 mile southwest of Maitland and at mileage 75·5 from Halifax.
- 408-B In north face of boulder in centre of shallow cut on Halifax and Southwestern railway—10 feet southeast of track—150 feet southwest of a small stone culvert and 1·2 miles northeast of Bridgewater station.
- 409-B In second course of stonework above bridge-seat, in south end of east face of west abutment of highway bridge over Lahave river at Bridgewater.
- 410-B In second course of stonework below brickwork, in north end of front (or east) wall of Bridgewater post office.
- 411-B In fourth course of stonework below bridge-seat, in northwest end of northeast face of southwest abutment of Halifax and Southwestern railway bridge over Lahave river, $1\frac{1}{2}$ miles from Bridgewater station—in the direction of Yarmouth.
- 412-B In first course of stonework above bridge-seat, in northwest end of southwest face of retaining wall behind northeast abutment of bridge on Halifax and Southwestern railway, $4\frac{1}{2}$ miles southwest of Bridgewater and at mileage 85·6 from Halifax.
- 413-B In northwest end of northeast stone abutment of open culvert under Halifax and Southwestern railway at mileage 90·6 from Halifax—midway between Conquerall and Italy Cross.
- 414-B In southeast face of large outcrop of rock—35 feet from southwest end of outcrop—12 feet northwest of northwest line of Halifax and Southwestern railway right-of-way, at sixteenth telegraph pole northeast of mile post 97 from Halifax and $2\frac{1}{2}$ miles northeast of County Line station.
- 415-B In fifth course of stonework below bridge-seat, in west face of north wing-wall of Halifax and Southwestern railway bridge over Port Medway river, 1,000 feet northeast of Medway.

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- 416-B In concrete bench-mark pier, 5 feet southeast of northwest line of Halifax and Southwestern railway right-of-way, 135 feet southwest of crossing of Liverpool-Bridgewater highway and 1 mile northeast of Brooklyn.
- 417-B In second course of stonework below bridge-seat, in west face of north wing-wall of bridge on Halifax and Southwestern railway, $\frac{1}{2}$ mile northeast of Brooklyn.
- 418-B In northwest end of southwest face—4 feet 6 inches below bridge-seat—of northeast concrete abutment of Halifax and Southwestern railway bridge over Liverpool river, $\frac{1}{2}$ mile southwest of Liverpool station.
- 419-B In second course of stonework below water-table course, in north end of west wall of Liverpool post office.
- 420-B In north end of west concrete foundation wall—18 inches below woodwork—of Liverpool town hall.
- 421-B In west face of large flat boulder, 6 feet southeast of northwest line of Halifax and Southwestern railway right-of-way, between fourth and fifth telegraph poles southwest of mile post 119 from Halifax and at northeast end of tangent at Hunt Point station.
- 422-B In northwest end of southwest face of northeast stone abutment of open culvert under Halifax and Southwestern railway, 1 mile southwest of Hunt Point station.
- 423-B In east face of large mass of rock, 22 feet northwest of northwest line of Halifax and Southwestern railway right-of-way, at thirteenth telegraph pole northeast of mile post 126 from Halifax and $1\frac{1}{2}$ miles southwest of Port Mouton.
- 424-B In southeast end of southwest face of northeast stone abutment of open culvert under Halifax and Southwestern railway, $\frac{1}{2}$ mile southwest of Wilkins.
- 425-B In south face of large mass of rock lying along southeast line of Halifax and Southwestern railway right-of-way, $1\frac{1}{2}$ miles southwest of Wilkins and between eighth and ninth telegraph poles northeast of mile post 135 from Halifax.
- 426-B In southeast end of southwest face of concrete retaining wall behind northeast abutment of Halifax and Southwestern railway bridge over Tom Tigney river, $1\frac{1}{2}$ miles northeast of Sable River station.
- 427-B In east face of south concrete wing-wall—1 foot below bridge-seat—of Halifax and Southwestern railway bridge over Sable river, $\frac{1}{2}$ mile northeast of Sable River station.
- 428-B In northwest end of southwest face of northeast stone abutment of open culvert under Halifax and Southwestern railway, $2\frac{1}{4}$ miles northeast of Lockeport and at mileage 144.4 from Halifax.
- 429-B In southeast face of north concrete wing-wall—2 feet above bridge-seat—of Halifax and Southwestern railway bridge over East river, $2\frac{1}{2}$ miles southwest of Lockeport.
- 430-B In northwest end of northeast face of concrete retaining wall behind southwest abutment of bridge on Halifax and Southwestern railway, 300 feet northeast of East Jordan.
- 431-B In second course of stone work above bridge-seat, in southeast end of northeast face of retaining wall behind southwest abutment of Halifax and Southwestern railway bridge over Jordan river, $\frac{1}{2}$ mile northeast of Jordan Falls station.
- 432-B In southeast end of northeast face—20 inches below bridge-seat—of southwest concrete abutment of bridge on Halifax and Southwestern railway, $1\frac{1}{2}$ miles southwest of Jordan Falls station.
- 433-B In second course of stonework below woodwork, in front (or west) wall of Shelburne academy, 18 feet from southwest corner.

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- 434-B In top course of stonework, in west end of south foundation wall of Shelburne court house.
- 435-B In third course of stonework below water-table course, in south wall of Shelburne post office, 5 feet 4 inches from wall of clock tower.
- 436-B In east face of south concrete wing-wall—at level of bridge-seat—of bridge on Halifax and Southwestern railway, $\frac{1}{4}$ mile southwest of Shelburne.
- 437-B In northwest end of northeast face—4 feet below bridge-seat—of southwest concrete abutment of Halifax and Southwestern railway bridge over Shelburne river, $1\frac{1}{2}$ miles southwest of Shelburne.
- 438-B In northwest end of northeast face—4 feet below bridge-seat—of southwest concrete abutment of Halifax and Southwestern railway bridge over Roseway river, 0.4 mile northeast of Birchtown.
- 439-B In concrete bench-mark pier, 3 feet southeast of northwest line of Halifax and Southwestern railway right-of-way, on top of small knoll 1,600 feet southwest of mile post 175 from Halifax and $1\frac{1}{2}$ miles southwest of Gunning Cove.
- 440-B In west face of north concrete wing-wall—8 inches below bridge-seat—of Halifax and Southwestern railway bridge over Round Bay brook, 2 miles southwest of Roseway.
- 441-B In second course of stonework below timber-seat, in southeast end of southwest face of northeast abutment of open culvert under Halifax and Southwestern railway, 800 feet northeast of Port Saxon.
- 442-B In north face of west concrete wing-wall—6 feet below bridge-seat—of Halifax and Southwestern railway bridge over Clyde river, 1,000 feet northeast of Port Clyde.
- 443-B In west face of granite boulder—about 20 feet square—on north side of Halifax and Southwestern railway, 700 feet northeast of a highway crossing, $2\frac{1}{4}$ miles southwest of Port Clyde and at eighth telegraph pole southwest of mile post 190 from Halifax.
- 444-B In northwest end of northeast face of concrete retaining wall behind southwest abutment of Halifax and Southwestern railway bridge over Barrington river, 1,200 feet northeast of Barrington.
- 445-B In north face of boulder, 35 feet southeast of southeast line of Halifax and Southwestern railway right-of-way, 2 miles southwest of Barrington and at mileage 196.8 from Halifax.
- 446-B In first course of stonework below water-table course, in west wall of Royal Bank at Barrington Passage, 26 feet from southwest corner of building.
- 447-B In second course of stonework below bridge-seat, in north face of west wing-wall of bridge on Halifax and Southwestern railway, 1 mile southwest of Barrington Passage.
- 448-B In southeast end of northeast face of southwest stone abutment of open culvert under Halifax and Southwestern railway, 1 mile southwest of Atwoods Brook station and at mileage 201.75 from Halifax.
- 449-B In third course of stonework below bridge-seat, in north face of west wing-wall of bridge on Halifax and Southwestern railway, $\frac{1}{4}$ mile northeast of Shag Harbour.
- 450-B In east end of north face of south stone abutment of open culvert under Halifax and Southwestern railway, $1\frac{1}{2}$ miles north of Woods Harbour.
- 451-B In west end of south face of north stone abutment of open culvert under Halifax and Southwestern railway, $\frac{1}{4}$ mile south of Upper Woods Harbour.
- 452-B In east face of small square stone culvert under Halifax and Southwestern railway, $\frac{1}{4}$ mile north of Lower East Pubnico.

- 453-B In west face of concrete retaining wall behind south abutment of bridge on Halifax and Southwestern railway, $\frac{1}{2}$ mile north of East Pubnico.
- 454-B In first course of stonework below bridge-seat, in southwest face of southwest retaining wall of Halifax and Southwestern railway bridge over Pubnico river, 1,000 feet south of Pubnico.
- 455-B In south end of west face of small square stone culvert under Halifax and Southwestern railway, 1,500 feet north of Lower Argyle.
- 456-B In east end of north face of south concrete abutment of open culvert under Halifax and Southwestern railway, 1 mile north of Central Argyle and 800 feet north of mile post 227 from Halifax.
- 457-B In first course of stonework below bridge-seat, in southeast face of southeast wing-wall of Halifax and Southwestern railway bridge over Argyle river, $\frac{1}{2}$ mile north of Argyle.
- 458-B In east face of north concrete abutment of open culvert under Halifax and Southwestern railway, 2 miles south of Belleville.
- 459-B In northwest face of northeast wing-wall of open culvert under Halifax and Southwestern railway, $\frac{1}{2}$ mile west of Belleville.
- 460-B In second course of stonework above bridge-seat, in northeast face of northeast retaining wall of Halifax and Southwestern railway bridge over Tusket river, $\frac{1}{2}$ mile west of Tusket.
- 461-B In concrete bench-mark pier, 3 feet north of south line of Halifax and Southwestern railway right-of-way, 520 feet east of west fence line of Yarmouth-Barrington highway crossing, and $1\frac{1}{2}$ miles west of Tusket.
- 462-B In second altar-step below top, in northeast face of northeast concrete wing-wall of large open culvert under Halifax and Southwestern railway, 0.4 mile east of Arcadia.
- 463-B In second course of stonework below water-table course, in south end of west wall of Yarmouth post office.
- 464-B In eleventh course of stonework below woodwork, in south end of west wall of Yarmouth court house.
- 465-B In first course of stonework below water-table course, in south wall—9 feet from southeast corner—of Congregational church, Collins street, Yarmouth.

BENCH-MARKS BETWEEN DEPOT HARBOUR AND RENFREW, ONTARIO,
VIA GRAND TRUNK RAILWAY.

- 567 In rear (or westerly) concrete wall of Grand Trunk roundhouse at Depot Harbour, 18 inches below water-table and at foot of pilaster between engine stalls 11 and 12.
- 566 In concrete bench-mark pier, 8 feet south of north line of Grand Trunk railway right-of-way, 12 feet west of a private crossing, $\frac{1}{2}$ mile east of Depot Harbour and at sixth telegraph pole east of mile post 396 from Alburgh Junction.
- 565 In south end of east face of stone and concrete retaining wall behind east abutment of Grand Trunk railway swing-bridge, 400 feet west of Rose Point station. The copper bolt is 4 feet 4 inches below top and 2 feet 10 inches north of south face of retaining wall.
- 564 In south face—6 feet from southwest corner—of most southerly concrete pier of bridge by which Canadian Pacific railway passes over Grand Trunk railway, $2\frac{1}{2}$ miles east of Rose Point.
Note.—Bench-mark No. 418, on the Bolton-Sudbury line of levels, is in the north abutment of this bridge.

- 563 In north face of exposed rock surface, 10 feet south of Grand Trunk railway track, 20 feet west of mile post 387 from Alburgh Junction, 1 mile east of Otter Lake station and at sixth telegraph pole east of point where Grand Trunk railway and Canadian Northern railway diverge from one another.
- 562 In south side of small rock cut on Grand Trunk railway, at fourth telegraph pole west of mile post 382 from Alburgh Junction.
- 561 In west end of south face—3 feet below top—of southwest concrete retaining wall of Grand Trunk railway bridge, $\frac{1}{2}$ mile east of Maple Lake station.
- 560 In south face of exposed rock surface, 10 feet south of north line of Grand Trunk railway right-of-way, 1.4 miles east of Edgington and 340 feet west of mile post 374 from Alburgh Junction.
- 559 In north face—3 feet 6 inches below top—of northwest concrete retaining wall of Grand Trunk railway bridge over Seguin river, $\frac{1}{2}$ mile west of Seguin Falls station.
- 558 In south face of exposed rock surface, 8 feet south of north line of Grand Trunk railway right-of-way, 180 feet east of a whistle post and between fourth and fifth telegraph poles west of mile post 366 from Alburgh Junction.
- 557 In north side of small rock cut on Grand Trunk railway—70 feet from west end of cut—300 feet east of mile post 362 from Alburgh Junction and $1\frac{1}{2}$ miles east of Bear Lake station.
- 556 In west concrete foundation wall—28 inches from northwest corner—of Wm. Morrison's general store at Sprucedale; this is a concrete block building at southeast corner of main road and first cross road east of the station.
- 555 In north face of exposed rock surface, 37 feet south of Grand Trunk railway track, 880 feet west of a private crossing and between fifth and sixth telegraph poles east of mile post 354 from Alburgh Junction.
- 554 In north face of concrete bench-mark pier, 4 feet south of north line of Grand Trunk railway right-of-way—at a private crossing between second and third telegraph poles east of mile post 350 from Alburgh Junction—and $3\frac{1}{4}$ miles west of Scotia Junction.
- 553 In south side of rock cut on Grand Trunk railway, 690 feet east of east line of a highway crossing and $\frac{1}{2}$ mile east of Scotia Junction.
- 552 In south end of west concrete foundation wall—3 feet below woodwork—of H. Braithwaite's hardware store at Kearney, opposite the Kearney house.
- 551 In north side of small rock cut on Grand Trunk railway at mile post 336 from Alburgh Junction.
- 550 In north side of rock cut on Grand Trunk railway, 1,500 feet east of section-house at east end of passing track at Ravensworth and 160 feet east of mile post 333 from Alburgh Junction.
- 549 In south face of exposed rock surface, 25 feet north of Grand Trunk railway track, 280 feet east of a small timber culvert and at twentieth telegraph pole west of mile post 328 from Alburgh Junction.
- 548 In south face of exposed rock surface, 20 feet north of Grand Trunk railway track, 1 mile west of Rainy Lake station and 450 feet west of mile post 325 from Alburgh Junction.
- 547 In east end of north face—3 feet 3 inches below top—of northeast concrete retaining wall of Grand Trunk railway bridge, $3\frac{1}{2}$ miles west of Brûlé Lake station.
- 546 In east face of exposed rock surface, 20 feet south of Grand Trunk railway track and 770 feet east of station-house at Brûlé Lake.

- 545 In west face of exposed rock surface, 47 feet south and slightly below rail level of Grand Trunk railway track, 230 feet west of mile post 313 from Alburgh Junction--immediately east of a small lake.
- 544 In second course of stonework below top, in north face of northeast retaining wall of Grand Trunk railway bridge, 150 feet east of Canoe Lake station.
- 543 In third course of stonework below top, in south face of southwest retaining wall of Grand Trunk railway bridge over the narrows of Joe lake, 420 feet east of Joe Lake station.
- 542 In third course of stonework below top, in north face of northwest retaining wall of Grand Trunk railway bridge over Madawaska river, 2 miles west of Algonquin Park station.
- 541 In north face—3 feet 6 inches below top—of northeast concrete retaining wall of Grand Trunk railway bridge over Madawaska river, $1\frac{1}{2}$ miles east of Algonquin Park station.
- 540 In third course of stonework below top, in south face of southeast retaining wall of Grand Trunk railway bridge over Madawaska river, $4\frac{1}{2}$ miles east of Algonquin Park station.
- 539 In third course of stonework below top, in north face of northeast retaining wall of Grand Trunk railway bridge over Madawaska river, $\frac{1}{2}$ mile west of Rock Lake station.
- 538 In south side of large rock cut on Grand Trunk railway—at rail level—300 feet west of “Men-Wah-Tay”, the summer residence of A. W. Fleck, $1\frac{1}{2}$ miles east of Rock Lake station.
- 537 In south face—at rail level and near centre—of vertical rock surface about 500 feet long, situated 10 feet north of Grand Trunk railway track and 1,100 feet east of mile post 284 from Alburgh Junction, facing Long lake.
- 536 In fourth course of stonework below top, in north face of northeast retaining wall of Grand Trunk railway bridge over Madawaska river, $1\frac{1}{2}$ miles east of Whitney.
- 535-A In concrete bench-mark pier, 36 feet north of Grand Trunk railway track, 350 feet east of mile post 276 from Alburgh Junction and 3 miles east of Whitney—on eastern slope of small depression in centre of a long clay cut.
- 535 In north face—at rail level and near centre—of vertical rock surface, 10 feet south of Grand Trunk railway track and 360 feet east of mile post 274 from Alburgh Junction.
- 534 In third course of stonework below top, in north face of northeast retaining wall of small plate-girder bridge on Grand Trunk railway, at mile post 271 from Alburgh Junction.
- 533 In northeast face of large boulder, 20 feet south of Grand Trunk railway track, 800 feet west of station-house at Egan Estate and between sixth and seventh telegraph poles east of mile post 267 from Alburgh Junction.
- 532 In concrete bench-mark pier, 8 feet south of north line of Grand Trunk railway right-of-way, 650 feet west of first rock cut west of Madawaska and 300 feet west of sign “Madawaska, 1 mile.”
- 531 In south concrete wall of Grand Trunk roundhouse at Madawaska, 2 feet above water-table and at foot of first pilaster from southeast corner of engine stall number 1.
- 530 In second course of stonework below top, in north face of northeast retaining wall of Grand Trunk railway bridge over Madawaska river, 1,200 feet east of Madawaska station.
- 529 In northeast face of large flat boulder, 30 feet south of Grand Trunk railway track, 3 miles east of Madawaska and 175 feet east of mile post 260 from Alburgh Junction.

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- 528 In third course of stonework below top, in north face of northeast retaining wall of Grand Trunk railway bridge over Opeongo river, $6\frac{1}{2}$ miles east of Madawaska.
- 527 In north face of boulder, 35 feet south of Grand Trunk railway track and 200 feet east of mile post 253 from Alburgh Junction—at east end of a gravel cut.
- 526 In south face of boulder, 30 feet north of Grand Trunk railway track, between sixth and seventh telegraph poles west of mile post 250 from Alburgh Junction and 200 feet west of west end of cut at head of grade to the east of Aylen lake.
- 525 In third course of stonework below top, in south face of southwest retaining wall of Grand Trunk railway bridge, $5\frac{1}{2}$ miles west of Barrys Bay.
- 524 In south side of rock cut on Grand Trunk railway, 4 miles west of Barrys Bay and 915 feet east of mile post 246 from Alburgh Junction.
- 523 In east end of north face of coping on north end of concrete arch culvert under Grand Trunk railway, 1,700 feet east of Barrys Bay.
- 522 In third course of stonework below top, in north face of northeast retaining wall of open culvert under Grand Trunk railway, 270 feet west of Wilno.
- 521 In south side of rock cut on Grand Trunk railway, $1\frac{3}{4}$ miles east of Wilno and 960 feet east of first highway crossing east of mile post 234 from Alburgh Junction.
- 520 In south side of rock cut on Grand Trunk railway, 1,125 feet west of a highway crossing, 120 feet east of a farm crossing and $2\frac{1}{2}$ miles west of Killaloe.
- 519 In second course of stonework below top, in south face of southeast retaining wall of Grand Trunk railway bridge over Brennan creek, 360 feet west of Killaloe station.
- 518 In concrete bench-mark pier, 4 feet south of north line of Grand Trunk railway right-of-way, $\frac{1}{2}$ mile east of Killaloe and 2,130 feet east of mile post 227 from Alburgh Junction.
- 517 In south side of small rock cut on Grand Trunk railway, $3\frac{3}{4}$ miles east of Killaloe and between thirteenth and fourteenth telegraph poles west of mile post 223 from Alburgh Junction.
- 516 In south side of shallow rock cut on Grand Trunk railway, $1\frac{3}{4}$ miles west of Golden Lake station and 1,875 feet east of mile post 220 from Alburgh Junction.
- 515 In south side of shallow rock cut on Grand Trunk railway, $\frac{1}{2}$ mile east of Golden Lake station and 2,000 feet west of mile post 217 from Alburgh Junction.
- 514 In fourth course of stonework below top, in south face of southwest retaining wall of Grand Trunk railway bridge over Hurd brook, 0.6 mile west of Eganville.
- 513 In east face of large limestone boulder, 20 feet south of north line of Grand Trunk railway right-of-way and 95 feet west of mile post 208 from Alburgh Junction.
- 512 In north end of west stone foundation wall of residence owned by Moses Walsh at Caldwell; this is a brick building at southeast corner of main road and first cross road west of the station.
- 511 In west end of north face of small stone culvert under Grand Trunk railway, 1 mile east of Caldwell and 360 feet east of mile post 202 from Alburgh Junction.
- 510 In fourth course of stonework below top, in south face of southwest retaining wall of Grand Trunk railway bridge, $1\frac{3}{4}$ miles east of Douglas and at fourth telegraph pole west of mile post 198 from Alburgh Junction.

- 509 In fourth course of stonework below top, in northeast face of northeast wing-wall of stone arch culvert under Grand Trunk railway, 800 feet east of Admaston.
- 508 In fifth course of stonework below top, in north face of northeast retaining wall of Grand Trunk railway bridge, $2\frac{3}{4}$ miles west of Renfrew and at fifth telegraph pole east of mile post 191 from Alburgh Junction.
- 507 In water-table course of stonework, in front (or east) wall of Renfrew high school, 20 feet south of south wall of tower.
- 506 In first course of stonework below water-table course, in front (or west) wall of Renfrew Presbyterian church, 5 feet south of south wall of entrance porch at northerly doorway.
- 505 In third course of stonework below water-table course, in front (or west) wall of Renfrew post office, 8 feet to the south of the letter drop.

BENCH-MARKS BETWEEN WINNIPEG, MANITOBA, AND KENORA,
ONTARIO, VIA CANADIAN PACIFIC RAILWAY, (direct line).

- 1-F In first course of stonework above concrete walk, in west end of north wall of Grand Trunk-Canadian Northern union station at Winnipeg.
- 2-F In first course of stonework below brickwork, in south end of east wall of rear section of Winnipeg post office—at northwest corner of lanes running north from Graham avenue and east from Garry street.
- 3-F In second course of stonework above concrete walk, in west wall of main (or southerly) section of Canadian Pacific station at Winnipeg, between third and fourth basement windows from southwest corner.
- 4-F In concrete bench-mark pier, 4 feet north of south line of Canadian Pacific railway right-of-way, 108 feet west of intersection of south line of right-of-way with west line of a highway crossing and $3\frac{1}{2}$ miles east of Winnipeg station.
- 5-F In west end of north face of square concrete culvert under Canadian Pacific railway, 3 miles east of North Transcona and at mileage 116.7 from Kenora.
- 6-F In south end of east face of concrete retaining wall behind west abutment—10 inches above bridge-seat—of plate-girder bridge on Canadian Pacific railway, at mileage 108.8 from Kenora.
- 7-F In concrete bench-mark pier, 10 feet north of south line of Canadian Pacific railway right-of-way, 86 feet west of mile post 102 from Kenora and about 900 feet west of a highway crossing.
- 8-F In southeast face of southwest concrete retaining wall—6 feet above bridge-seat—of Canadian Pacific railway bridge over Brokenhead river, 1 mile east of Lydiatt.
- 9-F In west face of concrete coping on south end of concrete arch culvert under Canadian Pacific railway, $1\frac{3}{4}$ miles east of Lydiatt and at mileage 93.4 from Kenora.
- 10-F In east face of southwest retaining wall of square concrete culvert under Canadian Pacific railway, 600 feet east of Molson.
- 11-F In west face of boulder, partly buried in muskeg, 25 feet south of centre line between tracks of Canadian Pacific railway, and at fourth telegraph pole east of mile post 84 from Kenora.
- 12-F In north face of concrete footing of Canadian Pacific railway semaphore, $\frac{1}{2}$ mile west of Shelley.
- 13-F In east face of southwest retaining wall of square concrete culvert under Canadian Pacific railway, $2\frac{1}{4}$ miles west of Whitemouth and at mileage 74.36 from Kenora.

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- 14-F In second course of stonework above bridge-seat, in south end of east face of retaining wall behind west abutment of Canadian Pacific railway bridge over Whitemouth river, $\frac{3}{4}$ mile east of Whitemouth.
- 15-F In south end of east face—4 feet below bridge-seat—of west concrete abutment of Canadian Pacific railway bridge over Bog river, $1\frac{1}{2}$ miles west of Darwin and at mileage 67·1 from Kenora.
- 16-F In south face of large mass of rock, 40 feet south of centre line between tracks of Canadian Pacific railway, $\frac{1}{4}$ mile west of mile post 64 from Kenora and 85 feet west of sign "Darwin, 1 mile"—east of station.
- 17-F In south side of shallow rock cut on Canadian Pacific railway—near east end of cut—at fourteenth telegraph pole west of mile post 60 from Kenora.
- 18-F In west face of south face-wall of square concrete culvert under Canadian Pacific railway, at mileage 57·5 from Kenora.
- 19-F In north end of east face of westerly concrete pier of bridge by which Grand Trunk Pacific railway crosses over Canadian Pacific railway, 2·7 miles west of Rennie. The bench-mark is near the level of the Canadian Pacific rails.
- 20-F In south end of east face of concrete retaining wall behind west abutment—16 inches above bridge-seat—of plate-girder bridge on Canadian Pacific railway, $\frac{1}{4}$ mile east of Rennie.
- 21-F In south face of west concrete abutment—16 inches below bridge-seat—of plate-girder bridge on Canadian Pacific railway, 2·4 miles east of Rennie and at mileage 49·7 from Kenora.
- 22-F In north face of exposed rock surface at south side of Canadian Pacific railway track, $1\frac{1}{2}$ miles west of Telford and 500 feet east of mile post 46 from Kenora.
- 23-F In west end of south face of square concrete culvert under Canadian Pacific railway, $2\frac{1}{2}$ miles east of Telford and at mileage 41·93 from Kenora.
- 24-F In southwest face of coping stone on southeast wing-wall of stone arch culvert under Canadian Pacific railway, at mileage 38·44 from Kenora.
- 25-F In concrete bench-mark pier, between seventh and eighth telegraph poles west of mile post 35 from Kenora and about 460 feet east of a divergence between the eastbound and westbound tracks of the Canadian Pacific railway; the pier is 62 feet north of the south track and 82 feet south of the north track.
- 26-F In south side of rock cut on Canadian Pacific railway, $\frac{3}{4}$ mile west of Ingolf and opposite mile post 32 from Kenora.
- 27-F In north side—25 feet from west end—of large rock cut on Canadian Pacific railway, $2\frac{1}{4}$ miles east of Ingolf and between fifth and sixth telegraph poles east of mile post 29 from Kenora.
- 28-F In north face of large boulder near southerly line of Canadian Pacific railway right-of-way, between fourth and fifth telegraph poles east of mile post 26 from Kenora.
- 29-F In exposed rock surface at south side of Canadian Pacific railway track, 100 feet west of mile post 21 from Kenora.
- 30-F In south side of shallow rock cut on Canadian Pacific railway—25 feet from west end—at mileage 17·6 from Kenora.
- 31-F In south side of long rock cut on Canadian Pacific railway—420 feet east of west end of cut—between sixth and seventh telegraph poles west of Busteed and directly opposite a railway bench-mark painted white.

- 32-F In south side of rock cut on Canadian Pacific railway, between second and third telegraph poles west of mile post 11 from Kenora.
- 33-F In concrete bench-mark pier, 46 feet south of centre line between tracks of Canadian Pacific railway, directly opposite an abandoned spur line leading to a ballast pit, and about 2,000 feet east of mile post 9 from Kenora.
- 34-F In east end of north face—1 foot below top—of northeast concrete retaining wall of bridge on Canadian Pacific railway, 450 feet west of Keewatin station.
- 35-F In north end of east face of concrete retaining wall behind west abutment—2 feet 8 inches above bridge-seat—of Canadian Pacific railway bridge over Winnipeg river, 1·17 miles west of Kenora.
- 36-F In second course of stonework below brickwork, in west end of north wall of Canadian Pacific station-house at Kenora.
- 37-F In fourth course of stonework below brickwork, in west wall of Kenora post office, 11 feet 6 inches north of north wall of tower.
- 38-F In third course of stonework below water-table course, in east face of corner stone at northeast corner of Kenora court house.

**BENCH-MARKS BETWEEN SASKATOON, SASKATCHEWAN, AND
WAINWRIGHT, ALBERTA, VIA GRAND TRUNK PACIFIC
RAILWAY.**

- 1-H In north end of west face of concrete retaining wall behind east abutment of Grand Trunk Pacific railway bridge over South Saskatchewan river, 2½ miles west of South Saskatoon station.
- 2-H In north face of concrete pier supporting pulleys for interlocking plant—at north side of Grand Trunk Pacific railway track—and 120 feet east of diamond crossing of Canadian Northern railway, 5 miles west of South Saskatoon station.
- 3-H In west concrete foundation wall—7 inches below woodwork and 30 inches from northwest corner—of Grand Trunk Pacific railway section-house, at west end of Grandora passing-track and immediately east of a highway crossing.
- 4-H In concrete bench-mark pier, 5 feet south of north line of Grand Trunk Pacific railway right-of-way, 335 feet east of east line of a highway crossing, 1¾ miles west of Hawoods and at fifth telegraph pole east of mile post 488 from Winnipeg.
- 5-H In west concrete foundation wall—4 inches below woodwork and 7 feet from southwest corner—of Grand Trunk Pacific railway section-house, at east end of passing-track at Asquith.
- 6-H In south concrete foundation wall—1 foot below woodwork and 19 feet from southwest corner—of frame house owned by J. B. King, 100 yards north of Juniata station.
- 7-H In north end of east face of concrete retaining wall behind west abutment—4 feet above bridge-seat—of Grand Trunk Pacific railway bridge over Eaglehill creek, 2¼ miles east of Kinley.
- 8-H In west concrete foundation wall—8 inches below woodwork and 2 feet from southwest corner—of a frame school house, ¼ mile northeast of Leney station.
- 9-H In north concrete foundation wall—6 inches below galvanized iron sheeting and 6 inches from northeast corner—of engine house of Saskatchewan Co-operative Elevator company's elevator (local No. 11), 5½ miles west of Leney.

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- 10-H In west concrete foundation wall—9 inches below woodwork and 7 feet from southwest corner—of Grand Trunk Pacific railway section-house, at east end of Neola passing-track.
- 11-H In concrete foundation—7 inches below woodwork and 40 inches to the right of the spout—of Grand Trunk Pacific water-tank, 3·3 miles east of Biggar.
- 12-H In east end of south concrete foundation wall—2 feet 10 inches below brickwork—of front (or southerly) section of Biggar public school.
- 13-H In concrete bench-mark pier, 9 feet south of north line of Grand Trunk Pacific railway right-of-way and immediately west of a jog in the right-of-way fence, 4·4 miles west of Biggar and 60 feet east of mile post 531 from Winnipeg.
- 14-H In south concrete foundation wall—4 inches below galvanized iron sheeting and 2 feet 6 inches from southwest corner—of Saskatchewan Co-operative Elevator company's elevator (local No. 38) at Oban.
- 15-H In west concrete foundation wall—4 inches below woodwork and 6 feet 6 inches from southwest corner—of Grand Trunk Pacific railway section-house at west end of Palo passing-track.
- 16-H In concrete foundation—8 inches below woodwork and 3 feet to the right of the spout—of Grand Trunk Pacific water-tank at Landis.
- 17-H In east concrete foundation wall—3 inches below woodwork and 7 feet 6 inches from northeast corner—of Grand Trunk Pacific station-house at Coblenz.
- 18-H In east end of north concrete foundation wall—10 inches below woodwork—of signal tower at diamond crossing of Grand Trunk Pacific and Canadian Pacific railways, 1 mile west of Reford.
- 19-H In east concrete foundation wall—4 inches below woodwork and 34 inches from southeast corner—of Grand Trunk Pacific railway station-house at Scott.
- 20-H In concrete foundation—4 inches below woodwork and 30 inches to the right of the spout—of Grand Trunk Pacific water-tank at Tako.
- 21-H In concrete bench-mark pier, 10 feet south of north line of Grand Trunk Pacific railway right-of-way, 3½ miles east of Unity and 10 feet west of mile post 581 from Winnipeg.
- 22-H In east concrete foundation wall—9 inches below woodwork and 25 inches from southeast corner—of Grand Trunk Pacific station-house at Unity.
- 23-H In north concrete foundation wall—6 inches below woodwork and 6 inches from northeast corner—of Grand Trunk Pacific railway section-house, at east end of Vera passing-track.
- 24-H In concrete foundation—6 inches below woodwork and 4 feet to the right of the spout—of Grand Trunk Pacific water-tank, 3¼ miles east of Winter.
- 25-H In south face, 5 inches below top, of block of concrete—about 3 feet by 7 feet—originally used as a foundation for a pumping engine—30 feet south of north line of Grand Trunk Pacific railway right-of-way and 460 feet west of Winter station.
- 26-H In concrete bench-mark pier, 8 feet south of north line of Grand Trunk Pacific railway right-of-way, 1¼ miles west of Yonker and 17 feet west of fourteenth telegraph pole west of mile post 612 from Winnipeg.
- 27-H In west concrete foundation wall—4 inches below woodwork and 6 feet 6 inches from southwest corner—of Grand Trunk Pacific railway section-house, at east end of Zumbro passing-track.
- 28-H In north concrete foundation wall—10 inches below top and 8 feet from northeast corner—of grain elevator on south side of Grand Trunk Pacific railway track, 1,000 feet east of Artland station.
NOTE.—The superstructure of this elevator has been burned down and only the foundation remains.

- 29-H In west concrete foundation wall—3 inches below woodwork and 15 inches from northwest corner—of Grand Trunk Pacific railway section-house at Butze siding.
- 30-H In east concrete foundation wall—10 inches below woodwork and 25 inches from southeast corner—of Grand Trunk Pacific station-house at Chauvin.
- 31-H In concrete bench-mark pier, 7 feet south of north line of Grand Trunk Pacific railway right-of-way, 2,940 feet west of bridge over Ribstone creek and 410 feet east of mile post 640 from Winnipeg.
- 32-H In north concrete foundation wall—5 inches below woodwork and 19 inches from northwest corner—of Grand Trunk Pacific railway section-house, at east end of Dunn passing-track.
- 33-H In north face—7 inches below top—of concrete abutment along westerly wall of Alberta Co-operative Elevator company's elevator (local No. 86) at Edgerton.
- 34-H In south concrete foundation wall—4 inches below woodwork and 8 inches from southwest corner—of Grand Trunk Pacific railway section-house at Heath, $\frac{1}{4}$ mile east of station.
- 35-H In concrete bench-mark pier, 6 feet south of north line of Grand Trunk Pacific railway right-of-way, 1 mile east of Greenshields and 96 feet west of mile post 661 from Winnipeg.
- 36-H In south concrete foundation wall—23 inches below brickwork and 18 inches from southwest corner—of Wainwright public school.

BENCH-MARKS BETWEEN MAPLE CREEK, SASKATCHEWAN, AND
COUTTS, ALBERTA, VIA CANADIAN PACIFIC RAILWAY.

- 146-C In south face of concrete retaining wall behind west abutment—4 feet above bridge-seat—of plate-girder bridge on Canadian Pacific railway, 0·4 mile west of Maple Creek and at mileage 84·9 from Swift Current.
- 147-C In east end of south face of stone coping on southeast retaining wall of plate-girder bridge on Canadian Pacific railway, $3\frac{1}{2}$ miles west of Maple Creek and at mileage 88·1 from Swift Current.
- 148-C In south face of concrete retaining wall behind west abutment of small plate-girder bridge on Canadian Pacific railway, $5\frac{1}{2}$ miles west of Maple Creek and at mile post 90 from Swift Current.
- 149-C In concrete bench-mark pier, 5 feet north of south line of Canadian Pacific railway right-of-way, $1\frac{1}{4}$ miles east of Kincorth and 150 feet west of mile post 96 from Swift Current.
- 150-C In west face of south face-wall of concrete arch culvert under Canadian Pacific railway, $1\frac{3}{4}$ miles east of Hatton.
- 151-C In west concrete foundation wall—9 inches below woodwork and 9 inches from southwest corner—of Hotel Forres at Hatton, 220 feet north of the station.
- 152-C In south face of central supporting wall of double concrete culvert under Canadian Pacific railway, 1 mile east of Cummings and at mileage 108·4 from Swift Current.
- 153-C In south end of west face—6 inches below top—of concrete retaining wall behind west abutment of plate-girder bridge on Canadian Pacific railway, $2\frac{1}{2}$ miles west of Cummings and at mileage 111·9 from Swift Current.
- 154-C In south end of east face—6 inches below bridge-seat—of west concrete abutment of open culvert under Canadian Pacific railway, $2\frac{1}{4}$ miles east of Walsh and at mileage 112·8 from Swift Current.

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- 155-C In south end of east face of concrete retaining wall behind west abutment of Canadian Pacific railway bridge over Mackay creek, $\frac{3}{4}$ mile west of Walsh.
- 156-C In south end of east face of concrete retaining wall behind west abutment of open culvert under Canadian Pacific railway, $2\frac{3}{4}$ miles west of Walsh and at mileage 117.9 from Swift Current.
- 157-C In south end of east face of west concrete abutment of plate-girder bridge on Canadian Pacific railway, at mileage 120.4 from Swift Current.
- 158-C In south end of east face—7 inches below top—of concrete retaining wall behind west abutment of plate-girder bridge on Canadian Pacific railway, $3\frac{1}{2}$ miles east of Irvine and at mileage 122.2 from Swift Current.
- 159-C In south end of east stone foundation wall—6 inches below brickwork—of Kalmbach Block at Irvine, southwest of the station.
- 160-C In west end of south stone foundation wall—22 inches below concrete water-table course—of Irvine public school, a concrete block building northwest of the station
- 161-C In south end of east face of concrete retaining wall behind west abutment of plate-girder bridge on Canadian Pacific railway, 2 miles west of Irvine and at mileage 127.6 from Swift Current.
- 162-C In south end of west face—6 inches below top—of concrete retaining wall behind west abutment of plate-girder bridge on Canadian Pacific railway, 3 miles west of Irvine and at mileage 128.6 from Swift Current.
- 163-C In south face-wall, immediately above southwest wing-wall, of double concrete culvert under Canadian Pacific railway, at mileage 131.6 from Swift Current.
- 164-C In concrete bench-mark pier, 7 feet north of south line of Canadian Pacific railway right-of-way, 26 feet west of mile post 135 from Swift Current and about 5 miles east of Dunmore.
- 165-C In west concrete foundation wall of Canadian Pacific roundhouse at Dunmore, 32 inches below brickwork and 10 inches from southwest corner.
- 166-C In south end of west face—6 inches below top—of concrete retaining wall behind west abutment of Canadian Pacific railway bridge over Bullshad creek, 5 miles southeast of Medicine Hat.
- 167-C In second course of stonework below water-table course, in northwest end of southwest wall (facing Sixth avenue southeast) of Medicine Hat post office.
- 168-C In northwest face of concrete coping on south retaining wall—at rail level—of Canadian Pacific railway bridge over South Saskatchewan river, $\frac{1}{4}$ mile northwest of Medicine Hat station.
- 169-C In second course of stonework below water-table course, in southwest end of northwest wall of Canadian Pacific station-house at Medicine Hat.
- 170-C In east face of southwest wing-wall of square concrete culvert under Canadian Pacific railway, at mile post 6 from Dunmore.
- 171-C In south end of west wall—3 feet 6 inches below line of window sills—of Canada Cement company's office and machine shop, a large concrete building 400 feet north of Canadian Pacific railway at Dauntless.
- 172-C In east face of southwest wing-wall of double concrete culvert under Canadian Pacific railway, at mile post 14 from Dunmore.
- 173-C In south face—1 foot below top—of concrete retaining wall behind west abutment of Canadian Pacific railway bridge over Sevenpersons river, 1.9 miles east of Sevenpersons.

- 174-C In west face of coping on south end of large concrete arch culvert under Canadian Pacific railway, 2·3 miles west of Sevenpersons and 1,000 feet east of mile post 20 from Dunmore.
- 175-C In west face of large boulder, 130 feet south of south line of Canadian Pacific railway right-of-way, 400 feet west of a highway crossing and 200 feet east of mile post 27 from Dunmore.
- 176-C In west concrete foundation wall—16 inches below woodwork and 6 feet from southwest corner—of Odd-fellows Hall at Winnifred, a frame building northwest of the station.
- 177-C In concrete bench-mark pier, 4 feet north of south line of Canadian Pacific railway right-of-way, 330 feet east of a farm crossing, 1½ miles west of Winnifred and 380 feet west of mile post 34 from Dunmore.
- 178-C In south face wall, immediately above southwest wing-wall of concrete arch culvert under Canadian Pacific railway, $\frac{3}{4}$ mile east of Bow Island and at mileage 40·3 from Dunmore.
- 179-C In north end of west concrete foundation wall—13 inches below woodwork—of Roman Catholic church at Bow Island.
- 180-C In north concrete foundation wall—1 foot 9 inches below woodwork and 4 feet 7 inches from northeast corner—of G. H. Johnston's general store and telephone office at Burdett.
- 181-C In west concrete foundation wall—8 inches below woodwork and 5 feet 5 inches from southwest corner—of Methodist church at Burdett.
- 182-C In west concrete foundation wall—15 inches below brickwork and 7 feet 6 inches from southwest corner—of hardware store of Larsen Bros. and Hinck, at Grassy Lake.
- 183-C In east end of north concrete foundation wall—5 feet 6 inches below brickwork—of Grassy Lake public school.
- 184-C In concrete bench-mark pier, 4 feet north of south line of Canadian Pacific railway right-of-way, 350 feet east of a highway crossing, 1 mile east of Purple Springs and 87 feet east of mile post 64 from Dunmore.
- 185-C In concrete bench-mark pier, 5 feet north of south line of Canadian Pacific railway right-of-way, 4½ miles east of Taber and 100 feet east of mile post 72 from Dunmore.
- 186-C In west concrete foundation wall—18 inches below brickwork and 4 feet from southwest corner—of Canadian Bank of Commerce at Taber.
- 187-C In west concrete foundation wall—9 inches below brickwork and 4 feet 8 inches from southwest corner—of Taber public school.
- 188-C In west end of south face of square concrete culvert under Canadian Pacific railway, 2 miles west of Taber.
- 189-C In centre of south face of square concrete culvert under Canadian Pacific railway, 360 feet east of a highway crossing and at mileage 85·7 from Dunmore.
- 190-C In south face-wall, immediately above southwest wing-wall, of square concrete culvert under Canadian Pacific railway, 600 feet west of westerly switch at Neidpath passing-track and at mileage 86·8 from Dunmore.
- 191-C In west concrete foundation wall—15 inches below woodwork and 4 feet 6 inches from southwest corner—of school house at Chin.
- 192-C In south face of concrete retaining wall behind west abutment of plate-girder bridge on Canadian Pacific railway, 1 mile west of Chin.

- 193-C In west end of south face of square concrete culvert under Canadian Pacific railway, 700 feet west of mile post 94 from Dunmore.
- 194-C In west end of south face of square concrete culvert under Canadian Pacific railway, 600 feet east of Coal-dale.
- 195-C In south face-wall, immediately above southwest wing-wall, of double concrete culvert under Canadian Pacific railway, $3\frac{1}{4}$ miles east of Lethbridge and 400 feet west of mile post 105 from Dunmore.
- 196-C In second course of stonework below water-table course, in east end of south wall of Canadian Pacific station-house at Lethbridge.
- 197-C In fourth course of stonework below water-table course, in west wall of Lethbridge post office, 17 feet from northwest corner.
NOTE.—The copper bolt is below the surface of the concrete sidewalk on Seventh street; access to it may be had by a small chamber fitted with an iron cover.
- 198-C In east face of granite plinth course at foot of pilaster at southeast corner of Lethbridge court house.
- 199-C In second course of stonework below water-table course, in east wall—11 feet 6 inches from southeast corner—of Wesley Methodist church, Lethbridge.
- 200-C In north concrete foundation wall—7 inches below woodwork and 12 feet from northeast corner—of stock building "C," at Lethbridge exhibition grounds, immediately west of Canadian Pacific railway—Coutts subdivision.
- 201-C In concrete bench-mark pier, 5 feet east of west line of Canadian Pacific railway right-of-way, $\frac{3}{4}$ mile north of Wilson and 67 feet south of mile post 9 from Montana Junction.
- 202-C In north face of boulder, 10 feet east of west line of Canadian Pacific railway right-of-way and at sixteenth telegraph pole south of mile post 12 from Montana Junction.
- 203-C In south end of west concrete foundation wall—1 foot below woodwork—of Canadian Pacific station-house at Stirling.
- 204-C In east concrete foundation wall—8 inches below woodwork and 12 feet from southeast corner—of Stirling Presbyterian church, a small frame building about $\frac{1}{4}$ mile west of the station.
- 205-C In concrete bench-mark pier, 5 feet east of west line of Canadian Pacific railway right-of-way, 2 miles north of New Dayton and 468 feet north of mile post 25 from Montana Junction.
- 206-C In south end of east concrete foundation wall—14 inches below woodwork—of Canadian Bank of Commerce at New Dayton.
- 207-C In east concrete foundation wall—20 inches below woodwork and 11 feet from northeast corner—of New Dayton public school.
- 208-C In concrete bench-mark pier, 4 feet east of west line of Canadian Pacific railway right-of-way, 520 feet north of a bridge over a small brook and 85 feet north of mile post 35 from Montana Junction.
- 209-C In south concrete foundation wall—15 inches below woodwork and 9 feet 7 inches from southeast corner—of First Evangelical church at Warner.
- 210-C In south concrete foundation wall— $7\frac{1}{2}$ inches below brickwork and 15 feet 6 inches from southwest corner—of Warner public school.
- 211-C In north face of large flat boulder, 200 feet west of west line of Canadian Pacific railway right-of-way, 1,450 feet south of a highway crossing and 1,335 feet north of mile post 43 from Montana Junction.

- 212-C In concrete bench-mark pier, 5 feet east of west line of Canadian Pacific railway right-of-way, 1 mile north of Milk River station and 215 feet north of mile post 51 from Montana Junction.
- 213-C In south end of east concrete foundation wall—18 inches below water-table—of Canadian Bank of Commerce at Milk River.
- 214-C In east face—8 feet 6 inches below bottom of coping—of northeast concrete retaining wall of highway bridge over Milk river, in the village of Milk River.
- 215-C In concrete bench-mark pier, 5 feet east of west line of Canadian Pacific railway right-of-way, 6 miles south of Milk River and 100 feet south of mile post 58 from Montana Junction.
- 216-C In north face of concrete pier (built originally for astronomical observations) 240 feet west of Canadian Pacific railway track, 1,050 feet north of international boundary and 150 feet south of Coutts post office.

BENCH-MARKS BETWEEN LETHBRIDGE AND CALGARY, ALBERTA,
VIA CANADIAN PACIFIC RAILWAY THROUGH KIPP,
CARMANGAY AND ALDERSYDE.

Note.—These descriptions are written with the assumption that the railway runs in a northwesterly direction from Kipp to Sandstone and thence northerly to Calgary.

- 83-D In south end of west face of concrete retaining wall behind east abutment of Canadian Pacific railway viaduct over Belly river at Lethbridge— $\frac{3}{4}$ mile west of station.
- 82-D In north end of east face of concrete retaining wall behind west abutment of Canadian Pacific railway viaduct over Belly river at Lethbridge— $1\frac{1}{4}$ miles west of station.
- 81-D In east end of north concrete foundation wall—10 inches below woodwork—of Canadian Pacific railway section-house, 500 feet west of Kipp station.
- 80-D In concrete bench-mark pier, 8 feet northeast of southwest line of Canadian Pacific railway right-of-way, 45 feet northwest of a farm crossing and 800 feet southeast of mile post 5 from Kipp.
- 79-D In northeast concrete foundation wall—7 inches below woodwork and 11 feet from north corner—of Canadian Pacific railway section-house, 600 feet northwest of Nobleford station.
- 78-D In concrete bench-mark pier, 7 feet northeast of southwest line of Canadian Pacific railway right-of-way, 820 feet southeast of mile post 12 from Kipp and about 1,900 feet northwest of a highway crossing.
- 77-D In west end of south concrete foundation wall—21 inches below brickwork—of westerly section of public school at Barons.
- 76-D In northeast concrete foundation wall—7 inches below woodwork and 10 feet from north corner—of Canadian Pacific railway section-house, 600 feet northwest of Barons station.
- 75-D In concrete bench-mark pier, 7 feet northeast of southwest line of Canadian Pacific railway right-of-way, 810 feet northwest of a highway crossing, $3\frac{3}{4}$ miles southeast of Carmangay and 1,025 feet southeast of mile post 24 from Kipp.
- 74-D In centre of north face of concrete parapet, on north side of stairway, at main entrance of Carmangay public school.
- 73-D In south end of rear (or east) concrete foundation wall—9 inches below woodwork—of Canadian Pacific station-house at Carmangay.

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- 72-D In concrete bench-mark pier, 6 feet northeast of southwest line of Canadian Pacific railway right-of-way, 4½ miles northwest of Carmangay and 320 feet southeast of mile post 32 from Kipp.
- 71-D In northwest concrete foundation wall—2 feet below brickwork and 5 feet 6 inches from west corner—of public school at Champion.
- 70-D In southwest concrete foundation wall—8 inches below woodwork and 11 feet from south corner—of Canadian Pacific railway section-house at Kirkcaldy.
- 69-D In southwest concrete foundation wall—9 inches below woodwork and 4 feet from west corner—of Canadian Bank of Commerce at Vulcan.
- 68-D In southeast end of rear (or southwest) concrete foundation wall—22 inches below woodwork—of Canadian Pacific station-house at Vulcan.
- 67-D In concrete bench-mark pier, 6 feet northeast of southwest line of Canadian Pacific railway right-of-way, 230 feet northwest of a trestle bridge, 255 feet southeast of mile post 54 from Kipp and 5 miles northwest of Vulcan.
- 66-D In northeast concrete foundation wall—8 inches below woodwork and 10 feet from north corner—of Canadian Pacific railway section-house, 740 feet southeast of Ensign station.
- 65-D In southeast end of rear (or southwest) concrete foundation wall—7 inches below woodwork—of Canadian Pacific station-house at Brant.
- 64-D In concrete bench-mark pier, 8 feet northeast of southwest line of Canadian Pacific railway right-of-way, 10 feet northwest of a highway crossing and 2½ miles northwest of Brant.
- 63-D In east end of north concrete foundation wall—15 inches below woodwork—of front (or east) section of public school at Blackie.
- 62-D In concrete bench-mark pier, 7 feet northeast of southwest line of Canadian Pacific railway right-of-way, 145 feet southeast of a highway crossing, 3 miles northwest of Blackie and 527 feet northwest of mile post 75 from Kipp.
- 61-D-2 In northeast concrete foundation wall—4 inches below woodwork and 30 inches from north corner—of Canadian Pacific railway section-house at Mazeppa.
- 61-D In concrete bench-mark pier, 7 feet northeast of southwest line of Canadian Pacific railway right-of-way, 187 feet southeast of southeast end of bridge over Highwood river and 1½ miles southeast of Aldersyde.
- 60-D In south face of west concrete retaining wall—32 inches above bridge-seat and directly in line with south-westerly truss—of Canadian Pacific railway bridge over Sheep creek, 1 mile southeast of Okotoks.
- 59-D In southwest end of southeast face of concrete retaining wall behind northwest abutment of plate-girder bridge on Canadian Pacific railway, 1¾ miles northwest of Okotoks.
- 58-D In north end of west face of square concrete culvert under Canadian Pacific railway, 460 feet south of Sandstone station.
- 57-D In north face of east face-wall of concrete culvert under Canadian Pacific railway, 1 mile north of De Winton.
- 56-D In north face of east face-wall of concrete culvert under Canadian Pacific railway, 2 miles north of De Winton.
- 55-D In west face of exposed rock surface, 6 feet east of east line of Canadian Pacific railway right-of-way, 600 feet south of mile post 10 and 1¼ miles south of Midnapore.

- 54-D In southeast face of northeast concrete retaining wall—2 feet above bridge-seat—of Canadian Pacific railway bridge over Fish creek, 0·6 mile north of Midnapore.
- 53-D In south face of west face-wall of concrete culvert under Canadian Pacific railway, $2\frac{3}{4}$ miles north of Midnapore.
- 52-D In west face—26 inches below top—of concrete footing of bridge by which Canadian Pacific railway (Macleod subdivision) passes under Canadian Northern railway, 2 miles southeast of Calgary station. The footing referred to is under a steel upright at south side of bridge and to the east of the Canadian Pacific railway track.
- 51-D In sixth course of stonework below water-table course, in south face of corner stone at southeast corner of Calgary city hall.
- 50-D In second course of stonework below water-table course, in west face of corner stone at northwest corner of Calgary court house.

TABLE II.

RESULTS OF PRECISE LEVELLING.

HALIFAX TO YARMOUTH, N.S.

BENCH-MARK.		Distance between successive bench-marks.	Distance from bench-mark 386-B.	DISCREPANCY.		Elev. above mean sea level.	BENCH-MARK.
From	To			Partial.	Total.		
No.	No.	Miles.	Miles.	Feet.	Feet.	Feet.	No.
386-B	386-B	1.0	1.0	- .013	- .013	12.590	†
386-B	387-B					60.743	386-B
						21.575	387-B
386-B	388-B	2.9	2.9	- .014	- .014	40.963	388-B
388-B	389-B	3.0	5.9	+ .025	+ .011	275.732	389-B
389-B	390-B	3.3	9.2	- .017	- .006	240.148	390-B
390-B	391-B	3.6	12.8	- .028	- .034	305.116	391-B
391-B	392-B	5.3	18.1	- .032	- .066	198.912	392-B
392-B	393-B	2.2	20.3	- .011	- .077	79.856	393-B
393-B	394-B	2.5	22.8	+ .002	- .075	56.192	394-B
394-B	395-B	4.5	27.3	- .035	- .110	28.259	395-B
395-B	396-B	4.6	31.9	- .015	- .125	79.564	396-B
396-B	397-B	2.3	34.2	- .017	- .142	34.887	397-B
397-B	398-B	4.6	38.8	- .029	- .171	115.522	398-B
398-B	399-B	3.7	42.5	- .024	- .195	56.172	399-B
399-B	400-B	0.6	43.1	+ .010	- .185	13.823	400-B
400-B	401-B	7.8	50.9	- .008	- .193	43.505	401-B
401-B	402-B	3.4	54.3	- .018	- .211	39.141	402-B
402-B	403-B	6.4	60.7	- .032	- .243	41.446	403-B
403-B	404-B	2.7	63.4	+ .001	- .242	32.542	404-B
404-B	405-B	3.4	66.8	+ .023	- .219	86.650	405-B
405-B	406-B	3.8	70.6	- .005	- .224	171.307	406-B
406-B	407-B	4.5	75.1	- .025	- .249	180.655	407-B
407-B	408-B	4.1	79.2	- .022	- .271	97.522	408-B
408-B	409-B	1.2	80.4	- .009	- .280	12.591	409-B
409-B	410-B	.....	80.4	.000	- .280	38.207	410-B
409-B	411-B	1.4	81.8	- .003	- .283	44.491	411-B
411-B	412-B	3.6	85.4	- .026	- .309	206.780	412-B
412-B	413-B	4.9	90.3	- .021	- .330	195.700	413-B
413-B	414-B	5.9	96.2	- .039	- .369	217.339	414-B
414-B	415-B	6.6	102.8	- .041	- .410	6.047	415-B
415-B	416-B	6.1	108.9	- .016	- .426	79.634	416-B

† Reference bench-mark, Department of the Naval Service.

RESULTS OF PRECISE LEVELLING.

HALIFAX TO YARMOUTH, N.S.—Continued.

BENCH-MARK.		Distance between successive bench-marks.	Distance from bench-mark 386-B	DISCREPANCY		Elev. above mean sea level.	BENCH-MARK.
From	To			Partial.	Total.		
No.	No.	Miles.	Miles.	Feet.	Feet.	Feet.	No.
416-B	417-B	0·6	109·5	+·011	−·415	37·351	417-B
417-B	418-B	2·4	111·9	+·002	−·413	5·868	418-B
418-B	419-B	1·1	113·0	−·013	−·426	20·064	419-B
419-B	420-B	.....	113·0	+·009	−·417	23·340	420-B
418-B	421-B	6·5	118·4	+·014	−·399	77·873	421-B
421-B	422-B	1·5	119·9	+·004	−·395	33·595	422-B
422-B	423-B	5·0	124·9	+·025	−·370	167·974	423-B
423-B	424-B	8·0	132·9	+·008	−·362	197·982	424-B
424-B	425-B	1·1	134·0	+·006	−·356	170·591	425-B
425-B	426-B	4·5	138·5	+·021	−·335	70·115	426-B
426-B	427-B	1·0	139·5	+·001	−·334	5·916	427-B
427-B	428-B	4·1	143·6	−·007	−·341	24·266	428-B
428-B	429-B	5·1	148·7	+·034	−·307	25·956	429-B
429-B	430-B	5·1	153·8	+·010	−·297	13·348	430-B
430-B	431-B	2·4	156·2	−·005	−·302	10·826	431-B
431-B	432-B	1·8	158·0	+·011	−·291	47·511	432-B
432-B	433-B	3·9	161·9	−·019	−·310	60·967	433-B
433-B	434-B	0·2	162·1	+·004	−·306	60·732	434-B
434-B	435-B	0·2	162·3	−·004	−·310	27·736	435-B
433-B	436-B	1·0	162·9	+·007	−·303	32·950	436-B
436-B	437-B	0·9	163·8	+·003	−·300	6·654	437-B
437-B	438-B	4·8	168·6	+·032	−·268	4·389	438-B
438-B	439-B	6·4	175·0	+·029	−·239	56·511	439-B
439-B	440-B	4·3	179·3	+·030	−·209	15·637	440-B
440-B	441-B	5·4	184·7	−·005	−·214	22·044	441-B
441-B	442-B	2·2	186·9	+·005	−·209	6·151	442-B
442-B	443-B	2·8	189·7	+·010	−·199	75·036	443-B
443-B	444-B	4·2	193·9	−·003	−·202	8·349	444-B
444-B	445-B	2·2	196·1	+·004	−·198	18·675	445-B
445-B	446-B	1·5	197·6	+·017	−·181	21·675	446-B
446-B	447-B	1·2	198·8	+·001	−·180	7·239	447-B
447-B	448-B	2·4	201·2	−·015	−·195	45·185	448-B
448-B	449-B	1·5	202·7	+·004	−·191	7·071	449-B
449-B	450-B	4·5	207·2	−·019	−·210	37·004	450-B
450-B	451-B	1·7	208·9	−·006	−·216	43·593	451-B
451-B	452-B	4·5	213·4	−·011	−·227	11·728	452-B
452-B	453-B	3·8	217·2	−·035	−·262	11·296	453-B

RESULTS OF PRECISE LEVELLING.

HALIFAX TO YARMOUTH, N.S.—*Continued.*

BENCH-MARK.		Distance between successive bench- marks.	Distance from bench- mark 386-B	DISCREPANCY.		Elev. above mean sea level.	BENCH- MARK.
				Partial.	Total.		
From	To						
No.	No.	Miles.	Miles.	Feet.	Feet.	Feet.	No.
453-B	454-B	2·1	219·3	+·017	—·245	9·558	454-B
454-B	455-B	4·1	223·4	—·005	—·250	50·344	455-B
455-B	456-B	3·4	226·8	+·007	—·243	31·522	456-B
456-B	457-B	2·3	229·1	—·001	—·244	8·896	457-B
457-B	458-B	2·9	232·0	—·011	—·255	39·942	458-B
458-B	459-B	2·7	234·7	+·005	—·250	14·720	459-B
459-B	460-B	2·8	237·5	—·014	—·264	11·608	460-B
460-B	461-B	1·1	238·6	+·004	—·260	22·191	461-B
461-B	462-B	3·7	242·3	—·028	—·288	20·061	462-B
462-B	463-B	5·5	247·8	—·031	—·319	48·212	463-B
463-B	464-B	0·2	248·0	+·001	—·318	61·489	464-B
464-B	465-B	0·3	248·3	—·008	—·326	67·755	465-B

Connections at Halifax with Public Works Dept's. levels:—

B.M.—MXXIV—No. 3 storehouse, Elev. 9·966

B.M.—MXXVII—Drydock pump-house, Elev. 9·933

B.M.—MXXVIII—Boulder near mile post 3, Elev. 13·294.

For connection at Yarmouth with Tidal Survey B.M., see Introduction.

RESULTS OF PRECISE LEVELLING.

DEPOT HARBOUR TO RENFREW, ONT.

BENCH-MARK.		Distance between successive bench-marks.	Distance from bench-mark 418.	DISCREPANCY.		Elev. above mean sea level.	BENCH-MARK.
From	To			Partial.	Total.		
No.	No.	Miles.	Miles.	Feet.	Feet.	Feet.	No.
418	418					674.930	418
418	564	.....		-.003	-.003	656.719	564
564	565	2.7	2.7	.000	-.003	596.598	565
565	566	2.0	4.7	-.010	-.013	603.974	566
566	567	0.9	5.6	+.002	-.011	604.136	567
418	418					674.930	418
418	564	.....		-.003	-.003	656.719	564
564	563	4.1	4.1	+.010	+.007	763.915	563
563	562	4.9	9.0	-.023	-.016	876.686	562
562	561	4.2	13.2	-.017	-.033	772.242	561
561	560	3.8	17.0	-.020	-.053	899.547	560
560	559	4.3	21.3	+.008	-.045	977.056	559
559	558	3.7	25.0	-.001	-.046	1018.716	558
558	557	4.0	29.0	-.019	-.065	1050.992	557
557	556	5.0	34.0	-.014	-.079	1082.741	556
556	555	3.2	37.2	-.001	-.080	1084.733	555
555	554	3.8	41.0	-.011	-.091	1133.032	554
554	553	4.3	45.3	+.001	-.090	1107.669	553
553	552	5.2	50.5	-.001	-.091	1115.299	552
552	551	4.5	55.0	+.010	-.081	1285.192	551
551	550	3.1	58.1	-.013	-.094	1438.433	550
550	549	4.4	62.5	-.006	-.100	1513.130	549
549	548	3.5	66.0	.000	-.100	1445.073	548
548	547	5.4	71.4	+.042	-.058	1542.919	547
547	546	3.6	75.0	+.015	-.043	1476.156	546
546	545	3.0	78.0	-.021	-.064	1433.632	545
545	544	3.4	81.4	+.034	-.030	1389.617	544
544	543	0.5	81.9	+.001	-.029	1392.434	543
543	542	5.4	87.3	+.043	+.014	1473.098	542
542	541	3.9	91.2	-.035	-.021	1378.840	541
541	540	2.4	93.6	-.017	-.038	1305.768	540
540	539	7.1	100.7	-.039	-.077	1288.014	539
539	538	2.0	102.7	-.027	-.104	1308.462	538
538	537	4.4	107.1	+.022	-.082	1287.267	537
537	536	6.1	113.2	+.033	-.049	1243.443	536
536	535-A	1.6	114.8	-.031	-.080	1264.648	535-A
535-A	535	2.1	116.9	+.024	-.056	1207.397	535
535	534	2.9	119.8	-.024	-.080	1130.619	534

RESULTS OF PRECISE LEVELLING.

DEPOT HARBOUR TO RENFREW, ONT—*Continued.*

BENCH-MARK.		Distance between successive bench- marks.	Distance from bench- mark 418.	DISCREPANCY.		Elev. above mean sea level.	BENCH- MARK.
From	To			Partial.	Total.		
No.	No.	Miles.	Miles.	Feet.	Feet	Feet.	No.
534	533	4.2	124.0	- .013	- .093	1084.772	533
533	532	2.1	126.1	- .001	- .094	1072.195	532
532	531	1.7	127.8	+ .005	- .089	1036.312	531
531	530	0.2	128.0	+ .005	- .084	1025.970	530
530	529	2.9	130.9	- .004	- .088	1065.976	529
529	528	3.2	134.1	- .019	- .107	1074.151	528
528	527	3.5	137.6	- .002	- .109	1181.215	527
527	526	2.8	140.4	- .031	- .140	1179.797	526
526	525	2.8	143.2	+ .010	- .130	1010.907	525
525	524	1.6	144.8	- .007	- .137	1021.980	524
524	523	4.1	148.9	- .031	- .168	952.841	523
523	522	6.1	155.0	+ .032	- .136	951.348	522
522	521	1.8	156.8	+ .016	- .120	881.362	521
521	520	4.3	161.1	+ .026	- .094	664.407	520
520	519	2.3	163.4	+ .012	- .082	594.072	519
519	518	0.5	163.9	- .002	- .084	567.497	518
518	517	3.2	167.1	- .014	- .098	576.581	517
517	516	3.7	170.8	+ .025	- .073	565.927	516
516	515	2.3	173.1	+ .015	- .058	582.652	515
515	514	6.5	179.6	- .007	- .065	574.743	514
514	513	2.8	182.4	- .013	- .078	531.263	513
513	512	5.0	187.4	- .021	- .099	496.990	512
512	511	0.9	188.3	+ .013	- .086	460.280	511
511	510	3.9	192.2	- .020	- .106	439.415	510
510	509	4.0	196.2	- .006	- .112	390.979	509
509	508	3.2	199.4	- .008	- .120	388.475	508
508	507	3.0	202.4	- .008	- .128	417.090	507
507	505	0.3	202.7	- .005	- .133	425.628	505
505	506	0.1	202.8	+ .003	- .130	449.162	506

Connections with Public Works Dept's levels:—

B.M.—DCCLXXI—Boulder at Scotia Jct., Elev. 1082.027

B.M.—CCCCLXXXIV—C.P.R. station, Renfrew, Elev. 417.090

B.M.—CCCCLXXXV—C.P.R. water-tank, Renfrew, Elev. 417.869.

RESULTS OF PRECISE LEVELLING.

WINNIPEG MAN., TO KENORA, ONT.

BENCH-MARK.		Distance between successive bench- marks.	Distance from bench- mark 1-F.	DISCREPANCY.		Elev. above mean sea level.	BENCH- MARK.
				Partial.	Total.		
From	To						
No.	No.	Miles.	Miles.	Feet.	Feet.	Feet.	No.
	1-F					764.684	1-F
1-F	2-F	0.5	0.5	+ .005	+ .005	763.856	2-F
2-F	3-F	1.3	1.8	- .022	- .017	765.484	3-F
3-F	4-F	3.5	5.3	+ .007	- .010	761.361	4-F
4-F	5-F	5.8	11.1	+ .016	+ .006	780.771	5-F
5-F	6-F	7.8	18.9	+ .044	+ .050	792.394	6-F
6-F	7-F	6.8	25.7	+ .018	+ .068	814.270	7-F
7-F	8-F	7.9	33.6	- .035	+ .033	813.454	8-F
8-F	9-F	0.8	34.4	- .008	+ .025	811.646	9-F
9-F	10-F	5.6	40.0	- .002	+ .023	878.794	10-F
10-F	11-F	3.8	43.8	+ .031	+ .054	915.601	11-F
11-F	12-F	5.3	49.1	- .010	+ .044	925.869	12-F
12-F	13-F	4.3	53.4	- .013	+ .031	903.605	13-F
13-F	14-F	3.0	56.4	+ .002	+ .033	898.019	14-F
14-F	15-F	4.3	60.7	+ .027	+ .060	932.099	15-F
15-F	16-F	3.0	63.7	- .001	+ .059	964.865	16-F
16-F	17-F	3.9	67.6	- .019	+ .040	995.920	17-F
17-F	18-F	2.9	70.5	+ .015	+ .055	1011.064	18-F
18-F	19-F	2.6	73.1	- .008	+ .047	1035.274	19-F
19-F	20-F	3.0	76.1	+ .004	+ .051	1051.124	20-F
20-F	21-F	2.1	78.2	+ .021	+ .072	1080.068	21-F
21-F	22-F	3.8	82.0	+ .019	+ .091	1113.841	22-F
22-F	23-F	4.0	86.0	+ .008	+ .099	1064.634	23-F
23-F	24-F	3.4	89.4	- .005	+ .094	1047.103	24-F
24-F	25-F	3.3	92.7	+ .013	+ .107	1125.015	25-F
25-F	26-F	3.2	95.9	+ .012	+ .119	1188.615	26-F
26-F	27-F	3.0	98.9	+ .030	+ .149	1223.854	27-F
27-F	28-F	3.1	102.0	+ .021	+ .170	1250.009	28-F
28-F	29-F	4.9	106.9	+ .025	+ .195	1226.108	29-F
29-F	30-F	3.4	110.3	- .005	+ .190	1182.367	30-F
30-F	31-F	3.5	113.8	- .021	+ .169	1183.081	31-F
31-F	32-F	3.0	116.8	+ .014	+ .183	1137.755	32-F
32-F	33-F	2.4	119.2	+ .003	+ .186	1118.948	33-F
33-F	34-F	5.4	124.6	+ .010	+ .196	1083.387	34-F
34-F	35-F	2.0	126.6	+ .001	+ .197	1084.013	35-F
35-F	36-F	1.2	127.8	- .022	+ .175	1093.051	36-F
36-F	37-F	0.2	128.0	- .002	+ .173	1090.832	37-F
37-F	38-F	0.3	128.3	+ .001	+ .174	1082.500	38-F

RESULTS OF PRECISE LEVELLING.

SASKATOON, SASK., TO WAINWRIGHT, ALTA.

BENCH-MARK.		Distance between successive bench- marks.	Distance from bench- mark 28-D.	DISCREPANCY.		Elev. above mean sea level.	BENCH- MARK.
				Partial.	Total.		
From	To						
No.	No.	Miles.	Miles.	Feet.	Feet.	Feet.	No.
	28-D					1651.349	28-D
28-D	1-H	1.7	1.7	- .008	- .008	1620.857	1-H
1-H	2-H	2.7	4.4	+ .024	+ .016	1653.142	2-H
2-H	3-H	10.8	15.2	- .048	- .032	1660.554	3-H
3-H	4-H	5.9	21.1	- .025	- .057	1642.618	4-H
4-H	5-H	3.2	24.3	- .015	- .072	1712.641	5-H
5-H	6-H	5.5	29.8	+ .015	- .057	1789.459	6-H
6-H	7-H	2.4	32.2	- .017	- .074	1751.705	7-H
7-H	8-H	8.0	40.2	+ .047	- .027	1813.974	8-H
8-H	9-H	5.3	45.5	- .017	- .044	1922.795	9-H
9-H	10-H	6.8	52.3	+ .004	- .040	2046.107	10-H
10-H	11-H	4.0	56.3	- .036	- .076	2096.242	11-H
11-H	12-H	3.3	59.6	+ .024	- .052	2193.804	12-H
12-H	13-H	4.4	64.0	- .007	- .059	2091.392	13-H
13-H	14-H	4.3	68.3	+ .026	- .033	2121.095	14-H
14-H	15-H	7.7	76.0	+ .052	+ .019	2110.567	15-H
15-H	16-H	6.3	82.3	- .003	+ .016	2134.549	16-H
16-H	17-H	7.3	89.6	+ .001	+ .017	2225.103	17-H
17-H	18-H	7.6	97.2	- .021	- .004	2142.559	18-H
18-H	19-H	5.0	102.2	- .012	- .016	2163.439	19-H
19-H	20-H	8.5	110.7	- .017	- .033	2106.474	20-H
20-H	21-H	3.2	113.9	- .012	- .045	2076.892	21-H
21-H	22-H	3.5	117.4	+ .029	- .016	2092.363	22-H
22-H	23-H	10.3	127.7	- .013	- .029	1922.229	23-H
23-H	24-H	5.8	133.5	+ .015	- .014	1958.406	24-H
24-H	25-H	3.3	136.8	- .003	- .017	1985.192	25-H
25-H	26-H	8.4	145.2	- .008	- .025	1993.118	26-H
26-H	27-H	5.0	150.2	- .006	- .031	2067.470	27-H
27-H	28-H	5.6	155.8	+ .017	- .014	2009.657	28-H
28-H	29-H	7.3	163.1	- .011	- .025	2013.876	29-H
29-H	30-H	3.3	166.4	- .005	- .030	2059.784	30-H
30-H	31-H	6.4	172.8	- .001	- .031	2041.998	31-H
31-H	32-H	3.0	175.8	- .003	- .034	2108.791	32-H
32-H	33-H	4.6	180.4	- .005	- .039	2108.818	33-H
33-H	34-H	6.6	187.0	+ .012	- .027	2185.465	34-H
34-H	35-H	6.8	193.8	+ .037	+ .010	2232.469	35-H
35-H	36-H	6.5	200.3	+ .021	+ .031	2236.888	36-H

RESULTS OF PRECISE LEVELLING.

MAPLE CREEK, SASK., TO COUTTS, ALTA.

BENCH-MARK.		Distance between successive bench- marks.	Distance from bench- mark 94-C.	DISCREPANCY.		Elev. above mean sea level.	BENCH- MARK.
From	To			Partial.	Total.		
No.	No.	Miles.	Miles.	Feet.	Feet.	Feet.	No.
146-C	146-C		198.8		+.070	2505.817	146-C
146-C	147-C	3.2	202.0	-.001	+.069	2506.670	147-C
147-C	148-C	1.9	203.9	-.007	+.062	2531.642	148-C
148-C	149-C	5.9	209.8	+.019	+.081	2533.311	149-C
149-C	150-C	5.6	215.4	-.004	+.077	2478.303	150-C
150-C	151-C	1.7	217.1	+.001	+.078	2469.640	151-C
151-C	152-C	5.0	222.1	+.029	+.107	2392.100	152-C
152-C	153-C	3.6	225.7	+.017	+.124	2420.192	153-C
153-C	154-C	0.9	226.6	+.002	+.126	2421.246	154-C
154-C	155-C	3.0	229.6	-.008	+.118	2441.800	155-C
155-C	156-C	2.0	231.6	+.004	+.122	2432.266	156-C
156-C	157-C	2.5	234.1	-.005	+.117	2461.658	157-C
157-C	158-C	1.8	235.9	+.010	+.127	2500.119	158-C
158-C	159-C	3.5	239.4	+.023	+.150	2503.461	159-C
159-C	160-C	0.2	239.6	+.003	+.153	2500.827	160-C
160-C	161-C	2.0	241.4	-.019	+.131	2480.328	161-C
161-C	162-C	0.9	242.3	+.004	+.135	2466.074	162-C
162-C	163-C	3.0	245.3	+.009	+.144	2426.056	163-C
163-C	164-C	3.2	248.5	+.014	+.158	2419.033	164-C
164-C	165-C	5.4	253.9	-.003	+.155	2413.604	165-C
165-C	166-C	2.3	256.2	-.009	+.146	2317.593	166-C
166-C	169-C	5.0	261.2	+.026	+.172	2183.274	169-C
169-C	168-C	0.2	261.4	-.004	+.168	2184.522	168-C
168-C	167-C	0.2	261.6	-.010	+.158	2186.099	167-C
165-C	170-C	6.0	259.9	-.033	+.122	2363.451	170-C
170-C	171-C	1.0	260.9	-.013	+.109	2388.988	171-C
171-C	172-C	6.9	267.8	-.001	+.108	2450.271	172-C
172-C	173-C	1.6	269.4	+.004	+.112	2460.625	173-C
173-C	174-C	4.2	273.6	+.014	+.126	2518.505	174-C
174-C	175-C	7.1	280.7	+.003	+.129	2763.200	175-C
175-C	176-C	5.8	286.5	-.010	+.119	2724.517	176-C
176-C	177-C	1.4	287.9	+.004	+.123	2688.157	177-C
177-C	178-C	6.3	294.2	+.019	+.142	2597.864	178-C
178-C	179-C	0.5	294.7	-.000	+.142	2621.734	179-C
179-C	180-C	7.3	302.0	+.019	+.161	2574.426	180-C

RESULTS OF PRECISE LEVELLING.

MAPLE CREEK, SASK., TO COUTTS, ALTA—*Continued.*

BENCH-MARK.		Distance between successive bench-marks.	Distance from bench-mark 94-C.	DISCREPANCY.		Elev. above mean sea level.	BENCH-MARK.
From	To			Partial.	Total.		
No.	No.	Miles.	Miles.	Feet.	Feet.	Feet.	No.
180-C	181-C	.....	302.0	+ .004	+ 165	2576.419	181-C
180-C	182-C	7.9	309.9	+ .041	+ 202	2649.851	182-C
182-C	183-C	.....	309.9	- .005	+ 197	2658.048	183-C
182-C	184-C	8.0	317.9	+ .008	+ 210	2619.290	184-C
184-C	185-C	8.1	326.0	+ .048	+ 258	2641.552	185-C
185-C	186-C	4.6	330.6	- .011	+ 247	2668.310	186-C
186-C	187-C	0.5	331.1	·000	+ 247	2658.769	187-C
186-C	188-C	1.9	332.5	·000	+ 247	2677.669	188-C
188-C	189-C	7.1	339.6	+ .035	+ 282	2730.286	189-C
189-C	190-C	1.0	340.6	- .002	+ 280	2739.649	190-C
190-C	191-C	3.6	344.2	+ .023	+ 303	2780.475	191-C
191-C	192-C	0.8	345.0	- .003	+ 300	2773.720	192-C
192-C	193-C	3.0	348.0	+ .013	+ 313	2812.108	193-C
193-C	194-C	3.8	351.8	+ .004	+ 317	2825.793	194-C
194-C	195-C	7.1	358.9	- .009	+ 308	2991.190	195-C
195-C	196-C	3.3	362.2	- .028	+ 280	2984.862	196-C
196-C	197-C	0.3	362.5	- .010	+ 270	2976.338	197-C
197-C	198-C	.....	362.5	+ .001	+ 271	2978.588	198-C
198-C	199-C	0.3	362.8	- .009	+ 262	2994.353	199-C
196-C	200-C	2.6	364.8	+ .014	+ 294	2992.352	200-C
200-C	201-C	8.1	372.9	+ .053	+ 347	3046.760	201-C
201-C	202-C	3.4	376.3	+ .003	+ 350	3072.232	202-C
202-C	203-C	5.1	381.4	- .013	+ 337	3040.674	203-C
203-C	204-C	0.3	381.7	- .008	+ 329	3041.123	204-C
203-C	205-C	7.3	388.7	+ .015	+ 352	3187.573	205-C
205-C	206-C	2.1	390.8	+ .021	+ 373	3196.207	206-C
206-C	207-C	.....	390.8	- .005	+ 368	3210.503	207-C
206-C	208-C	8.1	398.9	- .016	+ 357	3205.644	208-C
208-C	209-C	5.7	404.6	+ .017	+ 374	3319.603	209-C

RESULTS OF PRECISE LEVELLING.

MAPLE CREEK, SASK., TO COUTTS, ALTA.—*Continued.*

BENCH-MARK.		Distance between successive bench-marks.	Distance from bench-mark 94-C.	DISCREPANCY.		Elev. above mean sea level.	BENCH-MARK.
From	To			Partial.	Total.		
No.	No.	Miles.	Miles.	Feet.	Feet.	Feet.	No.
209-C	210-C	0.3	404.9	- .008	+ .366	3328.061	210-C
209-C	211-C	2.2	406.8	- .028	+ .346	3359.243	211-C
211-C	212-C	8.3	415.1	+ .015	+ .361	3467.163	212-C
212-C	213-C	1.0	416.1	+ .014	+ .375	3437.846	213-C
213-C	214-C	0.3	416.4	+ .002	+ .377	3409.719	214-C
214-C	215-C	5.8	422.2	- .006	+ .371	3425.941	215-C
215-C	216-C	6.6	428.8	+ .017	+ .388	3491.042	216-C
216-C	†	.....	428.8	- .006	+ .382	3466.647	†

†B.M. H-12 of the U.S. Coast and Geodetic Survey, in international boundary monument No. 354-B, at Coutts.

Connections with bench-marks of Irrigation Surveys Branch, Dept. of the Interior:—

At N.W. corner of Dixon Bro's. store, town of Maple Creek (bench-mark No. 118), Elev. 2507.344

At N.E. corner, tp. 11, rge. 1, W. 4th mer. (iron post), Elev. 2444.800

On N.W. $\frac{1}{4}$ sec. 26, tp. 11, rge. 1, W. 4th mer. (iron post), Elev. 2443.733

On N.W. $\frac{1}{4}$ sec. 31, tp. 11, rge. 2, W. 4th mer. (iron post), Elev. 2500.427

On S.E. $\frac{1}{4}$ sec. 16, tp. 12, rge. 5, W. 4th mer. (iron post), Elev. 2305.530

At N.E. corner of old court house, Lethbridge, Elev. 2993.430

On N.E. $\frac{1}{4}$ sec. 21, tp. 2, rge. 16, W. 4th mer. (iron post on north bank of Milk river), Elev. 3412.420

RESULTS OF PRECISE LEVELLING.

LETHBRIDGE TO CALGARY, ALTA.

BENCH-MARK.		Distance between successive bench- marks.	Distance from bench- mark 196-C.	DISCREPANCY.		Elev. above mean sea level	BENCH- MARK.
From	To			Partial.	Total.		
No.	No.	Miles.	Miles.	Feet.	Feet.	Feet.	No.
196-C	196-C					2984.862	196-C
196-C	83-D	0.8	0.8	+ .011	+ .011	2980.806	83-D
83-D	82-D	1.0	1.8	+ .014	+ .025	3001.708	82-D
82-D	81-D	6.3	8.1	+ .013	+ .038	3058.150	81-D
81-D	80-D	5.3	13.4	- .037	+ .001	3108.756	80-D
80-D	79-D	5.1	18.5	+ .016	+ .017	3221.527	79-D
79-D	78-D	1.8	20.3	+ .002	+ .019	3203.418	78-D
78-D	76-D	6.4	26.7	- .018	+ .001	3152.806	76-D
76-D	77-D	.....	26.7	- .004	- .003	3157.521	77-D
76-D	75-D	5.7	32.4	- .012	- .011	3115.784	75-D
75-D	73-D	3.6	36.0	- .022	- .033	3081.951	73-D
73-D	74-D	.....	36.0	- .005	- .038	3081.244	74-D
73-D	72-D	4.4	40.4	+ .013	- .020	3161.474	72-D
72-D	71-D	4.3	44.7	+ .019	- .001	3148.759	71-D
71-D	70-D	8.3	53.0	- .017	- .018	3322.059	70-D
70-D	68-D	5.0	58.0	+ .004	- .014	3440.767	68-D
68-D	69-D	.....	58.0	+ .003	- .011	3452.532	69-D
68-D	67-D	5.1	63.1	- .010	- .024	3346.238	67-D
67-D	66-D	4.5	67.6	- .004	- .028	3266.004	66-D
66-D	65-D	4.5	72.1	- .019	- .047	3268.847	65-D
65-D	64-D	2.3	74.4	- .005	- .052	3301.664	64-D
64-D	63-D	6.7	81.1	- .025	- .077	3355.118	63-D
63-D	62-D	3.0	84.1	+ .005	- .072	3350.073	62-D
62-D	61-D-2	3.0	87.1	- .015	- .087	3361.071	61-D-2
61-D-2	61-D	5.5	92.6	+ .016	- .071	3391.775	61-D
61-D	60-D	6.2	98.8	- .015	- .086	3429.972	60-D
60-D	59-D	2.8	101.6	- .018	- .104	3487.295	59-D
59-D	58-D	2.3	103.9	+ .012	- .092	3522.166	58-D
58-D	57-D	6.1	110.0	+ .025	- .067	3601.013	57-D
57-D	56-D	1.1	111.1	+ .006	- .061	3540.931	56-D

RESULTS OF PRECISE LEVELLING.

LETHBRIDGE TO CALGARY, ALTA.—Continued.

BENCH-MARK.		Distance between successive bench- marks.	Distance from bench- mark 196-C.	DISCREPANCY.		Elev. above mean sea level	BENCH- MARK.
From	To			Partial.	Total.		
No.	No.	Miles.	Miles.	Feet.	Feet.	Feet.	No.
56-D	55-D	5.0	116.1	+ .039	— .022	3429.961	55-D
55-D	54-D	1.9	118.0	+ .003	— .019	3413.626	54-D
54-D	53-D	2.1	120.1	+ .001	— .018	3435.760	53-D
53-D	52-D	5.4	125.5	+ .002	— .016	3419.459	52-D
52-D	51-D	2.0	127.5	— .020	— .036	3428.199	51-D
51-D	50-D	1.1	128.6	— .003	— .039	3443.837	50-D

Connections at Calgary:—

Irrigation Surveys Branch, Dept. of the Interior—Bench-mark (iron post) on left bank of Elbow river, 870 feet up-stream from Twelfth Avenue bridge, Elev. 3423.851

Topographical Surveys Branch, Dept. of the Interior, B.M. H-3, N.E. corner of city hall, Elev. 3430.649.

TABLE III.

RAIL ELEVATIONS, HALIFAX TO YARMOUTH, N.S.

(Elevations taken in 1913).

	FEET
Intercolonial Railway—Halifax.....	59·9
" Richmond.....	20·0
" Southwestern Junction.....	28·0
Halifax & Southwestern Ry.—Beechville.....	282·9
" Ninemile river; water, July 30, 1913, 211·7; rail.....	227·7
" Bowser.....	244·1
" Stream, mileage 14·1 from Halifax; water, July 30, 1913, 244·7; rail.....	252·4
" Stream, mileage 14·3 from Halifax; water, July 30, 1913, 242·7; rail.....	249·9
" Hubley.....	287·4
" Stream, mileage 18·2 from Halifax; water, Aug. 5, 1913, 196·3; rail.....	204·5
" French Village.....	79·1
" Northeast river; water, Aug. 5, 1913, 70·4; rail.....	84·7
" Indian river; rail.....	95·4
" St. Margaret.....	57·2
" Boutilier.....	30·8
" Ingram river; water, Aug. 7, 1913, 21·4; rail.....	34·4
" Ingramport.....	33·6
" Hubbards river; water, Aug. 12, 1913, 21·3; rail.....	40·8
" Hubbards.....	68·3
" East River (station).....	56·1
" East river; water, Aug. 16, 1913, 34·9; rail.....	44·1
" East Chester.....	91·3
" Chester.....	46·1
" Stream, mileage 54·1 from Halifax; water, Aug. 19, 1913, 36·8; rail.....	63·8
" Middle river; water, Aug. 19, 1913, 24·0; rail.....	43·4
" Chester Basin.....	75·8
" Western Shore.....	54·2
" Martin River.....	56·5
" Mahone Junction.....	84·9
" Blockhouse.....	181·6
" Maitland.....	206·7
" Bridgewater.....	10·9
" Conquerall.....	206·0
" Italy Cross.....	201·3
" County Line.....	120·0
" Port Medway river, rail.....	19·3
" Medway.....	24·6
" Brooklyn.....	30·4
" Liverpool (station).....	10·4
" Hunt Point.....	73·0
" Port Mouton.....	59·9
" Mitchell brook; water, Oct. 2, 1913, 226·3; rail.....	236·6
" Wilkins.....	215·3
" Tom Tigney brook, mileage 137·1 from Halifax; water, Oct. 3, 1913, 94·9; rail.....	105·4
" Tom Tigney brook, mileage 139·5 from Halifax; water, Oct. 3, 1913, 62·8; rail.....	74·3
" Sable River (station).....	15·3
" Lockeport.....	19·6
" Stream, mileage 149·6 from Halifax; water, Oct. 7, 1913, 17·8; rail.....	30·3

RAIL ELEVATIONS, HALIFAX TO YARMOUTH, N.S.—*Continued.*

(Elevations taken in 1913).

	FEET
Halifax & Southwestern Ry.—East Jordan.....	15.3
" Jordan Falls.....	16.0
" Stream, mileage 158.4 from Halifax; water, Oct. 11, 1913, 44.1; rail.....	55.1
" Shelburne.....	71.4
" Birchtown.....	11.3
" Gunning Cove.....	10.6
" Roseway.....	37.4
" Round Bay brook; water, Oct. 21, 1913, 11.4; rail.....	22.2
" Greenwood.....	25.2
" Port Saxon.....	25.9
" Port Clyde.....	21.7
" Barrington.....	10.9
" Barrington Passage.....	10.3
" Atwoods Brook.....	21.1
" Shag Harbour.....	57.8
" Woods Harbour.....	38.0

(Elevations taken in 1914).

	FEET
" Upper Woods Harbour.....	14.0
" Lower East Pubnico.....	14.5
" D'Entremont.....	20.7
" East Pubnico.....	15.9
" Pubnico.....	12.2
" Lower Argyle.....	69.7
" Central Argyle.....	42.4
" Argyle.....	12.2
" Belleville.....	54.9
" Tusket.....	34.9
" Pleasant Lake.....	15.1
" Arcadia.....	27.6
" Yarmouth.....	19.7

RAIL ELEVATIONS, DEPOT HARBOUR TO RENFREW, ONTARIO.

(Elevations taken in 1914).

	FEET
Lake Huron; water, Aug. 25, 1914.....	579.4
Grand Trunk Railway—Rose Point.....	600.2
" Boyne river, 1.4 miles east of Rose Point; water, Aug. 22, 1914, 617.3; rail.....	630.5
" Boyne river, 1.6 miles east of Rose Point; water, Aug. 22, 1914, 625.8; rail.....	634.5
" Boyne river, 2.5 miles east of Rose Point; water, Aug. 22, 1914, 628.8; rail.....	652.4
" James Bay Junction.....	686.3
" Otter Lake (station).....	736.9
" Beatty.....	901.2
" Maple Lake (station).....	797.0
" Edgington.....	891.3
" Seguin river, 0.5 mile west of Seguin Falls; water, Aug. 7, 1914, 936.2; rail.....	979.7
" Seguin Falls.....	962.8
" Seguin river, 1.8 miles east of Seguin Falls; water, Aug. 7, 1914, 969.5; rail.....	978.3
" Seguin river, 2 miles east of Seguin Falls; water, Aug. 7, 1914, 969.5; rail.....	980.6
" Bear Lake (station).....	1038.3
" Whitehall.....	1097.7
" Sprucedale.....	1074.5
" Scotia Junction (diamond crossing).....	1081.3

RAIL ELEVATIONS, DEPOT HARBOUR TO RENFREW, ONTARIO—*Continued.*

(Elevations taken in 1914).

	FEET
Grand Trunk Railway—Kearney	1109·8
" Tonawanda creek; water, July 10, 1914, 1261·4; rail	1292·9
" Ravensworth	1411·7
" Rainy Lake (station)	1452·2
" Stream, 3·5 miles west of Brûlé Lake; water, July 2, 1914, 1517·3; rail	1546·6
" Summit, 2 miles west of Brûlé Lake	1605·0
" Brûlé Lake (station)	1470·7
" Canoe Lake (station)	1392·1
" Joe Lake (station)	1395·6
" Joe lake; water, June 25, 1914	1381·4
" Madawaska river, 2 miles west of Algonquin Park; water, June 24, 1914, 1461·4; rail	1476·7
" Algonquin Park	1418·9
" Madawaska river, 1 mile east of Algonquin Park; water, June 23, 1914, 1406·1; rail	1416·8
" Madawaska river, 1·7 miles east of Algonquin Park; water, June 23, 1914, 1334·8; rail	1386·0
" Madawaska river, 4·2 miles east of Algonquin Park; water, June 23, 1914, 1293·9; rail	1309·5
" Rock Lake (station)	1292·1
" Whitney	1268·7
" Egan Estate	1093·6
" Madawaska	1035·0
" Opeongo Forks	1125·9
" Aylen Lake (station)	1157·2

(Elevations taken in 1913).

" Barrys Bay	983·4
" Wilno	955·2
" Brennan brook, immediately west of Killaloe; water, Sept. 16, 1913, 585·6; rail	596·1
" Killaloe	593·8
" Golden lake; water, Sept. 19, 1913	553·0
" Golden Lake (station)	589·3
" Hurd brook, 0·5 mile west of Eganville; water, Sept. 2, 1913, 549·7; rail	579·5
" Eganville	569·6
" Caldwell	494·7
" Douglas	436·7
" Admaston	412·2
" Canadian Pacific railway, Kingston-Renfrew line, (diamond crossing)	402·6
" Renfrew	420·9
Canadian Pacific Railway—Renfrew	416·0

RAIL ELEVATIONS, WINNIPEG, MANITOBA, TO KENORA, ONTARIO.

(Elevations taken in 1913).

	FEET
Canadian Pacific Railway—Winnipeg	766·5
" North Transcona	769·1
" Canadian Northern railway (diamond crossing)	772·7
" Oakbank	811·7
" Cook creek, 2·3 miles west of Hazelridge; water, June 12, 1913, 787·3; rail	795·3

RAIL ELEVATIONS, WINNIPEG, MANITOBA, TO KENORA, ONTARIO—*Continue*

(Elevations taken in 1913).

	FEET
Canadian Pacific Railway—Cook creek, 1·6 miles west of Hazelridge; water, June 12, 1913, 782·2; rail..	793·2
“ Hazelridge.....	796·0
“ Cloverleaf.....	837·0
“ Lydiatt.....	825·0
“ Molson.....	883·4
“ Julius.....	932·1
“ Shelley.....	929·6
“ Whitemouth.....	911·2
“ Whitemouth river; water, June 20, 1913, 879·6; rail.....	904·9
“ Darwin.....	959·7
“ Grand Trunk Pacific railway (overhead crossing) rail 1062·7; C.P.R. rail.....	1035·5
“ Rennie.....	1058·2
“ Telford.....	1112·6
“ Interprovincial boundary, Manitoba-Ontario.....	1164·3
“ Ingolf.....	1190·8
“ Lowther.....	1219·5
“ Busteed.....	1187·0
“ Lake of the Woods; water, July 16, 1913.....	1060·8
“ Keewatin.....	1085·7
“ Winnipeg river, 1·2 miles west of Kenora; water, July 16, 1913, 1060·1; rail..	1088·2
“ Winnipeg river, 0·7 mile west of Kenora; water, July 16, 1913, 1060·8; rail..	1089·4
Kenora.....	1091·0

RAIL ELEVATIONS, SASKATOON, SASKATCHEWAN, TO WAINWRIGHT, ALBERTA.

(Elevations taken in 1914).

	FEET
Grand Trunk Pacific Ry.—Canadian Northern railway, Regina-Prince Albert line (diamond crossing).....	1652·9
“ South Saskatchewan river; water, May 14, 1914, 1553; rail.....	1624·7
“ Canadian Northern railway, Saskatoon-Calgary line (diamond crossing).....	1654·4
“ Farley.....	1658·4
“ Grandora.....	1660·3
“ Hawoods.....	1645·1
“ Asquith.....	1710·8
“ Juniata.....	1791·1
“ Eaglehill creek; water, May 27, 1914, 1734·9; rail.....	1758·3
“ Kinley.....	1754·9
“ Leney.....	1823·4
“ Mead.....	1986·6
“ Neola.....	2044·3
“ Biggar.....	2154·0
“ Oban.....	2125·0
“ Palo.....	2107·4
“ Landis.....	2133·5
“ Coblenz.....	2225·1
“ Reford.....	2144·3
“ Canadian Pacific railway (diamond crossing).....	2143·2
“ Scott.....	2163·6
“ Tako.....	2106·0
“ Unity.....	2092·9
Canadian Pacific railway (overhead crossing) rail 2075·1; G. T. P. Ry. rail....	2046·4

**RAIL ELEVATIONS, SASKATOON, SASKATCHEWAN, TO WAINWRIGHT,
ALBERTA.—Continued.**

(Elevations taken in 1914).

	FEET
Grand Trunk Pacific Ry.—Vera.....	1930.2
" Yonker.....	1981.9
" Zumbro.....	2055.7
" Artland.....	2008.0
" Interprovincial boundary, Saskatchewan-Alberta.....	1997.0
" Butze.....	2017.8
" Chauvin.....	2059.8
" Ribstone.....	2032.5
" Ribstone creek; water, July 30, 1914, 2006.6; rail.....	2028.6
" Dunn.....	2107.2
" Edgerton.....	2119.1
" Heath.....	2172.5
" Greenshields.....	2255.3
" Wainwright.....	2222.1

RAIL ELEVATIONS, MAPLE CREEK, SASKATCHEWAN, TO MEDICINE HAT, ALBERTA.

(Elevations taken in 1914).

	FEET
Canadian Pacific Railway—Maple Creek.....	2507.0
" Kinorth.....	2550.1
" Hatton.....	2477.3
" Cummings.....	2400.2
" Walsh.....	2443.5
" Mackay creek; water, May 7, 1914, 2428.8; rail.....	2442.6
" Irvine.....	2504.7
" Ross creek; water, May 14, 1914, 2450.0; rail.....	2467.2
" Pashley.....	2415.8
" Dunmore.....	2411.0
" Bullshead creek; water, May 21, 1914, 2285.0; rail.....	2319.6
" Medicine Hat.....	2181.2

RAIL ELEVATIONS, DUNMORE TO COUTTS, ALBERTA.

(Elevations taken in 1914).

	FEET
Canadian Pacific Railway—Dunmore.....	2411.0
" Dauntless.....	2397.5
" Bulls Head.....	2411.8
" Sevenpersons river; water, June 3, 1914, 2437.5; rail.....	2462.2
" Sevenpersons.....	2480.0
" Stormham.....	2591.4
" Whitla.....	2747.8
" Winnifred.....	2725.7
" Bow Island.....	2621.4
" Burdett.....	2576.9
" Grassy Lake.....	2652.9
" Purple Springs.....	2626.4

RAIL ELEVATIONS, DUNMORE TO COUTTS, ALBERTA.—*Continued.*

(Elevations taken in 1914).

	FEET
Canadian Pacific Railway—Taber.....	2671·0
" Barnwell.....	2734·2
" Chin.....	2784·9
" Coaldale.....	2828·1
" Montana Junction.....	3013·5
" Lethbridge.....	2983·3
" Wilson.....	3045·1
" Stirling.....	3041·6
" Wells.....	3126·4
" New Dayton.....	3184·7
" Warner.....	3313·2
" Milk River.....	3424·2
" Milk river; water, Aug. 27, 1914.....	3404·5
" Coutts.....	3468·1

RAIL ELEVATIONS, LETHBRIDGE TO CALGARY, ALBERTA.

(Elevations taken in 1914).

	FEET
Canadian Pacific Railway—Lethbridge.....	2983·3
" Lenzie.....	3056·9
" Kipp.....	3059·5
" Nobleford.....	3225·7
" Barons.....	3152·8
" Carmangay.....	3082·2
" Little Bow river; water, July 22, 1914, 2932·0; rail.....	3071·1
" Champion.....	3152·0
" Kirkcaldy.....	3324·5
" Vulcan.....	3442·0
" Ensign.....	3261·6
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" Blackie.....	3360·8
" Mazepa.....	3360·3
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" Sandstone.....	3530·1
" De Winton.....	3631·6
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" Fish creek; water, May 26, 1914, 3395·1; rail.....	3418·3
" Turner.....	3443·7
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" Elbow river; water, May 22, 1914, 3406·2; rail.....	3425·0
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Note.—Under "Year of Publication,"

1910 refers to Appendix No. 5 to the Chief Astronomer's Report for 1910.

1913* refers to Vol. I, No. 2, on Precise Levelling.

1913 refers to Vol. I, No. 3, on Precise Levelling.

1914 refers to Vol. I, No. 8, on Precise Levelling.

1915 refers to the present publication.

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†Also B. M. in International Boundary Monument.

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Milk River, Alta.....	213-C, 214-C	1915	25	37
Minto, Y.T.....	106	1913*	30	30
Molson, Man.....	10-F	1915	17	33
Monckland, Ont.....	102	1910	457	466
Moncton, N.B.....	132-B, 133-B, 134-B	1913	45	73
" "	373-B, 374-B	1914	217	233
Montague, Y.T.....	69	1913*	28	28
Mooretown, Ont.....	362	1914	221	236
Moosejaw, Sask.....	94-C, 95-C, 96-C	1913	71	89
" "	103-C	1914	229	241
Morden, Man.....	7-C, 8-C	1913	66	87
Morse, Sask.....	116-C, 117-C	1914	229	241
Mortlach, Sask.....	110-C	1914	229	241
Mountain, Ont.....	111	1910	457	466
Mulgrave, N.S.....	185-B	1913	48	75
Muniac, N.B.....	37-B	1910	448	461
Musquash, N.B.....	91-B, 92-B	1910	451	462
Mystic, Qué.....	65	1910	453	464

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Nauwigewauk, N.B.	107-B	1913	44	73
Newbury, Ont.	242	1913	56	81
Newcastle, Ont.	176	1913	53	79
New Dayton, Alta.	206-C, 207-C	1915	24	36
New Glasgow, N.S.	160-B	1913	47	74
Ninga, Man.	29-C	1913	67	87
Nobleford, Alta.	79-D	1915	25	38
Nordenskiöld, Y. T.	47	1913*	27	27
Northfield, Ont.	494	1914	219	235
North Portal, Sask.	†	1913	88	88
Northwood, Ont.	245	1913	57	81
Norton, N.B.	113-B	1913	44	73
Norton Mills, Vermont.	23, 24, 25	1910	455	465
Notre-Dame-du-Lac, Que.	64-B	1910	449	461
	O.			
Oak Bay, N.B.	4-B	1910	446	460
Oakville, Ont.	193	1913	55	80
Oban, Sask.	14-H	1915	20	34
Okotoks, Alta.	60-D	1915	26	38
Orangeville, Ont.	267	1913	58	82
Osgoode, Ont.	117-A, 118-A	1913	52	78
Oshawa, Ont.	178-A, 179, 179-A	1913	54	79
Osler, Sask.	36-D	1914	228	240
Ottawa, Ont.	125-A	1913	53	78
" "	503, 504	1914	220	235
Owen Sound, Ont.	286, 287, 288	1913	60	82
Oxbow, Sask.	55-C	1913	69	88
Oxford, Ont.	114	1910	457	466
Oxford, N.S.	136-B	1913	46	74
Oxford Jct., N.S.	135-B	1913	45	74
	P.			
Palgrave, Ont.	376	1913	64	86
Palmerston, Ont.	305	1913	61	83
Paris, Ont.	222	1913	55	80
Parkbeg, Sask.	111-C	1914	229	241

†International Boundary Monument.

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Pelly, Y.T.	118, 119	1913*	30	30
Pense, Sask.	99-C	1913	71	89
Perth, N.B.	39-B	1910	448	461
Petitcodiac, N.B.	123-B	1913	45	73
Piapot, Sask.	141-C	1914	231	241
Pickering, Ont.	180-A-2	1913	54	79
Piedmont, N.S.	165-B	1913	47	74
Pierson, Man.	46-C	1913	68	88
Pike Creek, Ont.	253	1913	57	81
Pilot Mound, Man.	15-C	1913	67	87
Pinewood, Ont.	20-E	1914	226	239
Pinto, Sask.	67-C	1913	69	88
Plaster Rock, N.B.	301-B, 302-B	1914	213	232
Pomquet, N.S.	176-B	1913	48	74
Port Clyde, N.S.	442-B	1915	12	29
Port Hope, Ont.	172, 172-A, 173	1913	53	79
Port Robinson, Ont.	212	1913	63	85
Port Saxon, N.S.	441-B	1915	12	29
Port Union, Ont.	182	1913	54	79
Prescott, Ont.	119	1910	458	466
Prince Albert, Sask.	47-D, 48-D, 49-D	1914	228	240
Princeton, Ont.	224	1913	55	80
Pubnico, N.S.	454-B	1915	13	30
R.				
Rainy River, Ont.	17-E	1914	226	239
Refford, Sask.	18-H	1915	20	34
Regina, Sask.	1-D, 2-D, 3-D	1913	71	90
Renfrew, Ont.	505, 506, 507	1915	17	32
River Glade, N.B.	125-B	1913	45	73
Rivière-du-Loup, Que.	76-B, 77-B, 78-B	1910	450	461
Roche-Percée, Sask.	65-C	1913	69	88
Rock Island, Que.	33-A	1913	49	75
Roosevelt, Minn.	13-E	1914	226	239
Rose Point, Ont.	565	1915	13	31
Rosthern, Sask.	40-D	1914	*228	240
Rothesay, N.B.	103-B, 104-B	1913	44	73
Rouleau, Sask.	88-C, 89-C	1913	70	89
Rush Lake, Sask.	120-C	1914	230	241
Russell, Ont.	499	1914	220	235

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Saskatoon, Sask.	29-D, 30-D, 31-D, 32-D, 33-D	1914	227, 228	240
Scotia Jet., Ont.	553	1915	14	31
Scotstown, Que.	16-A-2	1913	49	76
Scott, Sask.	19-H	1915	20	34
Shag Harbour, N.S.	449-B	1915	12	29
Shallow Lake, Ont.	290	1913	60	83
Shannonville, Ont.	154	1910	459	467
Shelburne, N.S.	433-B, 434-B 435-B, 436-B	1915	11, 12	29
Shelburne, Ont.	271	1913	59	82
Sherbrooke, Que.	1, 2, 3	1910	454	465
" "	35, 36	1910	453	463
Sigas, N.B.	51-B	1910	449	461
South Stukely, Que.	45	1910	452	463
Sprague, Man.	10-E	1914	225	239
Springhill, Que.	19-A-2, 20-A	1913	50	76
Sprucedale, Ont.	556	1915	14	31
Stanbridge, Que.	67	1910	453	464
Stanstead, Que.	34	1913	49	75
Stephen, Minnesota.	1-C	1913	66	87
Stevens, Y.T.	148	1913*	31	31
Stewart Crossing, Y.T.	162, 163	1913*	32	32
Stickney, N.B.	32-B	1910	448	461
Stirling, Alta.	203-C, 204-C	1915	24	36
Stoney Creek, Ont.	201	1913	63	85
Stoney Point, Ont.	250	1913	57	81
Stottsville, Que.	79	1910	456	463
Sudbury, Ont.	454, 454-A	1914	225	238
Sussex, N.B.	117-B.	1913	44	73
Sutton, Que.	52	1910	454	464
Swift Current, Sask.	126-C, 127-C	1914	230	241
	ST.			
St. Anselme, Que.	214-B	1913	52	77
St. Armand, Que.	68, 69, 70	1910	453	464
St. Catharines, Ont.	207, 208	1913	63	85
St. Evariste, Que.	195-B, 196-B	1913	51	77
St. George, N.B.	83-B	1910	451	462

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St. Honoré, Que.	70-B	1910	450	461
St. John, N.B.	97-B, 98-B, 99-B, 100-B	1910	9 452	28 462
St. Johns, Que.	75	1910	452	463
“ “	76	1910	455	463
St. Joseph-de-Lévis, Que.	220-B	1913	52	77
St. Louis, Qué. (Beauharnois County)	88	1910	456	466
St. Margaret, N.S.	394-B	1915	9	28
St. Mary, Que.	209-B	1913	51	77
St. Polycarpe Jct., Que.	92	1910	456	466
Ste. Rose, Que. (Temiscouata County)	62-B	1910	449	461
St. Stephen, N.B.	2-B, 3-B	1910	446	460
T.				
Taber, Alta.	186-C, 187-C	1915	23	36
Takhini, Y.T.	20, 21	1913*	25	25
Tako, Sask.	20-H	1915	20	34
Tara, Ont.	293	1913	60	83
Tatamagouche, N.S.	147-B	1913	46	74
Thamesville, Ont.	243-A	1913	57	81
Thedford, Ont.	349	1914	221	236
Thornhill, Man.	9-C	1913	66	87
Thorold, Ont.	210, 211	1913	63	85
Tompkins, Sask.	138-C	1914	231	241
Toronto, Ont.	185, 186, 187, 188, 188-A, 189	1913	54	79
Tottenham, Ont.	377-A	1913	64	86
Trenton, Ont.	161	1910	460	467
Tring Jct., Que.	204-B	1913	51	77
Tupperville, Ont.	369	1914	222	236
Tusket, N.S.	460-B	1915	13	30
U.				
Unity, Sask.	22-H	1915	20	34
Upper Woods Harbour, N.S.	451-B	1915	12	29
Utopia, Ont.	387	1913	65	86

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Versailles, Que.	72	1910	452	463
Vulcan, Alta.	68-D, 69-D	1915	26	38
W.				
Wainwright, Alta.	36-H	1915	21	34
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Warner, Alta.	209-C, 210-C	1915	24	36, 37
Warroad, Minn.	12-E	1914	226	239
Waterville, Que.	9	1910	455	465
Webb, Sask.	132-C	1914	230	241
Welland, Ont.	213	1913	64	85
Welland Jct., Ont.	214	1913	64	85
West Merigomish, N.S.	163-B	1913	47	74
Weston, Ont.	256-A	1913	58	82
Weyburn, Sask.	80-C, 81-C	1913	70	89
Whitby, Ont.	180-A	1913	54	79
Whitehorse, Y.T.	1	1913*	25	25
Whitemouth, Man.	14-F	1915	18	33
White Pass, Y.T.	42-R, 43-R	1913*	23	23
Whitewater, Man.	35-C	1913	68	88
Whitney, Ont.	536	1915	15	31
Wilcox, Sask.	86-C, 87-C	1913	70	89
Winchester, Ont.	109	1910	457	466
Windsor, Ont.	255	1913	57	81
Wingham, Ont.	314	1913	61	83
Winnifred, Alta.	176-C	1915	23	35
Winnipeg, Man.	1-F, 2-F, 3-F	1915	17	33
Winona, Ont.	202	1913	63	85
Winter, Sask.	25-H	1915	20	34
Woodstock, Ont.	226, 227	1913	55	80
Woodstock, N.B.	25-B, 26-B, 27-B	1910	447	460
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Zumbro, Sask.....	27-H	1915	20	34

Dominion Observatory,
Ottawa,
February, 1915.