

REGULATIONS
AND
INSTRUCTIONS
OF THE
SURVEY DEPARTMENT
OF
NEW ZEALAND.

SECOND EDITION.



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REGULATIONS AND INSTRUCTIONS OF THE SURVEY DEPARTMENT OF NEW ZEALAND.

PREFACE.

THE general survey of this colony in the meantime comprehends two distinct branches only, viz., Geographical and Settlement, or, in other words, standard and sectional; and it may be anticipated that this will be the case till the advancement of wealth and increase of scientific institutions permit of pure geodetic problems being undertaken and investigated by the department.

2. The Geographical Branch will be based on astronomical and electric telegraph observations, combined with major triangulation, or—time and the calls of the settlers not permitting this—with meridional circuit; these again will govern minor triangulation. Minor triangulation, being executed on the principles of plane trigonometry, is not included in the Geographical but in the Settlement Branch; it, however, thus stands as a link or key between the two main processes. And it must be remarked that, though neither the meridional circuit nor major trigonometrical surveys are sufficiently refined to independently solve pure globe-form problems, yet, as geographical values of their points or trig. stations are determined on the surface of the earth with the assistance of geodetic formulæ and data supplied by great or primary triangulation executed elsewhere, these points or trig. stations are called geodesical.

3. These instructions are confined to settlement or section survey, so do not touch on the ruling processes.

MINOR TRIANGULATION.

4. The surveyor requires to be specially provided with a 5-inch theodolite, logarithm tables, standard chains, and thermometer. The surveys extend over an area of $12\frac{1}{2}$ miles square,* called survey districts, and which are apportioned on the maps of the standard survey of the colony.

5. In triangulating a survey district or a portion thereof, choose a level piece of ground—central, or most convenient—for the measurement of a base. The line should be chipped and otherwise prepared, and should be of about two miles in length. Before commencing the measurement of the base, lay down on the ground a chain's length by your standard chain or steel band—adjusted to 62° Fahrenheit—for reference. Try your chain on this at the commencement and ending of actual measurements. During measurements observe temperatures (the co-efficient to be used may be .000007 for each degree) for correction of expansions and contractions of chain, which have to be applied in calculations. Hold chain or steel band when in use with an equal tension, and mark the ends on flat-boards spiked into the ground. These flat-boards should have a hollow filled with lead, for receiving the end marks made by a sharp instrument. Three boards are used, the hinder being always carried forward. Measure the base thus: forward and back again, and

* Unless where other areas are already in use.

take the mean. Angles of inclination should be observed for reduction to true level.

6. Should a major triangulation cover the area to be surveyed, no measured base will be necessary, but the distances of minor trig. stations will be obtained by "breaking down" the larger triangles.

7. Fix your trig. stations at $2\frac{1}{2}$ -mile distances, more or less, and, in order to extend the true meridian from the geographical into the settlement survey, proceed to one of the geodesical or major trig. stations, and set your instrument on the bearing given in the standard maps. This done, if you have an Everest theodolite, take from thence three sets of observations to each minor trig. station in view; the vernier A of instrument being placed at Zero, 120 and 240 degrees of the horizontal limb respectively—thus you have nine readings; but if you have a plain theodolite, take four sets of observations, the vernier A of instrument being placed at Zero, 90, 180, and 270 degrees respectively—thus you have eight readings. This done, proceed to the next minor trig. station, observing the bearings in like manner, so as to complete the three angles of each triangle. Select your points so as to have well-conditioned triangles—no angle being less than 30° , unless under very exceptional circumstances. Avoid crossing triangles, or one bearing over another bearing, so that each triangle may appear on the maps distinct from others.

8. The differences of the means of bearings will give the value of the angles of each triangle; sum these up, and note the correction, one-third of which + or - for calculation will have to be applied to each angle. Also in each side the mean of the opposite bearings will have to be taken. The logarithms should be taken out to seven places, and the angles to seconds. This being completed, and so all the sides and angles being known, calculate all your stations on the meridian and perpendicular of the initial station of the survey district with the same accuracy, and prepare a table of these. This table serves to construct the skeleton maps by standard scale and beam compass from the above data, which, being mathematically calculated, is greatly more correct than mechanical construction by "building" with scale and protractor.

9. In executing the survey of an isolated section, or of a block, if you require to measure a base, carry on your minor triangulation from it to the sectional survey you wish to cover; but, if you base your work on major triangulation already executed, carry your triangles from thence in the most direct course to such section survey in hand, and execute no more work than is necessary for checking the chain measurements of this.

10. With average care the degree of error in minor triangulation need not exceed 2 links to the mile, so the extreme error allowable, but only in very special cases, is 4 links to the mile, and the summation of angles of a triangle $30''$ and $60''$, respectively. All work having error in excess of this will require revision.

11. Combined with your operations, carry on a topographical survey, showing the disposition of natural features and their names, also tracks, ridges, rocks, streams, forests, remarkable objects, natural and artificial, &c.; and construct a map of the same. Observe altitudes of prominent objects, based on the elevations given in the standard maps, and note them in this map. A surveyor of experience, and with a good eye, may generally make a very serviceable sketch-map from his trig. stations, and by theodolite alone, by taking the bearings, cross-bearings, and tangents, with estimated distances of objects; but, if the country be intricate, he

will plant his theodolite in intervening positions where necessary, or use prismatic compass on stand when the theodolite cannot be had recourse to.

12. Minor trig. stations should be constructed in the following manner: Gas-pipes, 2 inches internal diameter, are cut to $2\frac{1}{2}$ -feet lengths; these are inserted into cast metal plates with sockets, secured by an iron pin. The alphabetical letter of the station is cut on the upper end of the pipe with a cold-chisel (see Appendix V.). The tube or pipe thus constructed is sunk in the hole prepared for it to a depth of 2 feet 3 inches, with the metal plate downwards. The hole is then re-filled, and the loose soil firmly beaten down. Round this a circular ditch, 20 feet diameter, 1 foot deep, and 18 inches wide, is dug. When in use the trigonometrical tube has a pole carrying a black-and-white flag inserted into it and properly stayed. It is not desirable to build trigonometrical mounds, but in low positions these may be necessary, and of which the surveyor will exercise his own judgment. If mounds be built, they are better to be of stone than of earth or sods. But in peculiar positions and natures of soil the above will require to be modified as specially directed.

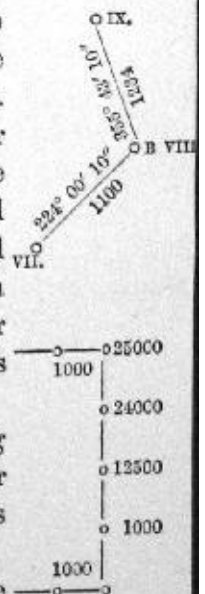
13. The trigonometrical work only is to be mapped on one sheet, which should show trig. stations (two concentric pink circles) with their alphabetical letters, the base line in red, other lines in black, bearings observed from each station (in blue), calculated mean distances (black), the observed angles (in the middle of each triangle) summed up (black). A few of the streams should be shown, so as to localize the trig. stations readily. There should also be a note giving the results of the different measurements of the base line. Scale, 40 chains to an inch.

14. The topographical map is to show the trig. stations lettered, their heights in feet (in red), streams (in blue), hills shaded (in Indian ink); the Native or local names of places, streams, hills, &c.; roads in use (in firm burnt-sienna lines), tracks (dotted sienna), bush (green). Shade the boundary of the district in colour. Scale, 40 chains to an inch. A tracing of this map on cloth, mounted on paper, will, as soon as practicable, be furnished to the Crown Lands Office by the Chief Surveyor of the district.

15. Provided the country to be surveyed is so covered with forest that no minor triangulation can be carried out, then circuit traverse must be had recourse to, which effects the objects of minor triangulation, but necessarily less accurately. Circuit traverse consists in taking a departure from a geodesical major or minor trig. station, and, by careful chain and angular measurements surrounding the block about to be sectionized, returning to the same station again. The ground selected for the traverse should be as level as is possible to obtain; the lines should be cut under the direction of a theodolite, and, if possible, be not less than 10 chains in length. At every two miles three iron tubes are to be inserted, as per margin, and marks, arrowhead and number of station, should also be made on trees adjacent, with bearing and distance noted in field-book and on map.

16. Where block lines are laid out by the same system, the manner of marking should be attended to as shown in margin—namely, three tubes at each corner 10 chains apart, and one tube in middle distance, all with their referring marks on adjacent trees.

17. When survey district or block lines cannot be cut or traversed owing to the impassable nature of the country, then it will be sufficient to fill in the maps the calculated positions as ascertained from the nearest survey marks. Generally



speaking, cutting the district and block lines over the brows of the ridges will suffice for their surface indication.

18. In forwarding plans the surveyor will require to append to the trig. map tables (on foolscap paper) of bearings and distances, angles of triangles, altitudes of stations, and reductions on the meridian and perpendicular; also the mean results of measurements of base line.

BLOCK AND SECTION SURVEYS.

19. The surveyor requires to be specially provided with a 5-inch theodolite, chain, beam compass, and protractor.

20. No magnetic bearings are admissible, unless under very special circumstances, in minor detail work, and this very sparingly. Flat or undulating country should be laid off in rectangular sections, but in rugged and hilly country the "lay" of the ridges and valleys must modify the disposal and form of these. It is desirable to have all the boundaries on the meridian and perpendicular; but when the general features of the country run obliquely to these, especially in rough districts, the boundaries must be arranged accordingly. The less diversity of bearings the better for the avoidance of errors and multiplication of office work. When necessary, road lines may cross sections diagonally. The boundaries of the block should be cut or pared, and no survey block should exceed in length or breadth the distance of 250 chains ($3\frac{1}{2}$ miles) unless under special circumstances, however much less, or of whatever form they may be. Circuit traverse round a block, being necessarily pared and cut, effects this purpose of itself. If the boundaries of the area to be sectionized exceed $3\frac{1}{2}$ miles, it will be necessary to divide it into two or more survey blocks, which separate blocks can be reduced into one plan for exhibition to the public.

21. In traversing, proceed to the nearest trig. station and base your work on it, setting the zero of the theodolite to true meridian by means of the given bearing to an adjacent trig. station. Unclamp the upper plate, and turn it from left to right until the signal of the forward station is bisected or nearly so, taking care not to overshoot the point; clamp, complete the bisection, and record reading of vernier in field-book. Then unclamp, and keep turning upper plate in same direction, or towards the right, until the back station is again bisected. A reference to the vernier will show whether the lower plate has remained unmoved. If so, proceed to the next station, and so forth, until you close with another trig. station. Observe angles of elevation and depression, and reduce to horizontal value. (See Appendix I., and of which tables will be printed on cards.) The road lines should be thus traversed in the first place,—the surveyor when on a trig. station having taken careful readings to many of the traverse or subsidiary points, so as to check his positions as he proceeds,—boundaries of sections in the same manner necessary to be measured, in the second place. Offsets to irregular boundaries, rivers, or streams must not exceed 4 chains in length, and must be taken at intervals in the traverse not greater than 3 chains, but they must be taken at closer distances if necessary to correctly define the irregularities to be mapped.


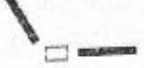
22. In the evenings the surveyor should invariably calculate his traverses, mathematically, all his bearings and distances on the meridian and perpendicular


of a central trig. station, so that no daily actual measurements get in advance of this mode of check to his operations. In rural and suburban surveys all actually chained lines (excepting to range pegs), all corners of blocks and of isolated sections, whether chained or not, and the intersections with the traverses of all boundary lines of sections, are to be so calculated. Should two traverses—say, of a road and of a river—run nearly parallel and not more than about 10 chains distant, it will not be necessary to calculate both. Enter reductions into form shown in Appendix III., to be forwarded with the map.

23. Unless where otherwise specially ordered, main road lines should be pegged generally to a breadth of 1 chain, occupation or by-roads to $\frac{1}{2}$ chain, main roads 3 to 4 miles apart, by-roads $\frac{3}{4}$ to $1\frac{1}{2}$ miles apart, and all necessary through-roads to give access to back or adjoining country 1 chain wide. In level country the opposite angles should be pegged by setting off half the included angle and calculated distance (see Appendix II.); but in hilly and mountainous districts, where the land is of little value, the roads tortuous, and the traverses short and intricate, this may be dispensed with and the roads shown curved. At the boundary of a section or block, however, pegs must be placed on both sides of the road.

24. Having designed and laid off the skeleton of the work by survey and calculation of road traverses, do this also for the exterior boundaries of your block, and at this time investigate all adjacent and included prior claims and their boundaries, for which object copies of the original plans will be furnished you from the chief district offices. Survey those claims as held by established or indicated marks on the ground, showing the same by firm lines if the boundaries disagree with your own measurements based on original plans. Boundaries as by descriptions in original plans will be marked by dotted lines. If owners of prior claims cannot be found, and if all the marks of their claims are obliterated, then it will be competent for the surveyor to re-establish the boundaries by his own actual survey, recording them in firm lines.

25. All pegs should be sawn or dressed totara, kowhai (goay), blue-gum, kauri, matai (black-pine), puriri, or hinau, 3 inches by 2 inches, in scantling 2 feet long, put 18 inches into the ground, the hole having first been driven by an iron jumper, and a piece of china-ware thrown in. The front pegs of sections must have the numbers of the sections and the letter R branded on them; road traverse pegs will have the letter R and the broad arrow, ranging pegs the broad arrow only. In forest country, at convenient distances, trees on the traverse lines should be blazed, having the linkage marked on the face. Conspicuous trees should also be branded, and their distances and bearings from section corners noted in field-book (see Appendix V.). Sections in open country must be pegged front and back as well as at every corner, and have ranging pegs placed 3 chains distant from the front ones with the lines pared up to them. When any of the boundary lines are over half a mile in length, they must be pegged and trenched at the 40th chain, and every 40th chain or thereby; but, if the ground be ridgy, the pegs should be put at the top of the ridge or ridges as near to the 40-chain distances as the ground will allow. These ranging pegs are to be shown in the field-book, but not on the working plan, as they need not be chained. In forest, back pegs need not be inserted, but fronts of sections must have, besides the corner pegs, two ranging ones at $\frac{1}{2}$ -chain and 3-chain distances.

26. All pegs in open country should have trenches dug in the following manner:
—6 feet long, 9 inches wide, and 9 inches deep at adjacent section frontages,
thus— At traverse boundaries thus—

At corners of isolated (spotting) sections thus— in all cases commencing 2 feet from the peg.

27. In mapping, first set off your meridian and perpendicular on the initial station of your survey,—which must be a trig. station,—by beam compass from the calculated traverse table already prepared; then set off all the skeleton boundaries and traverses by the same instrument, or by scale and parallel ruler. Ordnance protractor may be used in detail plotting.

28. Having drawn your road lines and boundaries on your map, then design the disposition of sections, adhering as much as possible to the cardinal points for sake of simplicity and the avoidance of error.

29. The positions of the section pegs in the traverse lines already surveyed are to be measured on the ground and noted in the map, and, should the section peg be on the opposite side of a road, the calculated distances should, where the roads are pegged on both sides, be given from adjacent pegs on same side also.

30. Note accurately all crossings of creeks and tracks in public use; also make such notes as will give a sketch of the topographical features, and delineate on the working plan.

31. Draw measured lines in pink, calculated lines in black, with figures in pink and black respectively. Draw observed bearings in blue, and calculated bearings in black. For minor detail prismatic compass work (which should, if possible, be avoided), use green. Pegs should be marked by a small pink circle in every case. Colour water in Prussian blue, roads in sienna, bush in green. Hills to be shaded in light Indian ink.

32. Draw a black marginal line round your map. Show road line and boundary ends of adjacent survey sections and blocks. Draw a scale 12 inches in length; also an inscription in upright letters denoting block and district, name of surveyor, date of survey. The interior detail writing should be similar to that in Appendix VI.

33. The error attached to traverse survey necessarily varies with the nature of the ground, and, as it is essential for the security of settlers in rural blocks that it should not accumulate above 20 links, it will be advisable to have recourse to triangulation subsidiary to minor, where the country is so rough as to prevent correct chaining. On an average, surveyors can chain a mile within a error of 2 or 4 links; thus a limit of error in traverse has to be assigned, and here it is so at 8 links to the mile. Should the error in closing exceed this limit, the work must be revised. So also, governed by minor triangulation, traverses should close by bearing with an error not exceeding 2 or 3 minutes of arc.

34. Reserve suitable sites for schools, about 10 acres in rural districts and 5 acres in suburban districts. Reserve 100 links frontage to all navigable rivers. Reserve also centres of bushes in sparsely timbered country, stone quarries, gravel and sand pits for road-making, where conveniently situated for trunk and district lines.

35. Upon the receipt of plan of a block for settlement, and as soon as possible after it has been checked, a tracing on cloth, without bearings and distances or traverse lines, and mounted on stiff paper, is to be sent to the Land Office; also a reduction to a suitable scale is to be prepared for lithographing either in the district or at the head office as the case may require.

36. As the land laws in various parts of the colony require a system of settlement before survey can be carried on, the same principles and practice of survey that have been denoted above may be adhered to, only there are greater difficulties and responsibilities cast on the officers of the department. The objects of advance or pioneer free-selectors may be admitted to certainly consist in a repayment of their enterprise by superior advantages beyond the reach of the general public. To curtail these advantages is in no way the duty of the surveyor, so long as public privileges are not unfairly interfered with. The surveyor of spotting claims must therefore have a care of legitimate public or prescriptive rights—such as in town, village, and ferry sites, roads, water-ways, water-races on gold fields or elsewhere, &c., &c.; and in so doing he may sometimes be opposed by personal pressure; but he is expected to be superior to this. His professional responsibilities are also greater than in block survey, as he is not subject to the same close supervision. The work is also not capable of such satisfactory check, while the inducements to evade toil and trouble are many.

37. In surveying a spotting or isolated claim, the surveyor must proceed to the nearest geodesical or trig. station and connect his section work by minor triangulation, and he will prepare a plan of the section and its connections on special sheets provided for that purpose (see specimen Appendix VI.). But if the claim be near to a trig. station he may connect by traverse.

38. If no geodesical or trig. station be available for connection, it will be the duty of the surveyor to report the circumstance to the head of his department before executing the survey; and in cases where a broken country is covered with forest, preventing minor triangulation or approved traverse circuit, special direction will be given for the survey and sectionizing of the locality under such conditions.

39. Surveyors in the employment of Government are to report to the Chief Surveyor of the district monthly, giving a statement of work completed, cost of party, &c., in the form given in Appendix VII. They will also have to furnish, on the 30th June in each year, a report and summary of work done, cost, &c., for the past twelve months, in the form given in Appendix VIII. Chief Surveyors will report to the Surveyor-General as soon as possible after the termination of each month, but not later than the 15th of the following month, giving a summary of work executed by the surveyors acting under their supervision, the arrears, or work on hand, and proposed course of duty for the following month (form given in Appendix IX.). They will also, on the 30th June in each year, furnish a statement of the work executed during the past year, and the expenditure in the district, in the form given in Appendix X.

40. Along with the monthly report Chief Surveyors will send diagrams of field inspections that have been made in the actual surveys then going on. In provincial districts having not more than ten parties at work, field check is to be done by the Chief Surveyor; but, if there be more than ten parties, an officer will be employed as a field inspector—in conjunction with his ordinary

duties, if the number to be inspected be few—to be stationed in such district and over such parties as the Chief Surveyor himself cannot overlook. The Chief Draughtsman will, in the absence of the Chief Surveyor, have general charge and authority in the head office of the provincial district, open and attend to correspondence, and sign for him.

41. Field-books to be kept in ink, and when filled up to be returned to the head office. It is to be understood that all field-books and maps, whether of the official or the contract surveyor, are the property of Government. Field-books should be dated for each survey, and their contents indexed.

42. Report if not able to repair all trig. stations that are seen to be dilapidated.

TOWN SURVEYS.

43. The streets in all towns shall be of a breadth not less than 150 links from building line to building line. In open country the sides of the main street lines shall be pared; in bush, cut. In addition to pegs at the corner of every section, not fewer than four stone blocks or iron trig. stations shall be placed 25 links from the building lines, so that three of them shall be reciprocally visible from each other, and on these the angular measurements of the town will be based. The blocks or trig. tubes to be flush with the surface of the ground.

44. Open spaces shall be set apart and reserved for recreation-grounds, the number of such reserves being regulated by the superficial area of the town, being not less than one-tenth of such area, the separate size of such reserves in no case being less than $12\frac{1}{2}$ square chains.

45. No reserve shall be made for cemetery purposes within any town.

46. Municipal reserves shall be made at the rate of one acre to every ten acres of the total area of the town; also one or two school sites of not less than two acres each. There should also be laid out sufficient land, either outside or inside such towns, for sites for depositing nightsoil, dirt, and rubbish, and such sites shall be selected on such side of the said towns as shall be opposite to the quarter from which the prevailing summer wind blows; also sufficient land, either outside or inside such towns, for sites for gravelpits and stone quarries, and for depositing gravel, stone, or other materials required for making and repairing roads within such towns: provided that gravel, stone, or other road materials can be obtained in the locality. On the plans these areas to have their specific purpose written on each, either in full or in abbreviated form.

47. The streets of all towns shall, as nearly as a due regard to the natural features of the country and drainage of the land will permit, be laid off in straight lines and at right angles to each other; and allotments are to be laid off at right angles to the streets which they front when possible.

48. In order to avoid repetition the names of towns and villages will be given by the Minister of Lands.

OFFICE RECORD.

49. Not less important than the field survey is the preservation of records. If the cost of surveys since the commencement of the colonization of New Zealand could be correctly summed up, it would be found to represent an immense amount. Several offices in the colony now have maps whose construction has cost from £100,000 to £200,000 sterling. Surely the preservation of these in

good order is a serious duty. It is therefore essential that records be kept in a fire-proof safe, and which being necessarily of limited dimensions, the mode of doing so demands compactness and economy of space.

50. In directing this duty, the following fact in regard to maps is attended to—namely, that sheets of paper of moderate size kept flat remain, after twenty or thirty years' use, in good condition, which is not the case with sheets rolled up, subject to be continuously unfolded. Hence, in a general system of map record, the above is the primary consideration.

51. As the working plans are the most valuable,—the originals of which when once destroyed never being entirely replaceable of equal value as evidence,—the first care of the surveyor should be to these. Thus working plans, whether of meridional circuits, major triangulations, minor triangulations, or block surveys, should be drawn on antiquarian paper, cut to 30 inches square. These are laid flat, in folios 33 inches square, which again slide in to level shelves 34 inches square, constructed in a closed press, set up in the fire-proof safes attached to the Survey Offices. Where there is not room for laying flat, folios may be placed upright. In this manner all the primarily important maps are compactly secured in a small space. The working plans of isolated sections are also kept in folios 18 inches by 16 inches. All these plans should remain unmounted. The compiled or index plans, however, being unavoidably of large size (56 inches square), are mounted, and kept in rolls; but these if destroyed are replaceable, containing as they do no original work. The tops and bottoms of these maps should have thin laths glued to them, and extra-fastened with copper tacks. This prevents the paper breaking and creasing.

52. The following are the scales to be used in surveys:—

Working Plans.

Town section ...	...	2 chains or $\frac{1}{40}$ mile to an inch.
Rural „ ...	...	10 „ $\frac{1}{8}$ „ „
Minor triangulations ...	40 „	$\frac{1}{2}$ „ „
Topographical ...	40 „	$\frac{1}{2}$ „ „
Meridional circuit ...	320 „	4 „ „
Major triangulations ...	320 „	4 „ „
Reconnaissance ...	160 „	2 „ „
Index maps ...	80 „	1 „ „

Copied or Compiled Plans.

Town or village selection maps ...	5 or 10 chains to an inch.
„ „ Crown-grant record maps	2 „ „
Rural selection maps (after survey)...	10 „ „
„ „ „ (before survey)	40 „ „
Crown-grant record maps (rural) ...	20 „ „
Territorial maps ...	4 or 8 miles „

Extreme Areas contained in Plans.

Working plans of Town sections ...	$\frac{7}{10}$ mile square.
„ Rural „ ...	$3\frac{1}{8}$ miles „
„ Minor triangulations ...	$12\frac{1}{2}$ „ „
„ Topographical ...	$12\frac{1}{2}$ „ „
„ Reconnaissance ...	112 „ „

Working plans of Major triangulations	...	112 miles square.
Meridional circuit	...	112 " "

The above are suitable for keeping in the fire-proof safes.

53. With a view to the systematic record of all transactions of the Land Transfer Branch, and of surveys executed under the Public Works Acts or Road Acts in force, record maps on the same scales as for original surveys—namely, 20 chains to an inch for rural lands, and 2 chains to an inch for town lands—will be prepared, on which all road lines, subdivisions, and other details surveyed since the issue of the Crown grant, under the Land Transfer Act, Public Works Acts, Road Acts, the Land Acts, or any other proper authority, should be recorded.

54. Wall maps may be of any size and scale. As the computations form a very important part of the practical work of the office, computation books should be of one size, so as to fit the shelves in the safe. The size should be a little above the ordinary foolscap, and the books should be numbered, paged, and the contents indexed, for easy reference.

55. Working plans are open to the inspection of professional men only, and on payment of the prescribed fee. Selection maps are open to the public free of charge.

QUALIFICATIONS FOR ENTRY INTO AND PROMOTION IN THE SURVEY DEPARTMENT.

56. The candidate for apprenticeship must exhibit a satisfactory certificate from his schoolmaster, also a certificate of his having passed the Junior Examination under "The Civil Service Act, 1866." (See Regulations, Appendix XI.) He must be over sixteen and under twenty-five years of age.

Besides the above, a satisfactory departmental inquiry as to good eyesight for observing, a healthy constitution, a legible hand, and taste for drawing, are necessary to qualify.

57. The Government will pay a salary of £50 for the first year, £60 the second, and £70 the third, together with an allowance at the rate of 2s. a day, or 14s. per week, while in tent.

58. The teaching surveyor will receive a sum of £50 when the apprentice passes his survey examination satisfactorily at the end of the three years.

59. No surveyor will be required or allowed to receive more than one apprentice.

60. Every facility will be given to the cadet by the surveyor under whom he will be placed to enable him to acquire a thorough knowledge of the public survey system. No private cadets are allowed to be taught by Government Surveyors.

61. During apprenticeship (which extends over three years—one in office, two in the field), the Senior Examination of the Civil Service Act and Regulations above quoted must be passed, otherwise no future engagement nor promotion is guaranteed. If this be passed, it will also be necessary to undergo a departmental inquiry as to knowledge of the first six books of Euclid, the use and adjustment of the theodolite, and aptness in map-drawing. A certificate of good conduct and competence from a Crown Lands Surveyor must also be shown. These requirements being complied with qualify for promotion into the grade of actual or section surveyor.

62. In order to obtain employment in the geographical or standard branch, a knowledge of spherical trigonometry and algebra will be necessary; the use and adjustment of sextant, alt-azimuth, and transit instruments; also of practical astronomy, particularly in reference to latitude, longitude, and true meridian.

CONTRACT SURVEY.

63. A surveyor when he contracts cannot be allowed to divest himself of professional responsibility, because the greater part of his work, being hidden from view and spread over large areas, cannot be fully inspected. Thus a contractor for surveys occupies quite a different position from a contractor for mechanical, engineering, or architectural work, over which inspection is done without difficulty.

64. No surveyor can be considered qualified to be a contractor unless he has had five years' experience in an approved system—that is, in any system whose field operations are subject to mathematical check.

65. Surveyors not already on the list of contractors, before tendering for survey contracts, will require to apply to a Chief Surveyor; and if such officer feel himself justified in attesting to, under the above conditions of experience, his personal knowledge of the competency, and his confidence in the integrity, of the surveyor, a certificate to this effect should accompany his first tender.

PRIVATE SURVEYORS.

66. Surveyors in private practice, whose plans have to be approved by the department, before obtaining a diploma, must apply to a Chief Surveyor, who will require exhibition of certificates: if these be satisfactory in regard to character and attainments, then surveying and mapping instruments complete will have to be shown.

67. The applicant must also produce plans actually surveyed in the district and drawn by himself completely and in a workmanlike manner, in accordance with rules and regulations—

- (1.) Of a base line at least one mile in length;
- (2.) Of a triangle as observed in minor triangulation, with bearings, distances, summation, reductions in meridian and perpendicular, &c.;
- (3.) Of a plan of a property of at least one hundred acres, connected to a trig. point, and reduced on true meridian, drawn to proper scale, with tables, title, &c., in a form recordable in the office, as executed by the staff.

The Chief Surveyor will thereafter sign and forward a diploma for the approval of the Surveyor-General, and if so approved the applicant will be placed on the list of qualified surveyors.

LAND TRANSFER SURVEYS.

68. Any plan purporting to be a survey, resurvey, or subdivision of any land is to be signed by the surveyor who actually made the measurements in the field, and shall also be verified by statutory declaration of the licensed surveyor employed to make such survey, such declaration to be in such one of the forms appended as may be appropriate.

69. The necessity for the greatest practical accuracy cannot be too strongly impressed upon surveyors. In many instances no means will exist by which their

errors can be detected by the department. This will make it the more necessary to watch those cases in which errors can be tested; and, if their discovery should show that the work of any surveyor cannot be implicitly relied on, it will become an imperative duty to revoke his license.

70. The surveyor will be expected to disclose all doubts, discrepancies, and difficulties, and to afford all such other information obtainable by him relating to the property and the application for certificate of title or transfer as will aid in insuring accuracy and completeness in the business of the Land Transfer Department. In these matters he will consider himself rather an agent and adviser of the Government than of the person incidentally employing him; nor will a regard to the interests of such employer be considered as excusing in any degree the withholding of any information affecting the merits of the application, even though the description supplied may be literally and technically correct.

71. In districts where triangulation exists, and where the triangulation points have not been obliterated, if a resurvey or subdivision of the whole of a rural section is made for the purposes of the Land Transfer Act the survey must be connected by traverse or by a subsidiary triangle with the nearest trig. station. If only a portion of a section is being dealt with, this will not be required, but the survey must be connected with at least two of the corners of the original section. If only part of an allotment on an already deposited plan is being dealt with, then such survey need only be connected with two or more points of that allotment, provided always that the allotment has been previously properly connected with two or more points of the original section in such a manner as to definitely fix the position thereof. In towns and cities where permanent bench-marks have been placed, then the survey must be connected both by angular and linear measurement with such bench-marks.

72. All measured lines and distances must be shown in red, all observed bearings in blue, all calculated bearings or distances in black, the same being written along the lines generally, as shown in Appendix VI. Included angles will only be admissible in such districts where minor triangulation does not exist, or where the original stations have been lost, and where the standard points for obtaining the meridian have not been re-established, or in the subdivision of small allotments.

73. Tie-lines in lieu of angles will only be admissible in the subdivision of very small pieces of land.

74. The true meridian bearing between two or more trigonometrical stations will always be obtained by reference to the survey office of the provincial district.

75. Where the boundary consists of natural features they must be traversed unless they form the boundary of the original section and have been traversed by the Government Surveyor. A retraverse of such boundaries may, however, be required in cases where the original survey appears to be faulty.

76. Where an irregular boundary is defined by offsets measured thereto from one or more survey lines, the surveyor must furnish the distances along such line or lines at which offsets have been taken and the lengths of such offsets.

77. Should a property be bounded on one or more sides by natural features of which a retraverse is not required, the survey must be closed by traverse-lines or tie-lines in such a manner as will enable the work to be thoroughly checked by the draughtsman.

78. All traverse-lines to be mathematically reduced on the meridian and perpendicular of the nearest trigonometrical station, or, if that is not required to be connected with in the survey, on the starting or initial point of the survey and tables deposited with maps. Traverse forms can be had at the Survey Offices, price 6d. per dozen.

79. In the subdivision of small areas or town lands 4 links to the mile will be the maximum error allowed, and in the case of the survey of rural land 8 links to the mile; bearings must close to two or three minutes, according to the nature of the survey.

80. All bearings must be observed with a serviceable and adjusted theodolite; the chain must be tested, and corrected before survey to the Government standard.

81. Deposited plans, if not indorsed on an application or instrument, must be either on antiquarian or mounted drawing paper 30 inches by 30 inches, 20 inches by 20 inches, or 10 inches by 15 inches, cut so that due north is perpendicular to the paper, which must be the exact size named, to fit the office portfolios.

82. For the smaller sizes protracting sheets can be obtained at the Survey Office of the provincial district, price 9s. per dozen. Plan to accompany application, transfer, lease, or mortgage when not drawn on the form, to be 15 inches by 10 inches.

83. Plans of allotments containing 1 to 10 perches, $\frac{1}{2}$ chain to 1 inch; 10 to 20 perches, 1 chain to 1 inch; 20 perches to 1 acre, 2 chains to 1 inch; 1 acre to 10 acres, 5 chains to 1 inch; 10 acres to 320 acres, 10 chains to 1 inch; 320 acres and above, 20 chains to 1 inch.

84. Where the land forms a part of two or more original allotments or sections, the boundaries of such allotments or sections must be shown by a distinguishing colour.

85. The sectional or allotment numbers, with the names of the owners or occupiers of adjoining lands, whenever obtainable, should be written on the plan, and inquiries, if necessary, must be made for that purpose by the surveyor. Names of adjoining proprietors may be dispensed with in surveys for subdivisinal purposes, under section 107 of the Land Transfer Act.

86. If a boundary is a wall it must be shown whether it is a party-wall, and whether the line runs through the centre or otherwise. The true position of all boundary fences must be shown, and the nature of the boundary of the land, whether wall, house, fence, ditch, hedge, stream, road, or undefined, should be stated.

87. Every plan must exhibit, distinctly delineated, all roads, streets, passages, thoroughfares, squares, or reserves appropriated or set apart for public use, and also show all allotments into which the said land may be divided, marked with distinct numbers.

88. The nature of the boundary, viz., roads, reserves, sections, natural features, &c., should be shown.

89. All measurements must be given in links.

90. An accurate description of the boundaries of the land must be furnished with each plan.

91. Roads and streets to be coloured with burnt sienna; rights-of-way, crimson lake; edge of land to be dealt with, green; water, prussian blue. Where

natural features, such as terraces, are shown as the boundary of an allotment section, they should be coloured with sepia.

92. If required, the licensed surveyor must produce his actual field-book for the inspection of the officer checking his work.

93. The actual measurements made in the field must be given, notwithstanding that they may not agree with the Crown grant or public map, and, should the difference be material, the measured distance and bearing to the next adjacent Crown-grant boundary is to be furnished, in order to determine whether there is any real encroachment, or whether the differences arise from former defective surveys. The license of any surveyor will be cancelled if it is found that the measurements or bearings certified by him as correct differ materially from those which exist on the ground. And, in dealing with this subject, the surveyor must adhere to the principle of the unchangeableness of original lines and corner, established by Government or other duly-authorized surveyors done in good faith; in other words, where the lines and corners are originally established on the ground by a proper officer, in pursuance of the survey system ordered by the law of the time, they must be regarded as the true lines and corners which they represent, even if subsequent surveys indicate that the posts, pegs, or marks are out of line, and that the corners are out of position, according to the original description thereof.

94. When a survey made under the Land Transfer Acts differs materially from the Crown grant or public map, the Chief Surveyor, before altering or rectifying the records of his department to enable a correct certificate of title to be issued, will, if he deem it necessary, require a verifying survey to be made by another surveyor, to be approved of by him, to determine the correctness or otherwise of the deposited or of the original survey.

95. Declaration to be made on the margin of the larger and on the margin or back of the smaller plans.

96. All surveys under the Land Transfer Act to be substantially pegged on the ground, such pegs to be not less than 3 in. by 2 in. scantling of the heart of totara, kowhai, blue gum, kauri, or matai (black pine), not less than 18 inches long, to be driven 15 inches into the ground, the hole having first been driven by an iron jumper; the pegs to be branded with the allotment number, with not less than 1-inch figures branded one-eighth of an inch into the wood. At frontage pegs of rural and suburban lands, when practicable, trenches at least 2 feet long, 9 inches deep, and 9 inches wide, and not less than 2 feet therefrom, to be cut in direction of boundary lines.

97. The position of the pegs to be shown on the plan by a red circle; old pegs, when found, by a black circle; the position of lockspits or other original marks to be shown on plans if necessary. In all cases in which lands are subdivided for townships exceeding 20 chains square, at least four iron pegs, not less than 1 inch square and 18 inches long, reciprocally visible from one another, should be driven in the street 25 links off the section lines, to which reference may be made in cases of dispute. Where the boundaries on the ground differ materially from the Crown-grant boundaries such Crown-grant boundaries to be shown by dotted black lines.

98. The following is the form of declaration under section 107 of the Land Transfer Act :—

I [*name in full*], of _____, a surveyor duly licensed under "The Land Transfer Act 1870 Amendment Act, 1871," do solemnly and sincerely declare and certify that the parcels of land hereon delineated have been surveyed and pegged on the ground and plotted, in accordance with the instructions issued by the Surveyor-General for the guidance of surveyors under the Land Transfer Acts, and that this map is in all respects accurate.

And I make this solemn declaration conscientiously believing the same to be true, and by virtue of an Act of the General Assembly of New Zealand entitled "The Justices of the Peace Act, 1866."

Declared at _____, this _____ day of _____, one
thousand eight hundred and _____, before me,
a Justice of the Peace for the Colony of New Zealand.

99. The following is the form of declaration under section 108:—

In the matter of an application by A.B., of _____, to bring under the provisions of "The Land Transfer Act, 1870" [*Here refer to number of section or block and district, with sufficient description to identify land with that in application*].

I, _____, of _____, a surveyor duly licensed under the provisions of "The Land Transfer Act, 1870," do solemnly and sincerely declare that I have been employed on behalf of the above applicant, and for the purpose of the above application, to survey the land the subject thereof; that I have satisfied myself that the same has been surveyed and pegged on the ground in the manner required by the instructions issued by the Surveyor-General for the guidance of licensed surveyors under the Land Transfer Act:

That this map truly represents the said land according to the boundaries pointed out by [*or on behalf of*] the applicant:

That all existing fences and buildings, so far as they affect the boundaries of the said land, are shown on the said plan, and are in the positions indicated:

That to the best of my knowledge and belief the said land is now in the occupation of _____ [*or unoccupied, as the case may be*].

And I make this solemn declaration conscientiously believing the same to be true, and by virtue of an Act of the General Assembly of New Zealand entitled "The Justices of the Peace Act, 1866."

Declared at _____, this _____ day of _____, one
thousand eight hundred and _____, before me,
a Justice of the Peace for the Colony of New Zealand.

100. All instructions previously issued to surveyors by the Registrar-General of Land are revoked as from the 13th February, 1879.

SURVEY OF NATIVE LANDS.

101. All surveys must be in the true meridian of the circuit placed in correct position within the survey district in which they are situated.

102. Boundary surveys of areas over 3,000 acres in extent may be made by the system of converging angles observed between fixed and known points, the intervening and adjacent features being delineated by cross bearings, or theodolite or compass chain traverses.

103. Surveys under 3,000 acres in extent must be triangulated and traversed, or traversed only if triangulation be inapplicable by reason of the denseness of the forest.

104. When true bearing is not obtainable, then only may surveys be executed on magnetic bearing, and when this is had recourse to the reasons must be stated on the face of the plan.

105. All boundaries must be permanently ground-marked by pegs, lockspits, mounds, cairns, witness marks on trees or on rocks, so that the corners and lines may be clearly indicated for future inspection.

106. Field-books must be kept in ink, and delivered up to Government when completed, or when the surveyor has done with his work.

107. Plans to be drawn according to specimens to be seen in the Inspector or Deputy Inspector's offices,—the scales used being 2, 5, 10, 20, 40, or 80 chains to an inch, according to extent.

108. Names of natural features to be given in plan; also the names of the owners or occupiers.

109. All theodolite, and chain, triangular, or traverse work to be mathematically reduced on the meridian and perpendicular, a table of which is to accompany each plan.

110. Surveys under clause 102, which can be classed only as reconnaissance or topographical sketch, must have the necessary roads drawn on the maps as nearly in their correct position as can be estimated by the method of survey adopted.

Surveys under clause 103, or such as may be classed equal in correctness to "block and section" surveys, must have roads traversed and laid out as hereinbefore directed for section surveys generally, as shown in Appendix VI.

RULES FOR SURVEYS, AND FEES TO BE PAID BY APPLICANTS FOR LAND, UNDER "THE LAND ACT, 1877."

WESTLAND DISTRICT.

111. All surveys shall be made by surveyors authorized by the Surveyor-General, and in accordance with instructions to settlement surveyors issued, or which may be issued, by him.

112. There shall be paid for the survey of any area—

			£	s.	d.	
Not exceeding 30 acres	...	...	0	4	0	per acre.
Exceeding 30 and up to 50 acres			0	3	6	per acre, but not less than £6.
" 50 "	100	"	0	3	0	" " " £8 15s.
" 100 "	200	"	0	2	6	" " " £15.

113. All fees so chargeable shall be deposited with the Receiver of Land Revenue at the time the application for land is made.

114. These regulations came into force and effect on the 15th August, 1878. (See *New Zealand Gazette*.)

AUCKLAND DISTRICT.

115. All surveys shall be made by surveyors authorized by the Surveyor-General, and in accordance with instructions to settlement surveyors issued, or which may be issued, by him.

116. There shall be paid for the survey of any area—

			£	s.	d.	
Not exceeding 30 acres	...	...	5	0	0	
Exceeding 30 and up to 50 acres			0	3	0	per acre.
" 50	"	100	"	0	2	6 "
" 100	"	200	"	0	2	0 per acre, but not less than £12 10s.
" 200	"	300	"	0	1	8 " " " £20.

117. Whenever two or more sections are surveyed together by the same surveyor, one-third of the above rates shall be deducted for all areas above 50 acres, and whenever also more than one-half the length of the boundary lines shall run through vegetation less than 6 feet high, one-third of the schedule rates shall be deducted.

118. All fees so chargeable shall be deposited with the Receiver of Land Revenue at the time the application for land is made.

119. These regulations came into force and effect on 14th March, 1878. (See *New Zealand Gazette*.)

SURVEYS TO BE CERTIFIED UNDER THE PUBLIC WORKS ACTS.

120. The traverse should be connected at intervals not greater than two and a half miles to the trig. stations of the district, as well as to the corners of the sections or properties through which it passes.

121. Where no triangulation exists the traverse should be chained and observed twice, and, if possible, connected at, say, three-mile intervals, to some permanent topographical feature outside the line of formation, at which place a peg should be placed and lockspitted.

122. The lengths of the sides of the area proposed to be taken for the work should be given to each property, as well as its true position in the property.

123. The distances on the meridian and perpendicular of each traverse peg must be tabulated. The surveyor, if he connect with a trig. station, must use it as the initial point or zero of his traverse; failing a trig. station, then a corner of a property should be used; and, failing a property-corner, some of the permanent topographical points hereinbefore referred to should be used as zero.

124. The error in closing on the triangulation should not exceed 8 links to the mile, and the total error in any traverse should not exceed 20 links, except in very rough ground.

125. The traverse should commence at the same end, and the pegs should be numbered in the same direction, as that of the original engineering traverse, if any, and each sheet should not contain more than one mile, and should be plotted upon *half-sheet* antiquarian drawing paper, to a scale of three chains to one inch.

126. The names of the present owners of properties should be written on each, wherever they can be ascertained; also the area of land taken for the work.

127. The ground-marking, pegging, &c., should be done generally as directed in a previous part of these instructions.

128. Maps should be drawn in the colours hereinbefore prescribed for working plans, or generally as given in the specimen in Appendix VI. Boundaries of Road Board districts should be edged in light colour, and the name printed in same colour, every district having different shades or colour.

129. An accurate description of the land proposed to be taken from each pro-

party must be furnished with the plan. The following example will serve as a guide:—

"All that piece or parcel of land, containing by admeasurement 27 acres and 3 perches, more or less, situate in the Survey District of _____, Provincial District of _____, being portion of Section No. 42, Block _____, (or Parish of _____), commencing at the northernmost corner of Section No. 51. Bounded generally northerly and north-easterly by the Okehu Creek, 1900 links, or thereabouts; thence generally easterly by lines 360, 352, 418, 521, 362, 447, 492, 365, and 529 links respectively; thence generally northerly by lines 535, 540, 374, 661, 645, 320, 960, 477, and 309 links respectively; thence westerly by public road, 153 links; thence generally southerly by lines 154, 678, 895, 452, 443, 272, 625, 515, and 400 links respectively; thence generally easterly by lines 542, 653, 469, 434, 617, 590, and 420 links respectively; thence generally southerly by lines 674, 491, and 590 links respectively; thence north-easterly by the Okehu Creek to commencing point, 168 links, or thereabouts."

DEPOSITS.

130. Deposits made for surveys to be executed by, or under the authority of, this department, are, in the first instance, to be handed to, or paid to, the Receiver of Land Revenue or of Gold Revenue, as may be, and will be by him placed in a deposit account.

131. When the plans are received and have been approved, the Chief Surveyor will—in cases where the survey has been made by an officer of the staff—forward to the Receiver an abstract or voucher, duly certified, in favour of the "Public Account." When the survey has been made by an authorized private surveyor, an abstract or voucher for the sum due, in favour of the person employed, will be sent in like manner.

132. The Receiver of Land or of Gold Revenue will, after noting the date and amount of the relative deposit, forward the voucher to the Head Office, Wellington, for approval, and when approved it will be returned to the Receiver, who will pay out of his deposit account the amount into the Public Account or to the surveyor entitled to receive, as the case may be, and should there be a balance he will repay it to the depositor.

INSTRUCTIONS FOR PREPARING MAPS FOR PHOTO-LITHO-GRAPHING.

133. The photographic apparatus of the Head Office is capable of producing plans 15 inches square to scale, and if larger plans than that size are desired they can be made by joining a number of the 15-inch transfers. These latter are, however, seldom so good as the one-plate map, as in transferring there is always a loss of sharpness.

134. To ascertain therefore what scale a map will be reduced to, to come within 15 inches, measure the extreme length of the original in inches, multiply that distance by the scale of chains, links, or feet to an inch of the original, and divide the result by 15. Thus: Size of original plans, 30 inches; scale, 10 chains to an inch = $\frac{30 \times 10}{15} = 20$ chains to an inch, will be the scale of the reduction.

135. Towns may be reduced to any convenient scale. Rural and suburban block or section surveys will be reduced to a uniform scale of 20 chains to an inch, except where a considerable portion of a district has been already printed on

a scale of 30 chains to an inch, in which case the district will be completed on the 30-chain scale. If only, say, two blocks have been printed on a scale of 30 they can be reprinted at 20 to an inch.

136. The paper on which the drawing is made should be perfectly white and smooth, and free from dirt, creases, or wrinkles. Tracing cloth may be used, but tracing paper, unless perfectly white and carefully drawn on, seldom does well.

137. The drawing should be executed with good Indian ink, freshly rubbed down, quite black, and free from grit or glaze.

138. The lines should be firm and clean, not too fine or too close together. They must all be perfectly black, and pale ink must on no account be used. Thick lines in the printing and borders should be well filled in.

139. Washes of any colour are inadmissible.

140. If cross-hatching or shading is required, the lines composing it must be kept as open and distinct as possible, and they should not be too fine, but firm enough to reproduce well. Intensity of shade should be shown by an increase in the thickness of the lines rather than by their being placed close together, as it must be borne in mind that throughout the process there is a tendency for the lines to thicken, so that if they are too close they are liable to block up in the printing, and the work will appear heavy and unsightly. This rule also applies to hill shading, the darker portions of which should be drawn in thick distinct lines, but not crossed and recrossed with fine lines.

141. As the process produces a perfect *fac-simile* of the original, it is essential that the latter should be complete in every respect, and the drawing, printing, and writing should all be done in as neat a style as possible, so that the result may be fit for immediate publication, and not require to be altered or touched up after transfer to stone, by which the work is always damaged more or less. The hair strokes of the printing must not be too fine. Border lines, which could not be conveniently shown on a large scale plan, can be drawn on the stone.

142. When plans are intended for reduction, care must be taken to draw the lines of the proper thickness relatively to the scale of reduction. The printing and detail must also be relatively large in proportion. This rule is often neglected, and the result is the loss of all the finer lines, words, and figures. When drawing for reduction care must be taken to leave sufficient space between the lines of the hill-shading, water-lines, or cross-hatching, so that they may be well separated when reduced, and may not block up in the printing. (See specimens, Appendix XII.)

143. When possible, it will be better to draw the original on a larger scale than is required for the copy, as a photographic reduction is always much sharper and clearer than a reproduction.

144. It is immaterial how the scales on maps for reproduction are shown, but in all cases when the copy is to be on a different scale from the original the scale should be drawn on the plan, and not stated as a scale of so many chains, feet, or miles, &c., to an inch.

J. T. THOMSON,
Surveyor-General.

Approved.

ROBERT STOUT,
Minister of Lands.

APPENDICES REFERRED TO.

APPENDIX I.

TABLE OF LINKS TO BE DEDUCTED FROM EACH CHAIN OF 100 LINKS IN MEASURING SLOPING GROUND.

Angle.	Links.	Angle.	Links.	Angle.	Links.	Angle.	Links.	Angle.	Links.	Angle.	Links.	Angle.	Links.
0 9	02	16 28	4.1	23 48	8.5	29 26	12.9	34 13	17.3	38 23	21.6	42 11	25.9
1 38	04	16 40	4.2	23 57	8.6	29 33	13.0	34 19	17.4	38 28	21.7	42 16	26.0
2 0	06	16 52	4.3	24 5	8.7	29 40	13.1	34 25	17.5	38 34	21.8	42 21	26.1
2 18	08	17 4	4.4	24 13	8.8	29 47	13.2	34 31	17.6	38 39	21.9	42 27	26.2
2 34	1	17 16	4.5	24 22	8.9	29 54	13.3	34 37	17.7	38 45	22.0	42 31	26.3
3 38	2	17 27	4.6	24 30	9.0	30 0	13.4	34 43	17.8	38 50	22.1	42 37	26.4
4 27	3	17 39	4.7	24 38	9.1	30 7	13.5	34 49	17.9	38 56	22.2	42 42	26.5
5 8	4	17 50	4.8	24 46	9.2	30 14	13.6	34 55	18.0	39 1	22.3	42 47	26.6
5 44	5	18 1	4.9	24 55	9.3	30 21	13.7	35 1	18.1	39 7	22.4	42 52	26.7
6 17	6	18 12	5.0	25 3	9.4	30 28	13.8	35 7	18.2	39 12	22.5	42 57	26.8
6 47	7	18 23	5.1	25 11	9.5	30 35	13.9	35 13	18.3	39 18	22.6	43 2	26.9
7 16	8	18 34	5.2	25 19	9.6	30 41	14.0	35 19	18.4	39 23	22.7	43 7	27.0
7 42	9	18 45	5.3	25 27	9.7	30 48	14.1	35 25	18.5	39 28	22.8	43 12	27.1
8 7	10	18 55	5.4	25 35	9.8	30 55	14.2	35 31	18.6	39 34	22.9	43 17	27.2
8 31	11	19 6	5.5	25 43	9.9	31 1	14.3	35 37	18.7	39 39	23.0	43 22	27.3
8 54	12	19 16	5.6	25 51	10.0	31 8	14.4	35 43	18.8	39 44	23.1	43 27	27.4
9 15	13	19 27	5.7	25 59	10.1	31 15	14.5	35 49	18.9	39 50	23.2	43 32	27.5
9 36	14	19 37	5.8	26 7	10.2	31 21	14.6	35 55	19.0	39 55	23.3	43 37	27.6
9 57	15	19 47	5.9	26 14	10.3	31 28	14.7	36 0	19.1	40 0	23.4	43 42	27.7
10 16	16	19 57	6.0	26 22	10.4	31 35	14.8	36 6	19.2	40 6	23.5	43 47	27.8
10 35	17	20 7	6.1	26 30	10.5	31 41	14.9	36 12	19.3	40 11	23.6	43 52	27.9
10 54	18	20 17	6.2	26 37	10.6	31 48	15.0	36 18	19.4	40 17	23.7	43 57	28.0
11 12	19	20 27	6.3	26 45	10.7	31 54	15.1	36 24	19.5	40 22	23.8	44 2	28.1
11 29	20	20 37	6.4	26 53	10.8	32 1	15.2	36 30	19.6	40 28	23.9	44 7	28.2
11 46	21	20 47	6.5	27 0	10.9	32 7	15.3	36 35	19.7	40 33	24.0	44 12	28.3
12 3	22	20 56	6.6	27 8	11.0	32 14	15.4	36 41	19.8	40 38	24.1	44 17	28.4
12 19	23	21 6	6.7	27 15	11.1	32 20	15.5	36 47	19.9	40 43	24.2	44 22	28.5
12 35	24	21 16	6.8	27 23	11.2	32 26	15.6	36 53	20.0	40 48	24.3	44 27	28.6
12 51	25	21 25	6.9	27 30	11.3	32 33	15.7	36 58	20.1	40 54	24.4	44 32	28.7
13 6	26	21 34	7.0	27 38	11.4	32 39	15.8	37 4	20.2	40 59	24.5	44 36	28.8
13 21	27	21 44	7.1	27 45	11.5	32 46	15.9	37 10	20.3	41 4	24.6	44 41	28.9
13 36	28	21 53	7.2	27 53	11.6	32 52	16.0	37 15	20.4	41 9	24.7	44 46	29.0
13 50	29	22 2	7.3	28 0	11.7	32 58	16.1	37 21	20.5	41 15	24.8	44 51	29.1
14 5	30	22 11	7.4	28 7	11.8	33 4	16.2	37 27	20.6	41 19	24.9	44 56	29.2
14 19	31	22 20	7.5	28 14	11.9	33 11	16.3	37 32	20.7	41 25	25.0	45 1	29.3
14 33	32	22 29	7.6	28 22	12.0	33 17	16.4	37 38	20.8	41 30	25.1	45 6	29.4
14 46	33	22 38	7.7	28 29	12.1	33 23	16.5	37 44	20.9	41 35	25.2	45 10	29.5
14 59	34	22 47	7.8	28 36	12.2	33 30	16.6	37 49	21.0	41 41	25.3	45 16	29.6
15 13	35	22 56	7.9	28 43	12.3	33 36	16.7	37 55	21.1	41 46	25.4	45 20	29.7
15 26	36	23 5	8.0	28 50	12.4	33 43	16.8	38 0	21.2	41 51	25.5	45 25	29.8
15 39	37	23 14	8.1	28 58	12.5	33 48	16.9	38 6	21.3	41 56	25.6	45 30	29.9
15 51	38	23 22	8.2	29 5	12.6	33 55	17.0	38 12	21.4	42 1	25.7	45 35	30.0
16 4	39	23 31	8.3	29 12	12.7	34 0	17.1	38 17	21.5	42 6	25.8		
16 16	40	23 39	8.4	29 19	12.8	34 7	17.2						

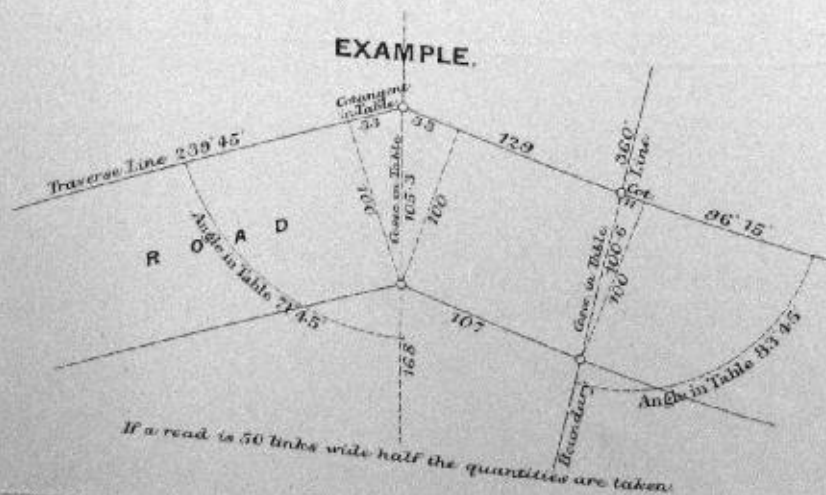
APPENDIX II.

TABLES FOR SETTING OUT THE OPPOSITE ANGLES OF A ROAD.

Natural Cossecants and Cotangents to Radius 100.

Angle.	Cossec.	Cotan.	Angle.	Cossec.	Cotan.	Angle.	Cossec.	Cotan.	Angle.	Cossec.	Cotan.
0			0			0			0		
45	141.4	100.0	51	127.5	79.1	62	112.8	52.3	76	103.1	24.9
6	141.2	99.7	50	127.2	78.6	36	112.6	51.8	15	103.0	24.5
12	140.9	99.3	52	126.9	78.1	48	112.4	51.4	30	102.8	24.0
18	140.7	99.0	10	126.6	77.7	63	112.2	50.9	45	102.7	23.5
24	140.4	98.6	20	126.3	77.2	12	112.0	50.5	77	102.6	23.1
30	140.2	98.3	30	126.0	76.7	24	111.8	50.1	15	102.5	22.8
36	140.0	97.9	40	125.8	76.3	36	111.6	49.6	30	102.4	22.2
42	139.7	97.6	50	125.5	75.8	48	111.4	49.2	45	102.3	21.7
48	139.5	97.2	52	125.2	75.4	64	111.3	48.8	78	102.2	21.3
54	139.3	96.9	10	124.9	74.9	15	111.0	48.2	15	102.1	20.8
60	139.0	96.6	20	124.7	74.4	30	110.8	47.7	30	102.0	20.3
6	138.8	96.2	30	124.4	74.0	45	110.6	47.2	45	102.0	19.9
12	138.6	95.9	40	124.1	73.6	65	110.3	46.6	79	101.9	19.4
18	138.3	95.6	50	123.9	73.1	15	110.1	46.1	15	101.8	19.0
24	138.1	95.2	52	123.6	72.7	30	109.9	45.6	30	101.7	18.5
30	137.9	94.9	12	123.3	72.1	45	109.7	45.0	45	101.6	18.1
36	137.6	94.6	24	123.0	71.6	66	109.5	44.5	80	101.5	17.6
42	137.4	94.2	36	122.7	71.1	15	109.3	44.0	15	101.4	17.2
48	137.2	93.9	48	122.4	70.5	30	109.0	43.5	30	101.4	16.7
54	137.0	93.6	55	122.1	70.0	45	108.8	43.0	45	101.3	16.2
47	136.7	93.3	12	121.8	69.5	67	108.6	42.4	81	101.2	15.8
6	136.5	92.9	24	121.5	69.0	15	108.4	41.9	15	101.2	15.4
12	136.3	92.6	36	121.2	68.5	30	108.2	41.4	30	101.1	14.9
18	136.1	92.3	48	120.9	68.0	45	108.0	40.9	45	101.0	14.5
24	135.9	92.0	56	120.6	67.5	68	107.9	40.4	82	101.0	14.1
30	135.6	91.6	12	120.3	66.9	15	107.7	39.9	15	100.9	13.6
36	135.4	91.3	24	120.1	66.4	30	107.5	39.4	30	100.9	13.2
42	135.2	91.0	36	119.8	65.9	45	107.3	38.9	45	100.8	12.7
48	135.0	90.7	48	119.5	65.4	69	107.1	38.4	83	100.8	12.3
54	134.8	90.4	57	119.2	64.9	15	106.9	37.9	15	100.7	11.8
48	134.6	90.0	12	119.0	64.4	30	106.8	37.4	30	100.6	11.4
6	134.4	89.7	24	118.7	64.0	45	106.6	36.9	45	100.6	11.0
12	134.1	89.4	36	118.4	63.5	70	106.4	36.4	84	100.6	10.5
18	133.9	89.1	48	118.2	63.0	15	106.3	35.9	15	100.5	10.1
24	133.7	88.8	58	117.9	62.5	30	106.1	35.4	30	100.5	9.6
30	133.5	88.5	12	117.7	62.0	45	105.9	34.9	45	100.4	9.2
36	133.3	88.2	24	117.4	61.5	71	105.8	34.4	85	100.4	8.7
42	133.1	87.9	36	117.2	61.0	15	105.6	33.9	15	100.3	8.3
48	132.9	87.6	48	116.9	60.6	30	105.4	33.5	30	100.3	7.9
54	132.7	87.2	59	116.7	60.1	45	105.3	33.0	45	100.3	7.4
49	132.5	86.9	12	116.4	59.6	72	105.1	32.5	86	100.2	7.0
10	132.2	86.4	24	116.2	59.1	15	105.0	32.0	15	100.2	6.6
20	131.8	85.9	36	115.9	58.7	30	104.9	31.5	30	100.2	6.1
30	131.5	85.4	48	115.7	58.2	45	104.7	31.1	45	100.2	5.7
40	131.2	84.9	60	115.5	57.7	73	104.6	30.6	87	100.1	5.2
50	130.9	84.4	12	115.2	57.3	15	104.4	30.1	15	100.1	4.8
10	130.5	83.9	24	115.0	56.8	30	104.3	29.6	30	100.1	4.4
20	130.2	83.4	36	114.8	56.3	45	104.2	29.1	45	100.1	3.9
30	129.9	82.9	48	114.6	55.9	74	104.0	28.7	88	100.1	3.5
40	129.6	82.4	61	114.3	55.4	15	103.9	28.2	15	100.0	3.1
50	129.3	81.9	12	114.1	55.0	30	103.8	27.7	30	100.0	2.6
51	129.0	81.5	24	113.9	54.5	45	103.6	27.3	45	100.0	2.2
10	128.7	81.0	36	113.7	54.1	75	103.5	26.8	89	100.0	1.7
20	128.4	80.5	48	113.5	53.6	15	103.4	26.3	15	100.0	1.3
30	128.1	80.0	62	113.3	53.2	30	103.3	25.9	30	100.0	.9
	127.8	79.5	12	113.0	52.7	45	103.2	25.4	45	100.0	.4

The Cossecant and Cotangent of the angle nearest to half the angle bisected to be taken.



APPENDIX III.

Traverses of

marked

District, Block

, Section

Page of Field Book.	Surveyor's No. of Peg or Trig. Sta.	Cardinal Direction.	True Bearing.	Measured Distance.	Traverses of each Distance.					Total Traverses from Trig.				Remarks.
					On Meridian.		On Perpendicular.		On Meridian.		On Perpendicular.			
					N.	S.	E.	W.	N.	S.	E.	W.		
					Links.	Links.	Links.	Links.	Links.	Links.	Links.	Links.		

* Note that surveyor's numbers should be seen on back of pegs in Roman figures, and distinct from branded section numbers in front or side of pegs.

APPENDIX IV.
TABLE SHOWING ACRES IN SQUARE MILES.

Square Miles.	Acres.	Square Miles.	Acres.	Square Miles.	Acres.	Square Miles.	Acres.	Square Miles.	Acres.
1	640	21	13,440	41	26,240	61	39,040	81	51,840
2	1,280	22	14,080	42	26,880	62	39,680	82	52,480
3	1,920	23	14,720	43	27,520	63	40,320	83	53,120
4	2,560	24	15,360	44	28,160	64	40,960	84	53,760
5	3,200	25	16,000	45	28,800	65	41,600	85	54,400
6	3,840	26	16,640	46	29,440	66	42,240	86	55,040
7	4,480	27	17,280	47	30,080	67	42,880	87	55,680
8	5,120	28	17,920	48	30,720	68	43,520	88	56,320
9	5,760	29	18,560	49	31,360	69	44,160	89	56,960
10	6,400	30	19,200	50	32,000	70	44,800	90	57,600
11	7,040	31	19,840	51	32,640	71	45,440	91	58,240
12	7,680	32	20,480	52	33,280	72	46,080	92	58,880
13	8,320	33	21,120	53	33,920	73	46,720	93	59,520
14	8,960	34	21,760	54	34,560	74	47,360	94	60,160
15	9,600	35	22,400	55	35,200	75	48,000	95	60,800
16	10,240	36	23,040	56	35,840	76	48,640	96	61,440
17	10,880	37	23,680	57	36,480	77	49,280	97	62,080
18	11,520	38	24,320	58	37,120	78	49,920	98	62,720
19	12,160	39	24,960	59	37,760	79	50,560	99	63,360
20	12,800	40	25,600	60	38,400	80	51,200	100	64,000

640 Acres=1 Square Mile.

LONG MEASURE.							SQUARE MEASURE.						
Inches.							Sq. Inches.						
7.92	1 link.						62.7264	1 sq. link.					
12	1.51	1 foot.					144	2.29	1 sq. ft.				
36	4.54	3	1 yard.				1,296	20.66	9	1 sq. yd.			
108	25	16	5.5	1 pole			39,204	625	272.25	30.25	1 sq. pole.		
722	100	66	22	4	1 ch.		1,568,160	25,000	10,890	1,210	40	1 sq. rd.	
7,920	1,000	660	220	40	10	1 fcr.	6,272,640	100,000	43,560	4,840	160	4	1 acre.
63,360	8,000	5,280	1,768	320	80	8	1 mile.						

[For Appendices V. and VI., see Lithograph at end.]

APPENDIX VII.

MONTHLY REPORT for , 18 , of Instructions unacted on, in the hands of Mr. Surveyor , with Statements of Progress and Proposed Course of Duty.

Instructions Unacted on.			Report of Services Performed.				
Date.	Area.	Locality and Tenor of Instructions.	District.	Block.	Section.	Area.	Remarks.
			Proposed Course of Duty for the Month of				

To the Chief Surveyor. | Total cost of party during the month, including | , Surveyor.
salary and allowances of Surveyor, £

APPENDIX VIII.

ANNUAL RETURN BY FIELD SURVEYORS.

RETURN of WORK executed by in the District from , 18 , to , 18 .

	Acres.	Number of Sections.	Cost per Acre.	Total Cost.
				£ s. d.
Major triangulation				
Minor triangulation without topography				
Topographical and trigonometrical survey				
Rural and suburban section survey				
Town section survey				
Mining surveys				
Native Land Court surveys				
Native Land Purchase surveys				
Road and railway surveys (in miles)				
Water-race surveys (in miles)				
Detention by Native opposition or other cause				
Office work (not to include preparation of original plans of surveys executed)				
Other duties				
Total cost of work finished during the year				£
Total cost of party for period 1st July to 30th June				£

REMARKS.—To give, shortly, whether bush or open country, within a gold field, or in an expensive district, cadets over one year's service assisting, &c.

APPENDIX IX.

ABSTRACT of MONTHLY REPORTS of SURVEYORS employed in the General Statement of Surveys to be executed, on 18 of , and

1.—Work Executed.

Surveyor.	District.	Block.	Section.	Area in Acres.	Remarks.

2.—*Work on Hand.*

Name of Surveyor detailed or proposed.	District where Arrears situated.	Number of Sections or Applications.	Total Area to survey.	Remarks.

3.—*Proposed Course of Duty for Month of* , 18 .

Surveyor.	District.	General Statement.

NOTE.—Under "Work Executed" include only such surveys as have been completed and mapped.
 Under "Work on Hand" include all arrears, whether a surveyor has been detailed for the work or not.
 Under "Proposed Course of Duty" indicate generally where each surveyor will probably be engaged during the following month.

To the Surveyor-General, Wellington.

[Appendix X, see following page.]

Chief Surveyor.

APPENDIX XI.

THE following extracts from the Regulations will enable Cadets to judge of the nature of the Examinations under "The Civil Service Act, 1868":—

I.—CONDUCT OF EXAMINATIONS.

Examinations will be held in June and December.

The Board will not examine candidates under the age of fifteen.

All candidates for examination must make application to the Secretary, according to Form A in the Schedule. Certificates of age and character must be forwarded with the application.
 Applications must be lodged not later than the 1st of May for the June examination, and not later than the 1st of November for the December examination.

Notice will be given to candidates by the Secretary to the Board, or by the Local Supervisor, of the exact time and place of examination. Further instructions will also be forwarded at the same time.

II.—SUBJECTS OF EXAMINATION.

JUNIOR EXAMINATIONS.

Compulsory Subjects.

English.—Dictation, reading, spelling, grammar, and composition.

Arithmetic.—including vulgar and decimal fractions.

History.—History of England.

Geography.

SENIOR EXAMINATIONS.

Compulsory Subjects.

English.—Grammar and composition, including abstract and précis writing; also dictation and reading, if the Board think necessary.

Arithmetic.

Plane Trigonometry.

Geography.—Political and physical.

Optional Subjects.

Any two or more of the following subjects, at the option of the candidate:—

Greek.—Any one of the following:—

Xenophon.—Anabasis.

Homer.—Any one book of the Iliad.

Æschylus, Sophocles, or Euripides.—Any one play.

Latin.

French.

German.

Maori.

Algebra.—So far as to include the solution of quadratic equations.

Geometry.—The first four Books of Euclid.

Physical Science.—Outlines of natural philosophy, chemistry, zoology, botany, or geology.

History.—History of England.

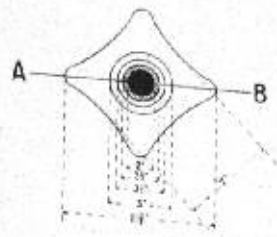
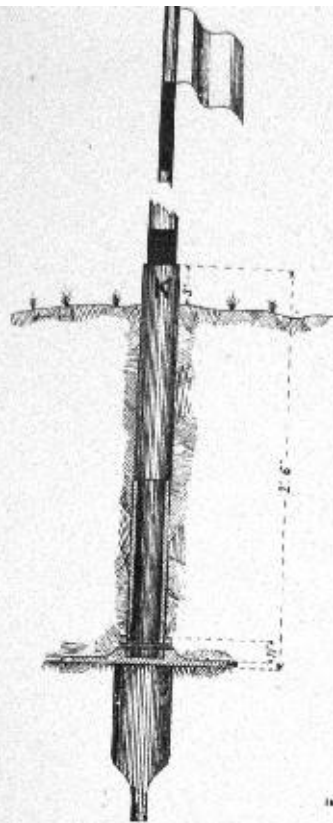
Book-keeping.

Shorthand.

APPENDIX X.
RETURN of FIELD Work executed by Staff and Contract Surveyors in the Provincial District of _____ **, under the supervision of** _____ **from** 18 to 18.

District.	Major Triangulation.			Minor Triangulation.			Topographical and Trigonometrical Surveys.			Rural and Suburban.			Town Section Survey.			Native Land Court Surveys.			Native Land Purchase Surveys.			Gold Mining Surveys.				Roads, Railways, and Water-races.			Detention by Re-lease or other cause.		Other Works.		Total Cost of Surveyor and Party from 1st July to 30th June.		Remarks.
	Acres.	Cost per Acre.	Total Cost.	Acres.	Cost per Acre.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Acres.	No. of Allotments.	Cost per Allotment.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Miles.	Cost per Mile.	Total Cost.	Cost.	Cost.	£ s. d.	£ s. d.		

APPENDIX V

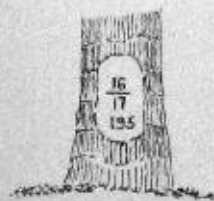
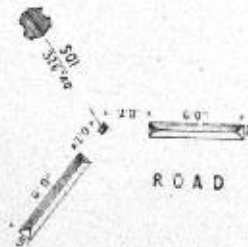
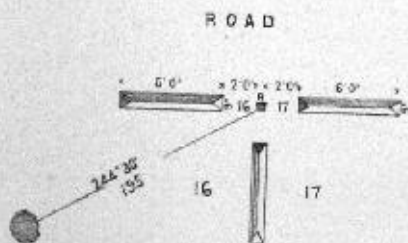


TRIG STATION
Weight Complete 20lbs



Part Elevation and Section
through A. B

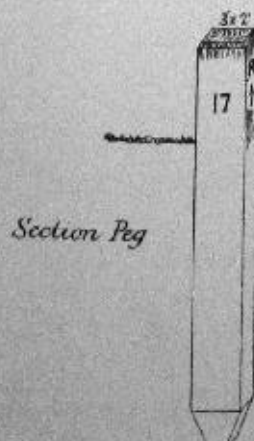
TRENCHES OR LOCKSPITS AND TREE MARKS



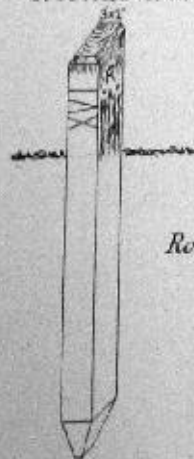
Tree near Corner



Tree near Traverse Line

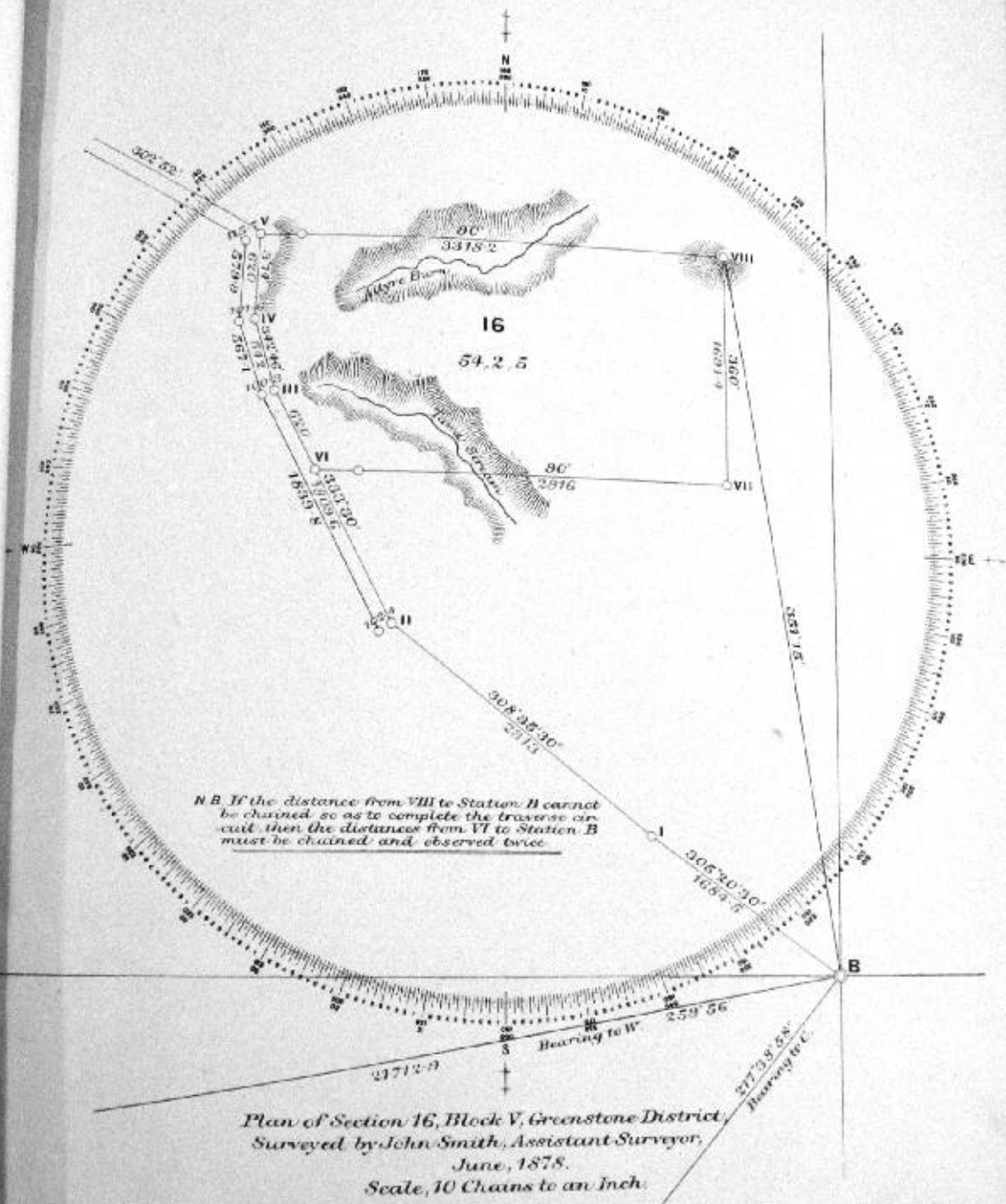


Section Peg



Road Traverse Peg

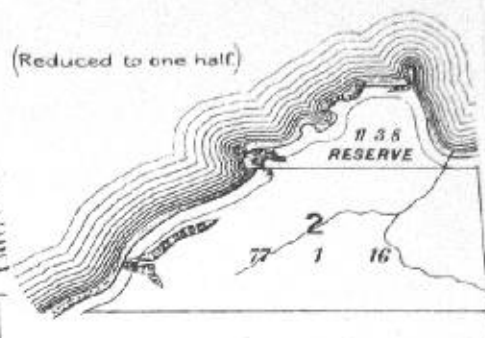
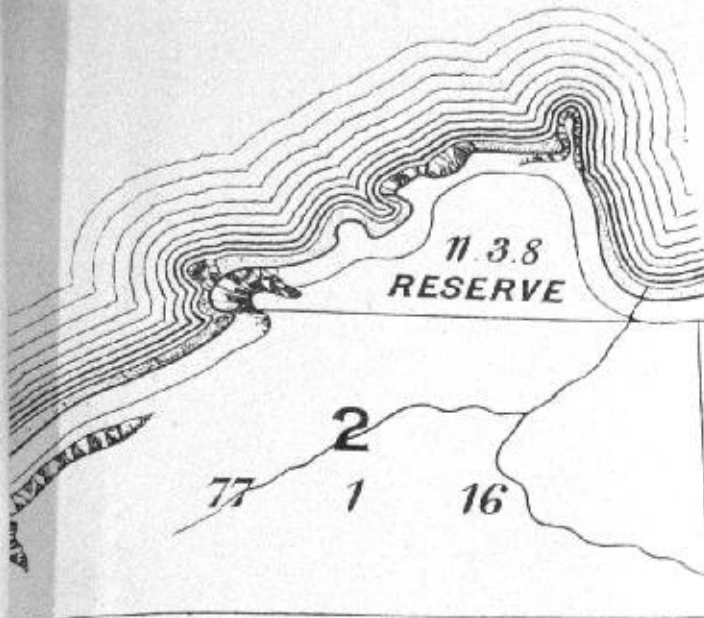
Appendix VI.
SPECIMEN OF SURVEY OF ISOLATED SECTION.



Traverses of Road, &c. Greenstone District, Block V, Section 16.

Traverses of Road, &c. Greenstone District, 1881-2																
Page of Field Book	Surveyed by	Trig. or Trig. Sta.	Cardinal Direction	True Bearing			Measured Distance	Traverses of each Distance				Total Traverses from Trig B.				Remarks
								On Meridian		On Perpendicular		On Meridian		On Perpendicular		
								N.	S.	E.	W.	N.	S.	E.	W.	
3	I	NW	305	20	30	Links	Links	Links	Links	Links	Links	Links	Links	Links		
	II		308	35	30	1684.5	374.4			1374.4	374.4			1374.4		
	III		333	30	30	2813.0	1442.7			1807.9	2417.1			3183.3		
	IV		342	46		1800.6	1610.4			807.4	4036.5			3989.7		
	V	NE	3	14		542.0	517.6			160.5	4559.1			4150.2		
	VI					620.0	619.6		34.9		5173.1			4115.3		
	VII	SE	153	30		620.0		554.8	276.6		4036.5			3989.7		
	VIII	E	80	00		2916.0			2916.0		3481.7			3713.1		
		N	0	00		1610.4	1610.4				5173.1			3713.1		

Note that Surveyors numbers should be given on back of page in Roman figures & distinct from branded Section numbers in front or side of page.



HAWK

HAWK

12
13
14
15
16

REED ST.

12
13
14
15
16

E X E

REED ST.

12
13
14
15
16

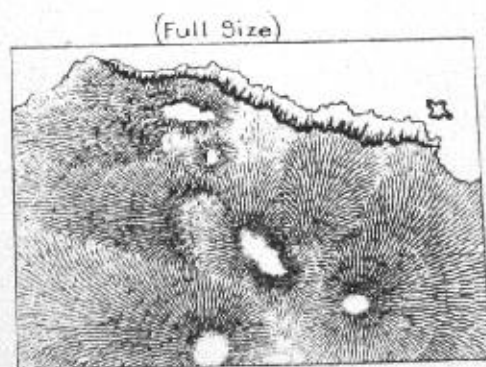
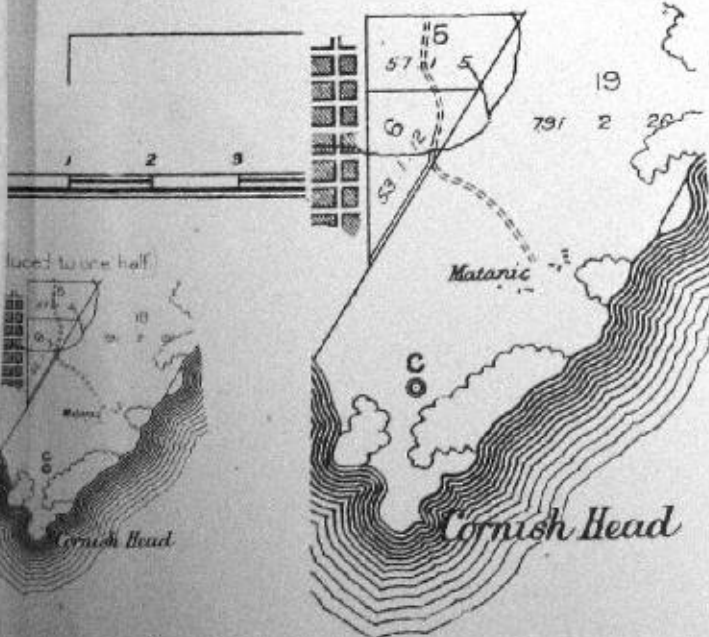
E X E

REED ST.

12
13
14
15
16

E X E

E X E



SPECIMEN SHEET OF
PHOTOLITHOGRAPHED DRAWINGS
FULL SIZE AND REDUCED