Surveyor-General's Direction

No. 7

Surveying and Spatial Information Regulation 2024 - Applications

NSW GOVERNMENT

SURVEYOR GENERAL NEW SOUTH WALES

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Surveying and Spatial Information Regulation 2024 – Applications

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1.1	Aug 1997	New *Surveyors (Practice) Regulation 1996*
1.11	Jan 1999	
1.12	Mar 2000	Introduction of GDA94
2.0	Dec 2004	New *Surveying and Spatial Information Regulation 2002*
3.0	Sept 2017	New *Surveying and Spatial Information Regulation 2017*
3.1	Apr 2019	Review and additional content.
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5.0	Feb 2025	New *Surveying and Spatial Information Regulation 2024*

Document Approval:

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1. Preamble

The *Surveying and Spatial Information Regulation 2024* ('the Regulation'), a Regulation under the *Surveying and Spatial Information Act 2002 ('the Act')*, has been developed by the Office of the Surveyor-General within DCS Spatial Services being a unit of the Department of Customer Service. The Act and the Regulation are administered by the Minister for Customer Service and Digital Government.

The Regulation prescribes minimum standards for surveys that are lodged with a public authority or carried out on behalf of a public authority, including Deposited Plans of survey lodged with the Registrar-General.

2. Introduction

Surveyor-General's Direction No. 7 ('the Direction') has been modelled on the structure of the Regulation. The Direction is to be used in conjunction with the Regulation and other Surveyor-General's Directions.

Section numbers referred to in the Direction are section numbers within the Regulation unless otherwise stated. The Regulation has been structured to contain all like functions in each Part. For example, all the requirements for accuracy are in Part 3 – Accuracy, there are no accuracy statements located anywhere else in the Regulation. If an accuracy requirement is needed there is a reference to the appropriate section in Part 3.

Based on this philosophy:

- Part 1 sets out the fundamental aspects, definitions and the application of the Regulation.
- Parts 2 & 3 set out the measurement and instrumentation standards.
- Parts 4,5,6 & 7 set out the requirements of undertaking the survey including definition of the land surveyed, marking, calculations and office-based activities.
- Part 8, 9 & 10 sets out the requirements to produce the outcome of the survey being the plan, reports and certificates.
- Parts 11,12 & 13 are the administrative functions covered by the Regulation.

The Regulation has one outcome per section to make the Regulation clearer and easier to use.

Notes:

1. Section headings have no effect to the interpretation of the section. These are for easy navigation of the document. The section headings in this document may differ to the exact wording found in the Regulation.
2. Any Section not detailed here is considered to not require any further clarification.
3. Initialisms and acronyms used throughout this document.
    a. PSM – Permanent Survey Mark
    b. RM – Reference Mark
    c. BM - Bench Mark
    d. SCIMS – Survey Control Information Management System
    e. MGA – Map Grid of Australia

3. Part 1 - Preliminary

3.1 Section 2 – Commencement

The Regulation will come into force on the 1 March 2025.

3.2 Section 3 – Definitions

This section has been separated into 'Definitions and the Dictionary'. The Definitions section defines terms as required by the Act, while the Dictionary defines terms used within the Regulation. There are definitions within some sections if that term is not widely used throughout the Regulation or a section that defines a fundamental concept such as 'urban land survey'.

3.3 Section 4 – Urban / Rural Land Survey

Section 4 defines the concepts of 'urban land survey' and 'rural land survey'. This will determine the density of Permanent Survey Marks (PSMs), the size of the pegs used to mark the corners, and the placement of Reference Marks (RMs). The aim is to provide the appropriate level of marking where there is the most activity or the most potential for conflict caused by boundary re-definition.

If the majority of the land surveyed has intervening boundaries greater than 250m the whole survey is deemed to be Rural.

Intersecting boundaries are boundaries that must be marked as part of the survey. **See Diagram 4**.

3.4 Section 8 – Mining Surveys

Section 8 clarifies that the Regulation applies to mining surveys however, there are supplementary guidelines for the conduct of mining surveys and the production of the required plans. The guidelines are published on DCS Spatial Services website under 'Surveyor-General's Direction – mining'. Many Parts of the Regulation still apply these are listed in the Regulation in Section 6(4) for clarity.

3.5 Section 10 – Necessary Information for Land Surveys

This section of the Regulation is fundamental to all surveys.

Prior to every survey, a search must be undertaken to obtain all information relevant to the survey. This includes (but not limited to) the cadastral search from NSW Land Registry Services (LRS), NSW Government Gazettes and the Survey Control search from the Survey Control Information Management System (SCIMS). (see *Surveyor-General's Direction No. 4* for a full description).

4. Part 2 - Equipment and Methods

4.1 The Chain of Traceability.

The chain of traceability is a sequence of measurement standards that are used to relate a measurement result to a reference such as the Australian or State Primary Standard of Measurement. To achieve this, it is necessary to create a chain of events that provide confidence in the measurement methods used and their reliability to produce true and accurate results.

A surveyor undertaking a survey is required to record the instruments used in their field notes as per Section 57(5)(d) & (e), list the Equipment/Methods used on the LRS Plan Checklist under Section 61(3) and store the Reports associated with Sections 12-14 under Section 72. The aim is to be able to trace the linage of each measurement or group of measurements through the chain to the Primary Standard of Measurement. The LRS Plan Checklist is considered part of the plan.

4.2 Section 11 – Approved Measurement Equipment and Methods

It is the responsibility of the surveyor to determine the accuracy of every instrument they use and know the limits of its ability. This will ensure that the measurements taken in any survey are within the required tolerance. The Regulation contains several tolerance specifications; the Regulation specifies the required outcome, not the methods to be used by the surveyor.

The methods which are used to carry out the survey, process the observation data and determine the accuracies obtained are at the discretion of the surveyor; the surveyor must be satisfied and be able to justify that the outcomes required by the Regulation have been met.

Approved equipment, methods of measurement and their verification/validation category are those that are listed in paragraph 4.2.1 below. Any other measurement method requires an exemption.

4.2.1 Approved Equipment and Methods:

- EDM and prism – verified only
- Tape or band – verified or validated
- EDM - reflectorless – validated only
- GNSS – validated only
- Automatic level or digital level – validated only
- Laser scanners – validated only:
    - May be used to collect additional data in cadastral surveys, not to be sole method used for cadastral boundary definition.
    - Limited to Strata used for strata boundaries that are represented by thin or thick lines and have no dimension associated with the boundary.
- Mining – the accuracies and methods required for control, subsidiary and secondary surveys carried out for the purposes of the *Work Health and Safety (Mines and Petroleum Sites) Act 2013*, are specified in the Surveyor-General's Direction *'Survey and Drafting Directions for Mining Surveyors 2020 (NSW Mines)'*.

4.3 Section 12 – Verification of Distance Measuring Equipment

Verification is an annual assessment for Electronic Distance Measurement (EDM) equipment or every two years for a tape or band. This is a direct comparison by an instrument to a known length being the State Primary Standard of Measurement.

Verification is limited to an EDM instrument used with a prism verified against a pillared test line or a tape or band verified by a NATA (National Association of Testing Authorities) certified organisation for length measurement.

Approved procedures for verification are given in *Surveyor-General's Direction No. 5*.

4.4 Section 13 – Validation of Measuring Equipment

This is an annual comparison of an instrument that has not been verified. This will ensure the operator is able to use the instrument and software to measure within the acceptable tolerances specified by the Regulation.

In the case of GNSS equipment, position measurement(s) and techniques must also be validated.

Note: Tapes and metal bands can be either verified or validated instruments.

Approved procedures for validation of measurement equipment and methods are given in *Surveyor-General's Direction No. 9*.

4.5 Section 14 – Confirmation of Measuring Equipment

At every survey, each day the surveyor must ensure that all the measurements made by validated instruments are measuring within the acceptable tolerances specified by the Regulation. This ensures that the equipment is functioning correctly during that survey. These are the normal checks that have always been required under the Regulation.

The quantity of confirmation measurements will vary from job to job. The surveyor is to ensure that there are sufficient confirmation measurements to substantiate that the validated instruments are functioning correctly for the whole survey. When using a validated instrument, confirm by re-measuring enough points to satisfy that the instruments are functioning correctly against a verified instrument, established survey marks, or previously measured survey points that are able to form a link to an appropriate reference standard.

These observations must be recorded in the field notes and be obvious to anyone reviewing the field notes that they are confirmation measurements. These confirmation measurements do not need to be recorded on the plan unless they are used for the datum line or confirming the datum line orientation.

5. Part 3 – Accuracy and Measurement

5.1 Accuracy, Precision and Tolerance

Accuracy means closeness of agreement between a measured quantity value and a true quantity value intended to be measured.

Precision means closeness of agreement among indications or measured values obtained by replicate measurements on the same or similar objects under specified conditions.

Tolerance means the limit of error tolerated as assigned by the Regulation.

All measurements must be expressed at the 95% confidence interval and therefore, the combination of knowing the precision of the instrument from the verification or validation process and undertaking the appropriate number of measurements for each point ensures that the accuracy of the measurement is within the tolerance specified by the Regulation.

Parts per million (ppm): A common expression is 'X'mm + 'Y' ppm this means the allowable tolerance is the specified number of millimetres 'X' plus an additional proportional variable of ('Y'/1,000,000) multiplied by the distance, all expressed as millimetres.

The values in this Part are referred to in many other sections of the Regulation. This is to allow the value to be set once and apply to many situations. This provides an easy to use reference to ensure all occurrences are the same.

5.1.1 Concept of Checks:

All measurements must be checked either by a second independent direct measurement, by an indirect independent measurement and/or calculation or by sufficient independent redundant observations. The check is to be designed to detect gross errors and ensure that the measurements are accurate within the specified tolerances. Checks are to be recorded in the field notes.

5.2 Section 16 – Tolerance of Angular Measurements

If two surveyed lines shown on the survey plan have a common vertex and those lines have bearings shown, the accuracy of the included angle must be within the tolerance of:

$$206265\left(\frac{0.01+\left(\frac{d}{20000}\right)}{d}\right)\ seconds\ of\ arc$$

$$d = length\ of\ the\ shortest\ line$$

Formula A – Tolerance of included angles

Note that neither of the lines can be a compiled line; this is a tolerance for surveyed lines only.

Formula A - Tolerance of included angles on a survey plan is based on the accuracy of length specification of 10mm + 50ppm; it is the angular displacement that results from 10mm + 50ppm of a length applied as an arc at 1 terminal of that length with the centre of the arc being the other terminal. The number '206265' is the conversion from radians to seconds of arc.

The length of the shortest line of the two lines comprising the subject angle is used as the input to determine the tolerance required. This is because a shorter surveyed line will give a larger angular displacement.

Shortest Distance (metres)	Tolerance of included angle (D°M'S")
5	0°07'03"
10	0°03'37"
50	0°00'52"
100	0°00'31"
200	0°00'21"
300	0°00'17"
400	0°00'15"
500	0°00'14"
1000	0°00'12"

Table 1 – Tolerance of included angles - selected values

5.3 Section 17 – Checking Angular Measurements

All angular work must be checked on all surveys. It is at the surveyor's discretion to determine the most appropriate method to check angular work, however, the angular misclose must be determined. The most common methods that are used for checking are as follows:

1. Complete angular close.
   The misclose of the angular close must be smaller than be the lesser of:
   a) the equation 10 seconds + $10\sqrt{n}$, where 'n' is the number of angular traverse stations or
   b) two (2) minutes.
   This method requires the surveyor to undertake a survey that starts and finishes on the same point and observes the first line twice, once at the beginning of the survey and once at the end of the survey.

2. Comparison with established survey marks.
   The surveyor does not have a closed loop traverse, it is acceptable to form a closed traverse using established PSMs of Class D or better. In this situation the surveyor starts on two (2) established survey marks at one end of the survey, then traverses to the end of the survey and closes on two (2) other established survey marks. Then apply the process for a complete close (point 1 above). The comparison between the calculated bearing and the surveyed bearing between two (2) other established survey marks must not exceed the allowable tolerance.

3. Comparison of observations from a different survey method.
   This method is very similar to method 2 however, the start and finish bearings are determined by survey by the surveyor using a different survey method such as GNSS (if a total station was used for the traverse). The GNSS observations used to check an angular misclose must attain an accuracy of Class C or better to be commensurate with the 10mm + 50ppm accuracy requirements.

5.4 Section 18 – Tolerance of Length Measurements

The confidence with which a length is measured is dependent upon the verification of measuring equipment, correct field procedure and well maintained equipment.

The acceptable tolerance of length measurement remains at 10mm + 50ppm. All measured lines on a plan of survey must achieve 10mm + 50ppm.

When measuring distances using EDM, surveyors must apply the appropriate corrections to account for differing meteorological conditions; for example, a change of 1°C in temperature is approximately equivalent to 1ppm of the distance measured using EDM.

5.5 Section 19 – Checking of Length Measurements

All measurements must be checked. There are several methods where this can be achieved.

1. Using a different method to measure the same line.
   In some instances it is possible to use a different method to measure the same line thereby providing an independent check that the measurement is correct.
   An example may be a line may be measured by total station as one method and by GNSS as an independent check.

2. Calculating the length from other measurements in the survey.
   In other cases it is advantageous to calculate the close of other measurements made in the survey to determine if the measurement made is correct. An example may be that a RM is radiated with a total station and then a fence post nearby is radiated and a taped distance between the RM and the fence post is measured and the close calculation undertaken to ensure that the two measurements agree.

3. Sufficient redundancy of independent observations.
   Several independent observations may be made to prove that the result is correct.

5.6 Section 20 – Tolerance of Relative Position

When conducting a survey, a surveyor must ensure that the accuracy of the measured relative positions between any two (2) surveyed points is within the tolerance of:

$$\sqrt{2\left(0.01+\frac{d}{20000}\right)^2}\ metres$$

where d is the distance in metres between the points

Formula B – Tolerance of relative position

Note that neither of the points can be a compiled point; this is a tolerance for surveyed points only.

Formula B - Tolerance of relative position is based on the tolerance of length specification of 10mm + 50ppm; formally it is the vector displacement that results from 10mm + 50ppm of the length of the subject vector between two surveyed points applied as two vector components; one being parallel to the subject vector, the other at right-angles to the subject vector. Practically speaking, for a bearing and distance between any two surveyed points, it is 10mm + 50ppm of the distance applied as both distance and swing at one end of that bearing and distance.

Distance (metres)	Tolerance of relative position (metres)	Class C precision Semi-major axis (m) REE (95% confidence level)
10	0.015	0.016
50	0.018	0.019
100	0.021	0.023
200	0.028	0.030
300	0.035	0.038
400	0.042	0.045
500	0.049	0.053
600	0.057	0.060
700	0.064	0.068
800	0.071	0.075
900	0.078	0.083
1000	0.085	0.090

Table 2 – Tolerance of relative position - selected values

It can be noted from Table 2 - Tolerance of relative position - selected values that the tolerance of relative position is very close to that of a Class 'C' precision of the semi-major axis of a relative error ellipse as specified by SP1 Version 1.7, published by ICSM.

5.7 Section 22 – Tolerance of Horizontal Comparisons

The comparison of measurements to other sources of information or data is a necessary part of cadastral surveying. If a comparison of measurement or derived dimension from the survey is made to any other source of information such as a document of title or survey plan (not just SCIMS), and the difference between the two values is greater than 40mm+200ppm there is a reportable discrepancy and hence an explanation is required in a report.

5.8 Section 26 - Checking Accuracy of Measurements and Calculations

A sequence of bearings and distances that start and end at the same point is termed a 'close'; it can be thought of as a closed 'loop' of lines with complete dimensions.

All closes on the survey plan MUST be checked and be within tolerance.

5.8.1 Checking Closes of Surveyed Lines.

Section 26(1) states that the closure of 'all measurements' of 'all surrounds' comprising the survey must be checked.

This means that every 'close' of surveyed lines shown on the survey plan must be checked for compliance with the misclose vector tolerance of 15mm + 100ppm required by Section 26(2). This is a fundamental requirement of a survey plan. There are no circumstances in which non-compliance with this requirement is acceptable.

The single misclose tolerance of 15mm + 100ppm applies for all surveyed closes for all forms of terrain. This specification applies to both surveyed land parcels and surveyed connections to the land surveyed that can be 'closed', such as connections from PSMs to the land surveyed.

5.8.2 Checking Closes of Partially Surveyed Lots.

Partially surveyed or partially compiled are two ways of indicating the same survey, however, they refer to different parts of the same parcel. Part of the parcel is surveyed, and the other part is compiled. Hence different misclose tolerances apply to the different parts of the parcel.

If 'partially surveyed' is used, it is likely that the statement is about the surveyed portion of the lot and likewise if 'partially compiled' is stated, then it is likely that the statement is about the compiled part of the parcel. However, care must be taken to ensure the intent is achieved regardless of the wording.

The Regulation also requires complete dimensions (i.e. bearings and distances of all boundary lines if available on any registered plan for that title) of all partially compiled residue lots are shown on the survey plan. This is required for two reasons:

1. Prevent systematic stripping of boundary dimensions whenever the partially compiled residue lot does not close or agree, and
2. Enable more flexible tolerances for digital plan preparation and assessment of partially compiled residue lots.

In this regard a table of misclose tolerances for the checking of closes for partially compiled residue lots is shown in Section 26(3); it is also reproduced below in Table 3 - Misclose vector tolerances for partially compiled lots. The Registrar-General's Guidelines for partially compiled plans must be adhered to; that is, the bearing and distance of each boundary must be derived only from the plan or plans that define the current title. The adjoining plans must not be used to source the boundary dimensions (i.e. bearings and distance). Only abuttal information is to be sourced from other survey plans.

Age of survey	**Length of misclose vector for level or undulating terrain**	**Length of misclose vector for steep or mountainous terrain**
1788 up to 1862	1000ppm	2000ppm
1862 up to 1975	500ppm	1320ppm
1975 up to 2001	500ppm	1000ppm
2001 up to present	60mm + 400ppm	60mm + 400ppm

Table 3 – Misclose vector tolerances for partially compiled lots

The terrain type of the land should be determined by reference to the following categories:

- 'Level,' where the slope does not exceed three (3) degrees;
- 'Undulating,' where the slope ranges from three (3) degrees to 10 degrees;
- 'Mountainous,' where the slope exceeds 10 degrees.

If the lot does not close within the tolerances specified above the surveyor must either resolve the inaccuracy by surveying additional boundaries or explain the discrepancy in a comprehensive report. The report must be lodged with the survey plan.

If parts of the dimensions of the partially compiled lot are compiled from plans that fall under different age categories, then the contribution of the compiled dimensions in each age bracket to the overall misclose vector must be calculated separately; in such a case, do not use a single overall misclose tolerance and apply to all dimensions.

5.9 Section 27 – Checking Area

All areas of the parcels defined must be calculated. Any published formula or commercial software is accepted as an approved method however, it is the surveyor's responsibility to ensure that the method used provides the correct answer.

Reasonable steps must be taken to ensure that the process used to determine areas provides reliable results.

When calculating and area from the dimensions on the plan, the resulting calculated area must be the same as the area stated on the plan to the appropriate number of significant figures as required by the Registrar-General.

Area determined by mechanical means such as a planimeter are not acceptable.

6. Part 4 – Horizontal and Vertical Datum

6.1 Section 28 – Horizontal Datum Line and Orientation

6.1.1 Datum Line Overview

'MGA all the way'.

Establishing datum is paramount to the reliability, traceability and spatial enablement of the survey. To maintain a reliable State control survey and State cadastre, boundaries must not only be accurately measured but must be related to survey marks and the State control survey network. To achieve this, the survey must be based on the most reliable, traceable and up-to-date information available.

Section 28 requires all surveys to adopt a Map Grid of Australia 2020 (MGA2020) orientation and MGA2020 position.

6.1.2 Datum Line for Each Survey

The survey is required to determine the position of the survey marks used for the datum line and each confirmation line for each survey. Each stage of a development may have the same datum marks but requires a unique connection for that survey.

Multiple surveys may use the same coordinates for the survey provided that the coordinates are obtained from SCIMS or the surveyor has determined the coordinates by an approved GNSS method. A survey must not use coordinates determined from a plan.

6.1.3 Survey Marks for Datum

Only PSMs or RMs may be used as datum points. Established survey marks are no longer mandated because it is possible for a surveyor to determine their own accurate MGA coordinate value on an established survey mark for their survey, using an approved GNSS method. This is to allow a homogeneous datum solution for each survey. An accurate MGA coordinate is defined in the Regulation and has a tolerance specified in Section 25.

The form and style of marks that can be used to define the terminals of the datum line under this section are RMs or PSMs as detailed in Schedules 3 & 4 of the Regulation. The marks comprising the terminals of the datum line do not have to be of the same form and style (i.e. a RM at one terminal and a PSM at the other terminal is acceptable).

If a mark of the form and style of a RM is being used exclusively to define a terminal of the datum line, that is, if the mark has not been referenced to a boundary corner, then that mark does not need to be within 30m of a boundary corner. In such a case, the mark should be shown in its actual position and by the appropriate symbol (the 'double circle') as described in Schedule 5 of the Regulation and have a direct connection to a corner of the land surveyed.

Under the Regulation, it is now acceptable to mix and match coordinates from SCIMS (established marks) and approved GNSS methods. This may cause issues for the survey as adopting values from various sources may result in the comparisons exceeding the allowable tolerance required in Section 22.

Note: It is recommended that mix and match scenarios do not include coordinates from established survey marks that have a Source Number of 300002. The reason for this is outlined in paragraph 6.1.9 established survey mark status.

6.1.4 The '1500m Rule'

The two survey marks used to determine the horizontal datum line must be within 1500m of the land surveyed. This is regardless of the survey being urban, rural or the purpose of the survey. This allows for project datums to be adopted for staged developments or other developments that may require a consistent orientation for the life of the staged project. This also ensures that the survey marks used for the datum of the survey are within a reasonable proximity to the land surveyed. A third survey mark is also required and is discussed below.

6.1.5 Adopting Grid Bearing

The surveyor must adopt the grid bearing derived from the accurate MGA coordinates of the survey marks defining the datum line as the orientation for the survey. This ensures that all survey plans are on the same orientation and compatible with current mapping systems.

Where an MGA orientation is adopted from accurate MGA coordinates, the surveyor must adopt the grid bearing calculated from one survey mark to another survey mark. Grid bearings can calculate differently depending on the direction calculated in certain circumstances in NSW therefore there is an obligation for the surveyor preparing a plan of survey for registration to show the grid bearing in the direction that has been adopted to orientate the plan. Generally, the difference between the two is negligible in a cadastral sense due to the small distances between adopted marks but in rural NSW the difference can be considerable.

6.1.6 Datum Line Confirmation

The datum line determined must be confirmed by connection to a third survey mark that has accurate MGA coordinates by bearing and distance. This provides a triangle (as a minimum) that proves the datum is reliable and proven in the survey. The third survey mark is not required to be within 1500m of the land surveyed.

All lines used to determine datum and confirm the datum require comparisons to be determined between the survey marks. The comparison is between the surveyed bearings and distances and those bearings and distances calculated from the accurate MGA coordinates of the survey marks.

If the comparison on the datum line or a datum confirmation line(s) reveal differences exceeding the tolerance in Section 22, between measured values and those calculated from the accurate MGA coordinates, then the surveyor is required to undertake two further actions:

1. Measure and show on the survey plan an additional connection to at least one other survey mark that has accurate MGA coordinates, with comparisons shown, and
2. Prepare a report that outlines the difficulty and the solution by supplying all the relevant data to replicate the problem and the source of the data as required by Part 10.

The comparison difference shown for the datum line will apply to the distance only as the datum line adopts the grid bearing from the accurate MGA coordinates; the comparison of the measured and calculated distances for the datum line is still subject to the Section 22 criteria.

Note: The historical practice of sighting to a distant object (e.g. distant Trig Station) to confirm orientation is no longer accepted as it only confirms part of the overall requirements. To confirm that the survey is on datum the comparisons between three marks by bearing and distance is required.

While a surveyor may still use this practice in the survey, it should not be shown on the plan because Section 63(1)(a) requires 'sufficient information to connect all survey marks shown on the plan by bearing and distance' as was the case in Clause 63(1)(a) of the Regulation 2017.

6.1.7 Closed Loop Connections

There are two requirements for the survey marks used for datum. The measurements must be determined and shown on the plan.

1. The datum line must be connected in a closed loop by direct lines to separate corners of the land surveyed.
   Meaning a closed loop through cadastral boundaries.
   This requirement does not apply to the survey mark used for the Confirmation of Datum.

2. Both the datum line and all confirmation lines must be contained in a closed loop connected by direct lines.
   Meaning that no cadastral boundaries are contained in this loop.

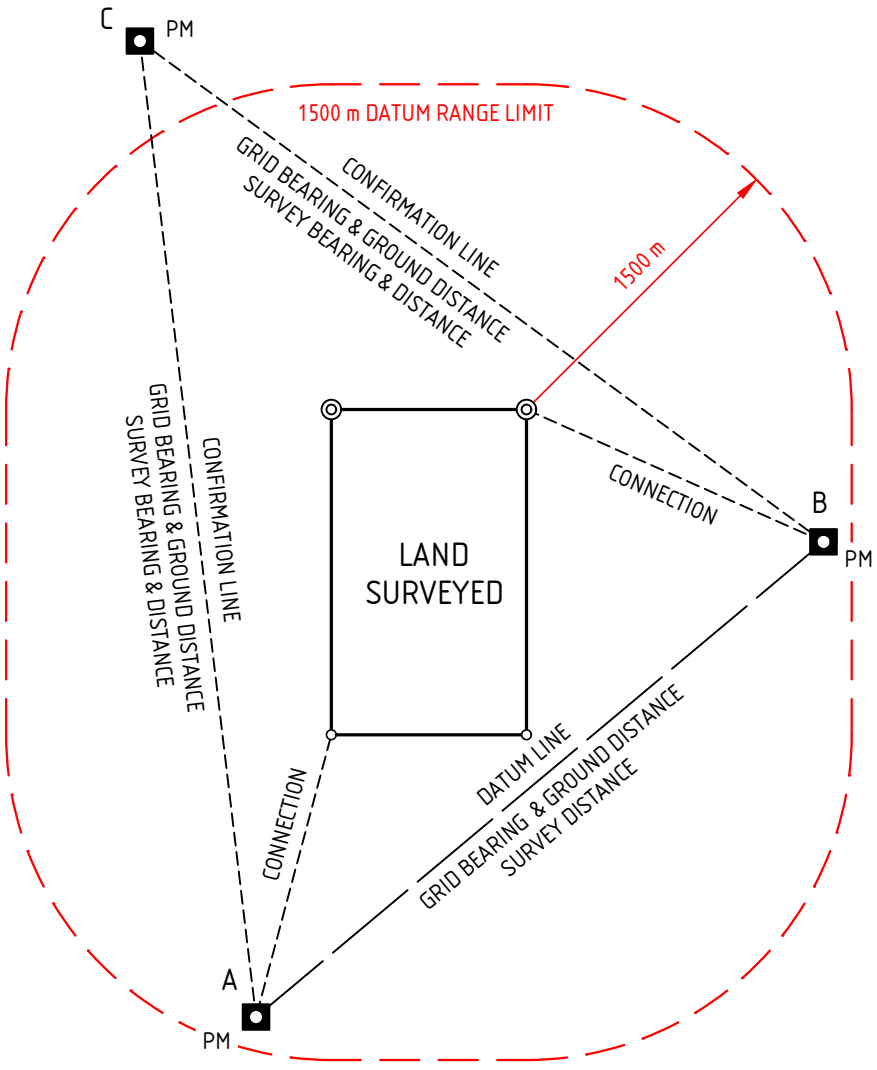


Diagram 1 – Datum marks and connections

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

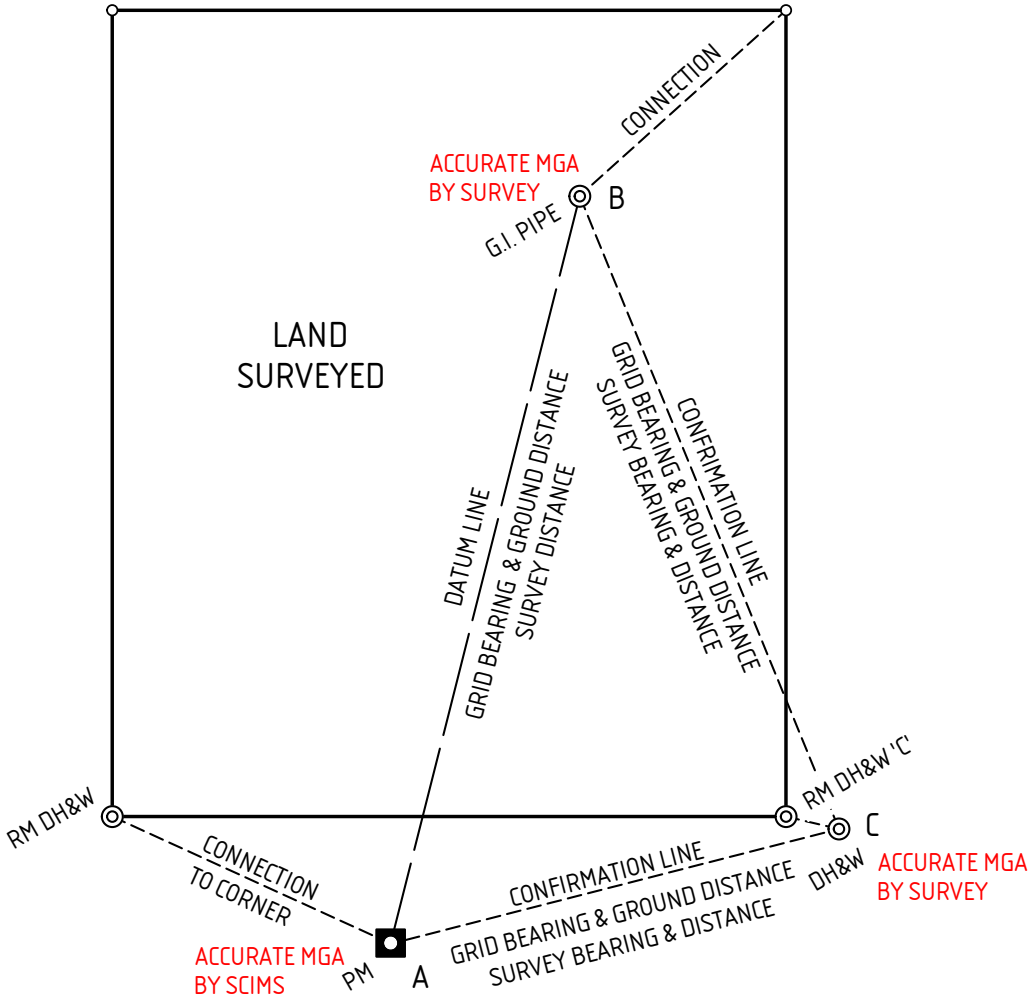


Diagram 2 – Alternate datum marks and connections using reference marks within 1500m of surveyed land

Note: Only dimensions and details relevant to this example are shown. All other requirements must be shown in accordance with the Regulation.

6.1.8 Approved GNSS Methods for Datum

Surveyor–General's Direction No. 9 specifies the GNSS methods that are approved by the Surveyor-General.

Not all approved GNSS methods are valid for determining accurate MGA coordinates used to determine the datum line under Section 28.

However, all the approved GNSS methods are otherwise valid for carrying out the survey, subject to the provisions of the Regulation and Directions.

The approved GNSS methods that may be used to determine accurate MGA coordinates from which a grid bearing is derived and adopted for datum line orientation are as follows:

- AUSPOS
- CORS NRTK (Network Real-Time Kinematic)
- CORS single-base RTK
- CORS static

Surveyor-General's Directions have comprehensive details regarding use of Approved GNSS Methods and should be read in conjunction with this section.

While Single-base RTK GNSS is an approved GNSS method for surveying, it is not an approved method to determine accurate MGA coordinates for datum. i.e. Single-base RTK GNSS not originating from a CORS station must adopt accurate MGA coordinates from established survey marks, similar to using a total station.

6.1.9 Established Survey Mark Status

Established survey marks used to adopt and confirm a SCIMS MGA orientation must have the appropriate mark status in SCIMS. Only use survey marks that are assumed to be stable and reliable as the basis of a datum line or confirmation line (i.e. mark status 'F' = found, 'Null' = nothing recorded - assumed OK). Do not use survey marks that have been reported as 'D' = destroyed, 'S' = subsided 'U' = uncertain; do not occupy survey marks reported as 'R' for restricted access without consent from the appropriate authority.

Source Number 300002 explained:

Source number 300002 is designated to all double transformed coordinates. That being transformed from AGD66 to GDA94 to GDA2020. None of the marks with the source number 300002 have been readjusted to GDA2020. Marks derived from Source 300002 will only be accurate to about 0.1m and hence will most likely fail the 'Confirmation Test'. There are currently 6,853 marks in SCIMS derived using Source number 300002.

The confirmation tolerance is shown in Section 22 as 40mm + 200ppm. The difference in datum when using marks from Source number 300002 is about 100mm, therefore after normal centering errors, measurement errors, datum realisation errors, the transformed mark will need to be at least 500m from the other marks used to have any chance of passing the confirmation test.

6.1.10 GridCalc (GDA2020).

The Regulation allows surveyors to derive ('bring your own') accurate coordinates for any PSMs and RMs using an approved GNSS method for survey plan orientation purposes.

The primary purpose of 'GridCalc_GDA2020_NSW.xlsm' is to calculate a grid bearing, ground distance, Combined Scale Factor (CSF) and other relevant geodetic elements between two points given the MGA2020 coordinates and Australian Height Datum 1971 (AHD71) values of two points within the same MGA zone. 'GridCalc_GDA2020_NSW.xlsm' is intended for distances between points less than 50km.

'GridCalc_GDA2020_NSW.xlsm' is available from the DCS Spatial Services website, Surveyor-General Directions page, under *Direction No 7*.

6.2 Section 29 – Vertical Datum

All height determinations are to be related to the Australian Height Datum 1971 (AHD71). However, if a surveyor wishes to use another datum, an exemption to use such a datum is required from the Surveyor-General. **See Appendix A**.

Section 29(2) relates to the adoption and confirmation of the datum used. See Schedule 9 of the Regulation for the definition of 'accurate AHD value'.

The accuracy a surveyor must attain for height differences in a survey is found in Part 3 Accuracy and measurement of the Regulation, Sections 23 & 24.

6.2.1 Datum Marks Form and Style.

The form and style of marks that can be used to define the terminals of the vertical datum under this section are bench marks (BMs) or PSMs as detailed in Schedules 1 & 4 of the Regulation.

7. Part 5 – Boundaries

7.1 Section 30 - Re-survey of Property Boundaries

This section is designed to ensure that the boundary definition is in accordance with legislative requirements and cadastral boundary principles. There is a hierarchy of evidence that applies to the facts and evidence that have been observed and recorded during field surveys in NSW. A thorough review of the hierarchy of evidence is outlined in 'Legal Aspects of Boundary Surveying as Apply in NSW' by Hallman and 'Some Aspects of Title Boundary Location in NSW' by K E Hamer.

The hierarchy of evidence is summarised below:

1. Natural features
2. Original Crown marking of grant boundaries
3. Monuments
4. Original undisturbed marking of private surveys
5. Occupations
6. Measurements.

The relative importance of each matter is subject to other evidence to the contrary. Further, all the land in each title affected by the survey must be accounted for in the survey. It is also a principle of law that a transfer or conveyance is construed more strongly against the grantor.

When undertaking a survey, the surveyor must identify and locate all the relevant survey marks, monuments and occupations within one metre of or relevant to the boundary to re-instate the boundary as originally positioned and marked on the land. Consideration must always be given to ensure that the evidence as located has not been disturbed.

The aim of a cadastral survey is to prove the title entitlement and form common boundaries with the abutting land, without creating overlaps or hiatus. The cadastre is based on the principle of 'monument over measurement' hence, the monuments must be adopted unless disturbed. However, this must be achieved while recognising that there will be measurement differences and also shortages or excesses in the land available. The surveyor needs to prove that there is enough land for the adjoining titles and that they are not taking more than they are entitled to or that is equitable.

The road should not be used as a buffer to accommodate excesses and shortages. Depending on the type of the survey approval may be required by the relevant road authority.

When dealing with land that abuts 'aligned streets', this means, streets that have been affected by an alignment action (i.e. an alignment plan), the alignment marks placed in the alignment survey will supersede any survey mark, monument or definition that defined the road alignment prior to the alignment survey. Hence, the alignment marks found must be adopted, over the other survey marks and monuments placed before the alignment survey, provided that the alignment marks have not been disturbed.

7.2 Section 35 – Partial Surveys

The Torrens Titling system is based on the concept that every title should have an accurate title diagram. The title diagram defines the size, shape, extent and abuttals of the land included in the title and the location of any affecting interests on the land.

If the title diagram complies with Section 26 a partial survey may be undertaken if the total area of the land, parent title/s involved, in the partial survey is greater than 10 hectares. If the title does not have a reliable title diagram a full survey is required. This restriction does not apply to acquisition surveys.

The purpose of this is to ensure that all small titles remain fully surveyed. Partial surveys should only be undertaken where it is excessively onerous to complete a full survey of the title/s affected.

To undertake a partial survey the surveyor is required to start and finish on known survey marks or monuments that are shown on registered plans of survey. Preferably from the title/s affected by the survey. If there are no monuments that define the affected titles, extensive survey may be required to redefine the boundaries. This will create a connection from the terminals of the survey to the monuments in known relation to the corners of the land.

Considering the extent of the survey, it is good survey practice not to adopt a survey mark or monument without proving it is, a) the mark the surveyor believes it is and b) that it is not disturbed, and (c) generally agrees with the parent survey plan. Hence, the surveyor needs to confirm the position of each terminal of the survey by surveying additional survey marks or monuments.

For the 'surveyed land' rather than the extent of the survey the surveyor is required to identify the terminals of each part surveyed. This means each end of the existing boundary that is intersected by the new boundary and where the new boundary intersects the existing boundaries. A unique letter should be used to label each point of the boundary. There are several benefits to providing unique identifiers to specific corners (see **Diagram 3** below) assume there is an existing boundary 'A'-'C' and on the other side of the property a boundary 'D'-'F' with the new boundary going from 'B'-'E' as an example ('B' being between 'A' & 'C' and 'E' being between 'D' & 'F'. All boundaries 'A'-'C', 'B'-'E' and 'D'-'F' must be defined by survey. Another common scenario is when cutting a small corner block (house paddock) out of the larger holding (see Diagram 4).

A connection between the terminals of the land surveyed 'A'-'F' and 'C'-'D' must be determined by survey and also by complied lines. This is to prove that the survey closes within the tolerance as defined in Section 26(2) and that the compiled boundaries close within the tolerance set by Section 26(3)(b). It will also assist describing the 'part of the land shown in this plan, being .....' that was surveyed and required by Section (b) of the Survey Certificate (Form 1).

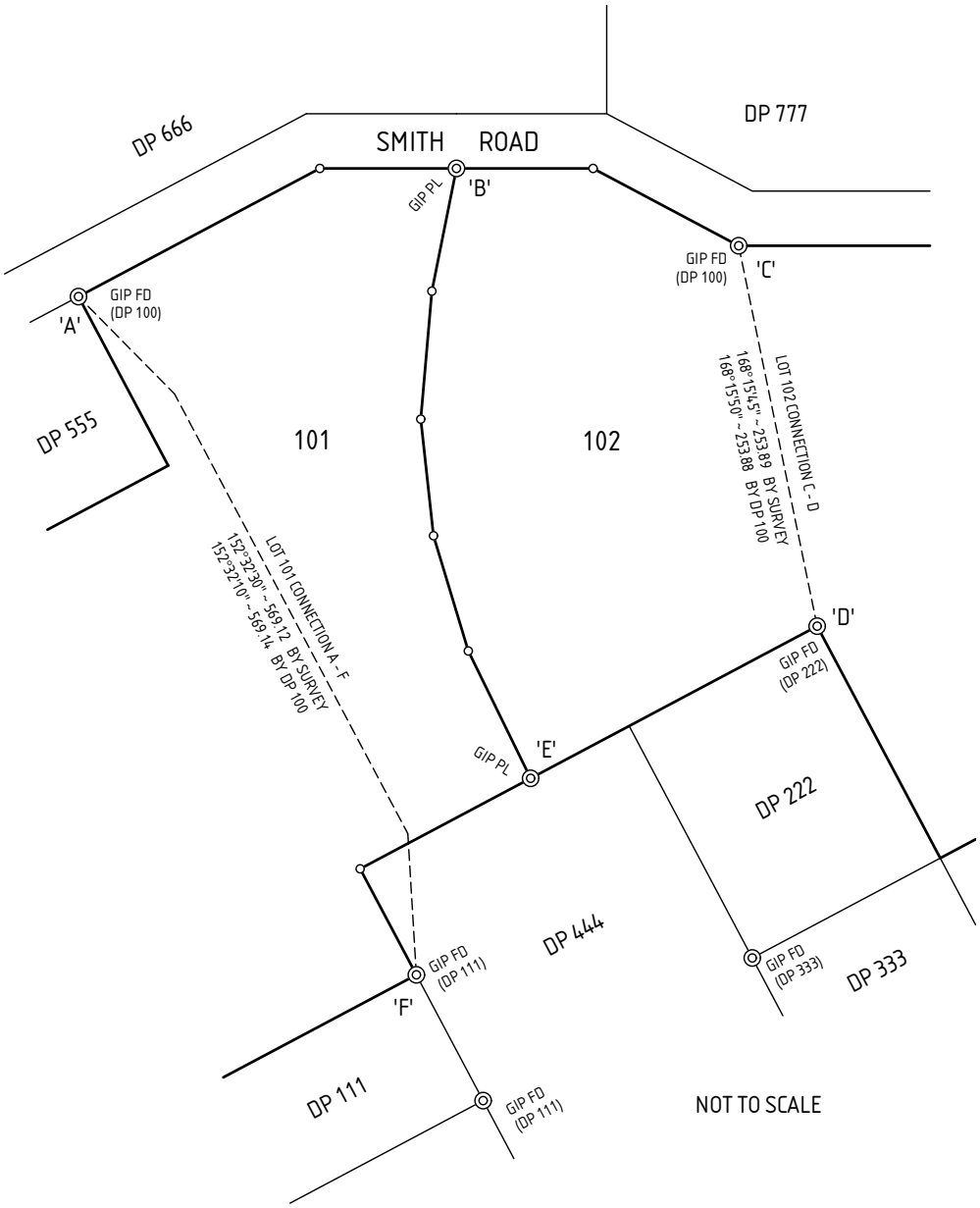


DIAGRAM IS FOR CONCEPTUAL PURPOSES ONLY

NOTES:

- EXAMPLE DEFINITION FOR A PLAN OF SUBDIVISION OF LOT 1 DP 100 BY PARTIAL SURVEY
- TOTAL AREA OF SUBJECT LAND, LOT 101 + LOT 102 > 10 Ha
- TERMINALS OF NEW BOUNDARY 'B' AND 'E' MARKED AS PER S.52(4)
- THE MISCLOSE VECTORS OF ALL LOTS ARE WITHIN THE LIMIT SPECIFIED IN S.26

Diagram 3 – Partial survey.

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

Intersecting boundaries (**Diagram 4** below) are the boundaries that are intersected by the new boundary being created. A surveyor is only able to define the clients land and therefore the surveyor is not required to mark any boundary that is not part of the subject title. From a titling perspective a long line that defines the boundary of Lot 102 and is also the common boundary of parcels 200, 300, 400 & 500. Lot 102 does not have vertices along the line for each of the adjoining titles and therefore these are not intersecting boundaries. Parcels 200, 300, 400 & 500 each share a common boundary with Lot 102 and therefore that boundary should have the same

definition as Lot 102 or there will be an overlap or hiatus created. An intersecting boundary means that there is a distance required to be shown on the plan between the corners of that title.

Partial surveys should not be undertaken on an undefined lot, as the title is not based on an accurate and reliable survey. However, in some rare instances this may be required, in those instances the boundaries that are intersected by the new boundary must be wholly defined by survey to ensure that the new boundary point does not create an overlap or hiatus with the adjoining titles. The survey must prove that it forms common boundaries with the adjoining land.

The primary outcome of any partial survey is that every surveyed boundary must be in a closed loop of boundaries or connections between boundary terminals.

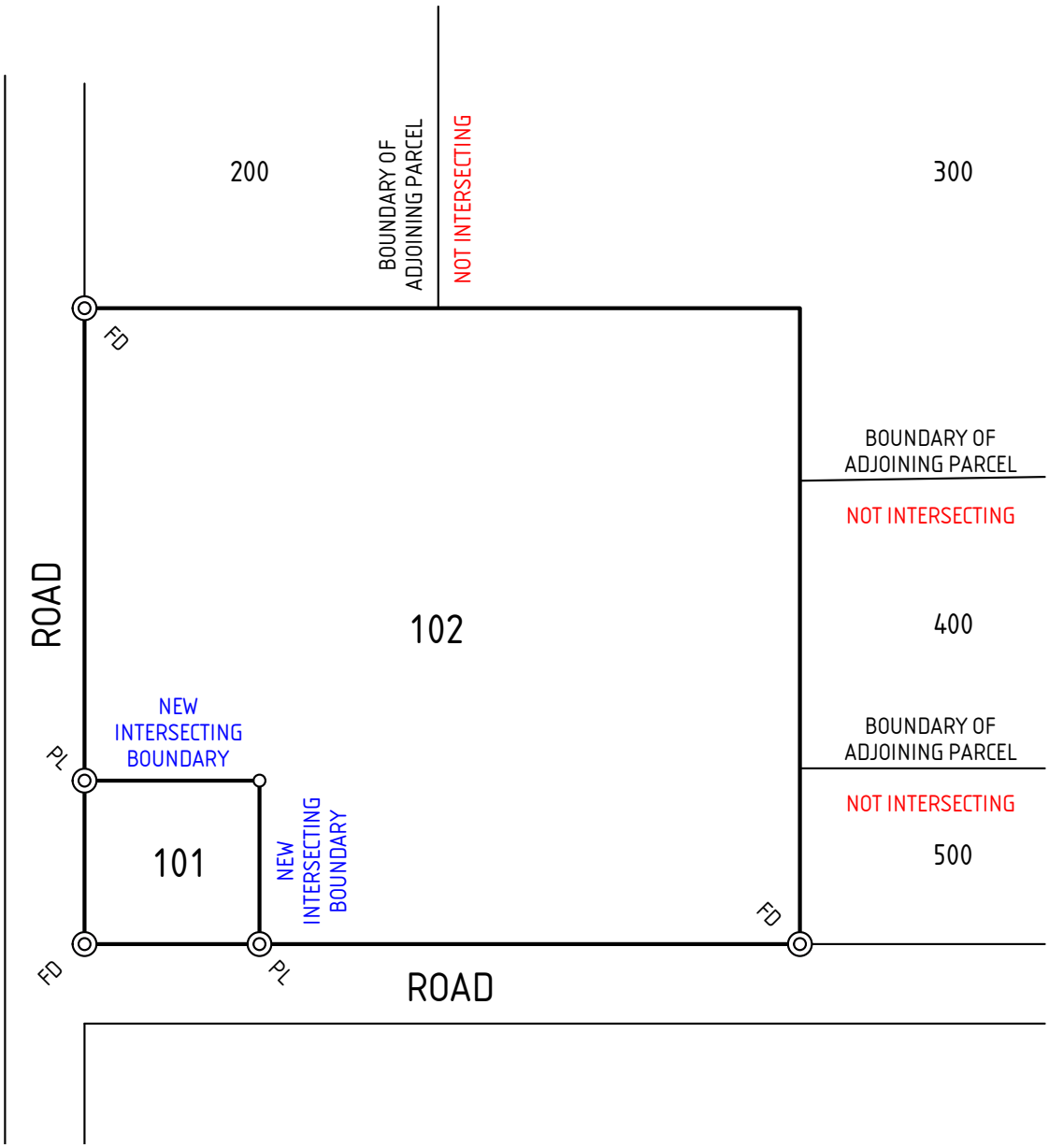


Diagram 4 – Intersecting boundaries.

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

7.3 Section 37 – Stratum Surveys

A stratum survey is any survey that limits a title or part of a title in height or depth or both.

Section 37 specifies the requirements for the BMs that must be related to the site of the subject survey. The BMs that must be related to the site of the subject survey may or may not include those BMs required by Sections 29(2) to acquire and confirm vertical datum.

The introduction of the new BM within 30m requirement is the equivalent of a RM but for height. This is to ensure that there is a survey mark or monument with accurate height within close proximity to the site. This means that a surveyor is only required to level from the BM within 30m of the site to the PSM within 250m of the site.

- All BMs are to be related to the survey by bearing and distance.
- All BMs are to have MGA Coordinates.
- A minimum of two BMs with accurate height are required to connect to the vertical datum of the survey (usually AHD71)

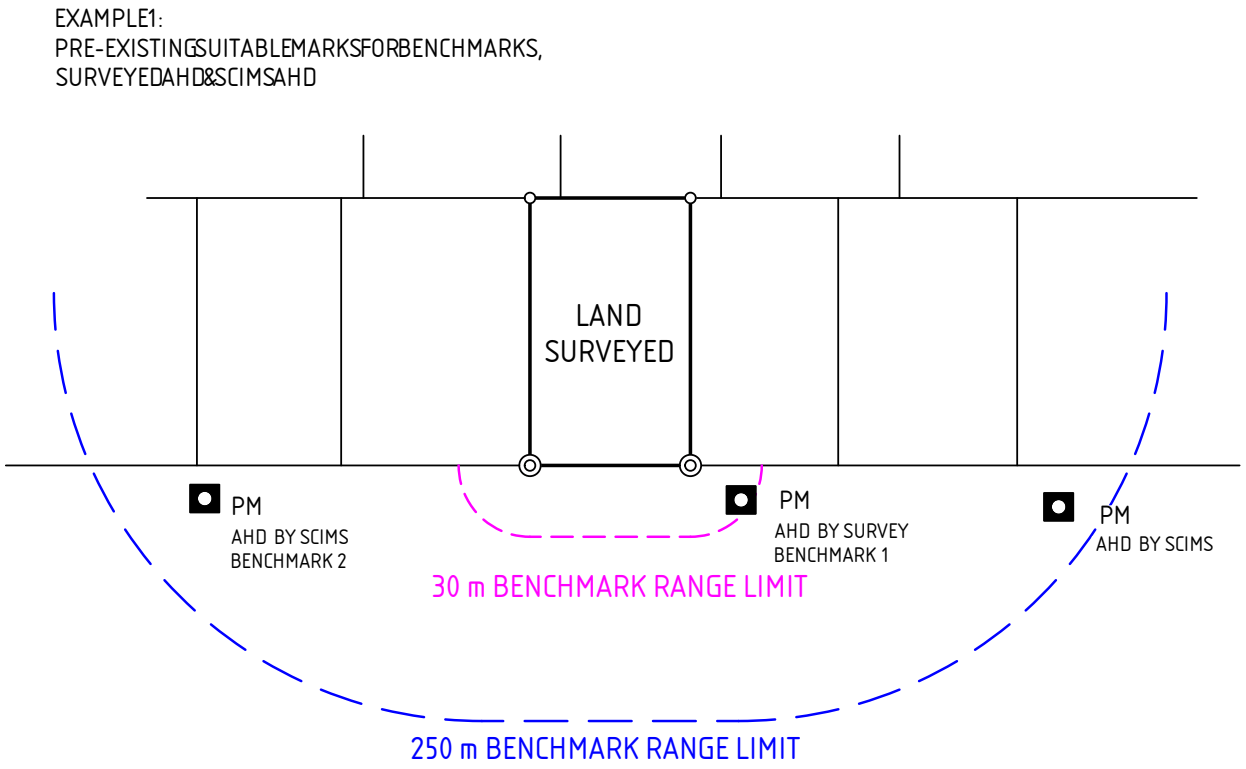


Diagram 5 – Stratum survey – close datum.

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

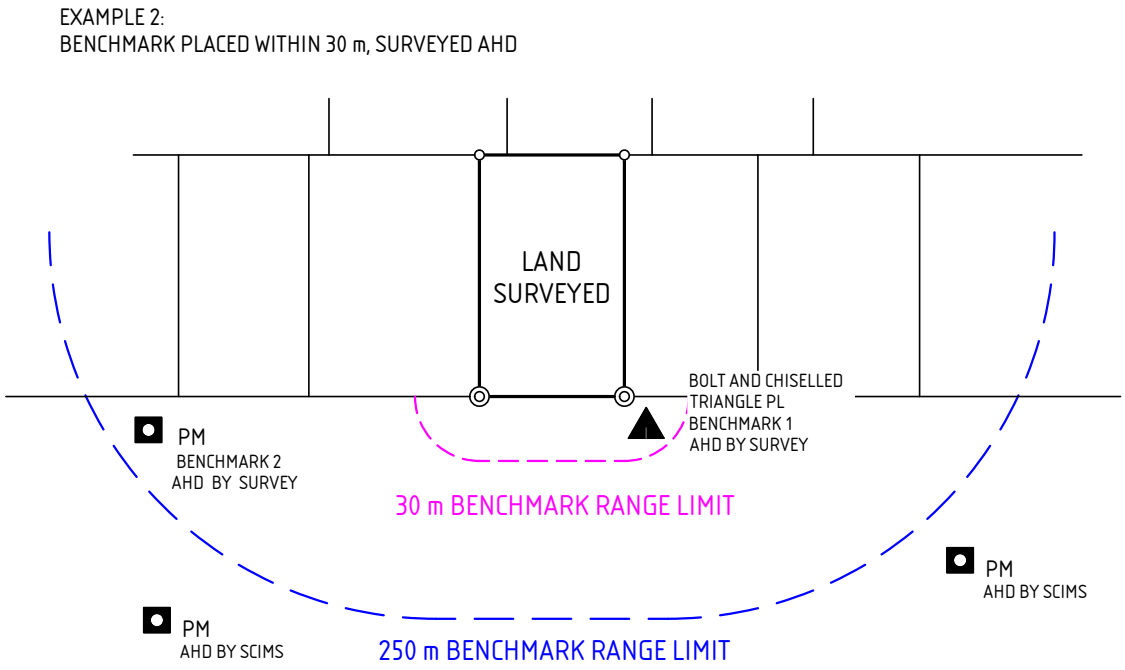


Diagram 6 – Stratum survey – far datum.

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

7.4 Section 38 – Surveys for Affecting Interests

This section applies to any survey which is carried out for the purpose of defining an affecting interest, including affecting interests created within a survey that are external to the land surveyed.

It should be noted that marking of the delineation of the affecting interest (the corners of the affecting interest) is optional and is a matter between the surveyor and their client. This option does not, however, include the requirements of the section regarding RM placement and PSM connection, which the surveyor must comply with.

It is recommended that RMs are placed to refer to the intersection of an affecting interest with a boundary of land held in different ownership.

7.5 Section 39 – Boundaries Common to Roads

This section relates to all surveys excluding a survey that has no roads shown on the face of the plan. When a lot is defined the common boundary of the road is defined by default and to ensure that no overlap or hiatus is created the road alignment must be determined before the lot can be defined.

The term 'the alignment of a road' is a standard concept in road design. From the perspective of physical road design, a road has a horizontal and a vertical alignment, both of these follow the centreline of the road along the design surface. It is how the position of the physical road is defined in space (see the Austroads Road Design publication).

Likewise, the Regulation aims to define the position of the road corridor or road boundaries in space and hence the term 'alignment' has been used. The term should not be confused with an 'aligned street' which is a specific process to define the street alignment based on alignment marks that appear in an alignment plan and have been published in the NSW Government Gazette. Hence there is a very strong link between the concepts; alignment plans define the alignment of certain streets; this section applies to all roads and intersections not just streets that have 'alignment plans'.

Note: The term road includes all pathways and access lanes etc. If the land is designated for public access and throughfare it is a road of some description. This should not be confused with private roads which are not roads and not designated for public use. There are many road-like corridors which are not actually roads but freehold lots. Lots described as 'Lot 1' in Community Plan DPs that provide access must be marked similar to a road as required by Sections 39, 42, 53 and 55 as they provide the same function as a road.

In this Regulation connections across roads have been clarified to ensure there is a consistent distribution of connections to reduce the length and complexity of the calculations required to cross a road.

These connections should be from corner to adjacent corner or if there is no adjacent corner within reasonable distance, a square connection with a distance to the nearest corner is acceptable. A single connection does not form a closed loop and is not checkable hence, a closed loop is required.

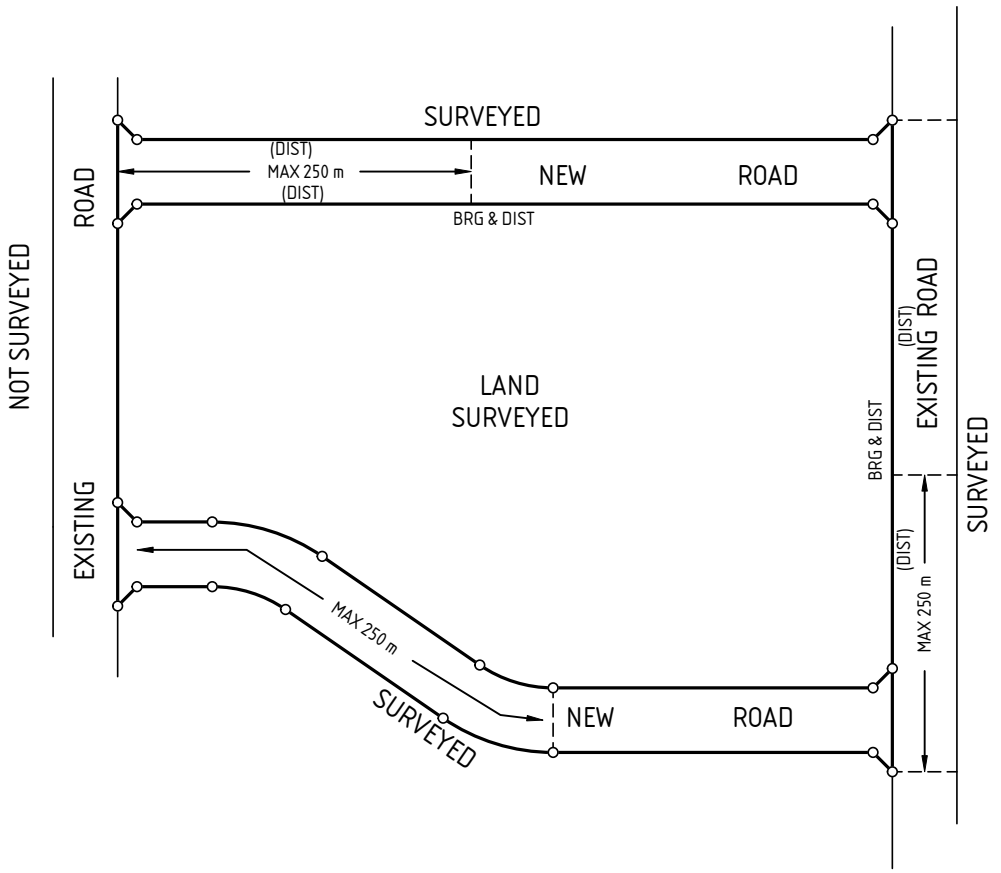


Diagram 7 – Connections across roads.

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

7.6 Section 40 – Landward Boundaries of Reserves

The first survey of the landward boundary of a Crown reserve that fronts a natural feature requires the consent of the Crown. This is regardless, if the survey is of the reserve or if the survey is of the land adjoining the reserve, being freehold land.

The right line boundary created must be parallel to the natural feature as it was originally surveyed when the adjoining land was granted. Noting that the reserve was either created at the time of the grant, but the reserve itself was not surveyed, or the reserve was created later by Government Gazette and the reserve was not surveyed.

The reserve exists unless there is a paper trail that revokes the reserve and creates freehold land.

Any survey that is not the first survey of the common boundary right line boundary of the reserve is undertaken by the same processes as any other right line boundary.

If the reservation fronts tidal waters (i.e. Mean High Water Mark), the landward boundary of the reservation must be surveyed and marked in accordance with Section 48 (See Section 50(1)).

If the reservation fronts non-tidal waters (i.e. bank of a non-tidal stream), the landward boundary of the reservation can be marked in accordance with Section 48 or place RMs at intervals not more than 1000m along the boundary (see Section 50(2)).

7.7 Section 41 – Natural Feature Boundaries

For natural feature boundaries refer to *Surveyor-General's Direction Number 6*.

7.8 Section 42 – Density of Permanent Survey Marks

This section refers to the connection of the survey to the State control survey network.

Historically the density of PSMs has been determined by the number of lots in the plan. Over time, as the size of lots has gotten smaller, this has resulted in an oversupply of PSMs.

The new requirement is taken from the grid patten layout of towns where each section is 10 chains, approx. 200m square and there is a road approx. 20m wide along each edge of the square. Hence, if there is a PSM at each intersection the marks would not be more than 250m apart and every lot would be within 250m of two (2) PSMs.

If a PSM does not exist within this requirement the surveyor is required to place it. However, if a PSM already exists the surveyor is not required to place an additional PSM unless they believe it is warranted.

In an urban survey there is a requirement for a PSM maximum spacing of 250m along a road.

- The minimum urban requirement is to connect to two PSMs, each within 250m of the land surveyed and the two PSMs are not to be more than 250m apart.
- If the land surveyed has a road frontage greater than 250m. The number of PSMs is determined as follows: Two (2) PSMs plus the total length of road frontage of the land surveyed, divided by 250 and rounded down to the nearest whole number (2 PSM + (Road Frontage/250)).
- For the portion of the survey that is only on one side of the road the survey must connect to a PSM for every 250m interval or part thereof that the land survey fronts a road. Being one at the beginning and one for every 250m interval thereafter.
- For the portion of the survey that fronts both sides of the road. Take the centre-line length of the road and ensure there is a connection to a PSM for every 250m of road. Being one at the beginning and one for every 250m interval thereafter.

For a rural survey there must be a minimum of two PSMs connected and within 1500m (Section 55) of the land surveyed. These can be the PSMs used for datum as the distance requirement is the same. However, the distance between PSMs along a road is a maximum spacing of 2000m.

Section 42 of the Regulation requires the placement of PSMs on formed roads or roads to be created under any Act. Unformed Crown roads do not require PSMs to be placed at regular intervals due to Section 42(5)(a).

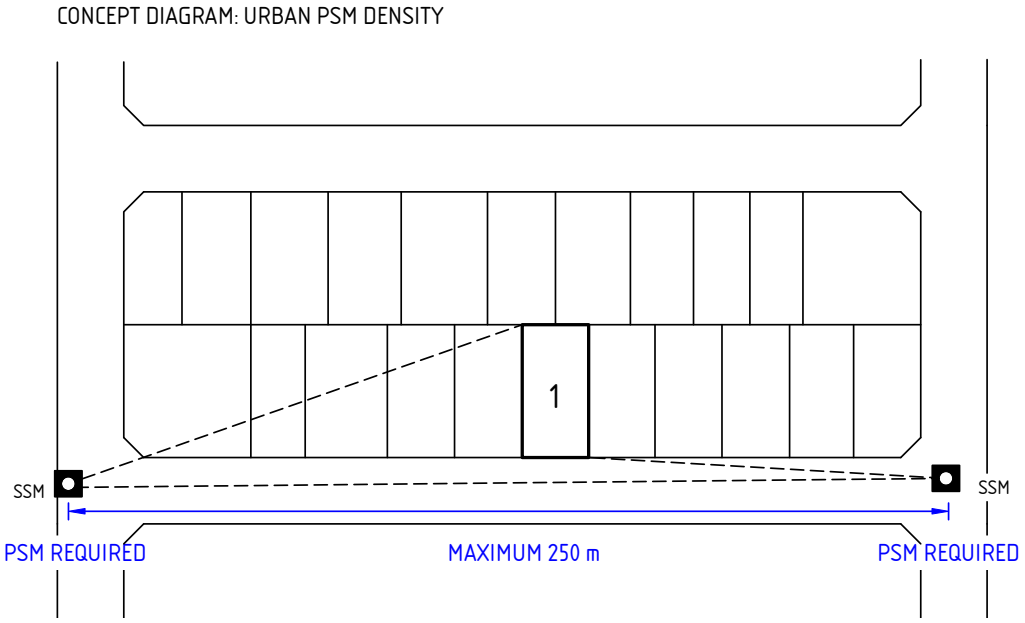


Diagram 8 – Density of permanent survey marks minimum requirement

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

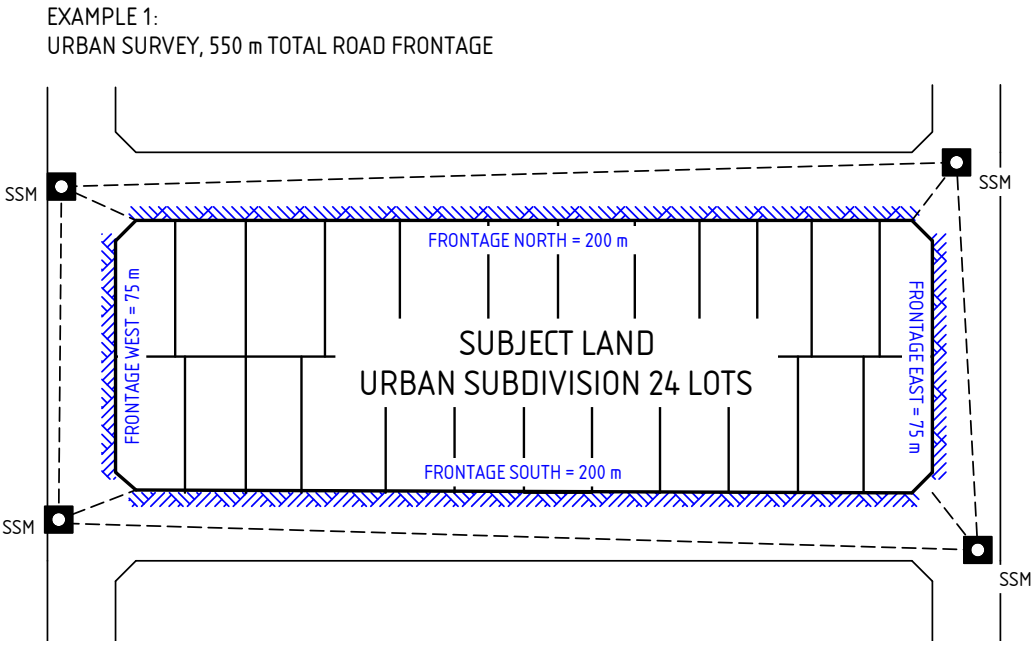


Diagram 9 – Density of permanent survey marks Multiple roads minimum requirement

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

7.9 Section 43 – Propagation of Vertical Datum

All urban surveys that are either a stratum survey or place a PSM where there are two other PSMs with accurate AHD within 250m of the land surveyed (whether connected to or not) are required to propagate the vertical datum i.e. provide accurate AHD71 values onto all other PSMs connected within the survey.

This will result in height being available to the public in urban areas. Where there is a greater need for vertical control.

7.10 Section 44 – Connection to Permanent Survey Marks

While undertaking the survey and associated calculations a surveyor is required to determine:

- Direct connections from each PSM adjacent to the land surveyed. A maximum of one PSMs per corner of the land surveyed i.e. Connect to separate corners. Each connection line must be included in a closed loop calculation at least once.
- Direct connections between adjacent PSMs. To form a closed loop of PSMs that does not involve any boundary line or boundary connection line.

Most surveys must connect to at least two (2) PSMs. Emphasis is placed on using existing PSMs in preference to placing more PSMs.

Section 42(4)(b) small surveys for the purpose of creating an affecting interest only (i.e., affecting interests less than or equal to 250m in length) are not required to place PSMs; if two or more existing PSMs are available within 250m of the survey, then connections must be made to at least two existing PSMs. If two or more PSMs are not available within 250m of the survey, then connection to PSMs is not required. The short easement survey must still adopt an accurate MGA orientation.

Section 42(4) of the Regulation requires all large easement surveys (i.e. greater than 250m in length) to connect, or place and connect a minimum of 2 PSMs.

Subdivisions of two (2) lots or more including dual occupancies must connect or place and connect to two (2) PSMs and adopt an accurate MGA orientation. No exemptions to this requirement will be granted. Policy 3 Exemptions are no longer possible.

Areas used for access within 'neighbourhood and community developments' are treated the same as roads. Therefore, PSMs must be placed and/or connected in accordance with all the provisions of Section 42.

Where PSMs are used to define the accurate MGA orientation of a survey under Section 28 of the Regulation and the connection of those established PSMs to the land surveyed exceeds connection distances stipulated in Section 55, additional existing or newly placed PSMs must be connected to the survey to meet the requirements of Section 42. The PSMs defining the accurate MGA orientation must be related to the land surveyed by closed connection (Section 61(3)).

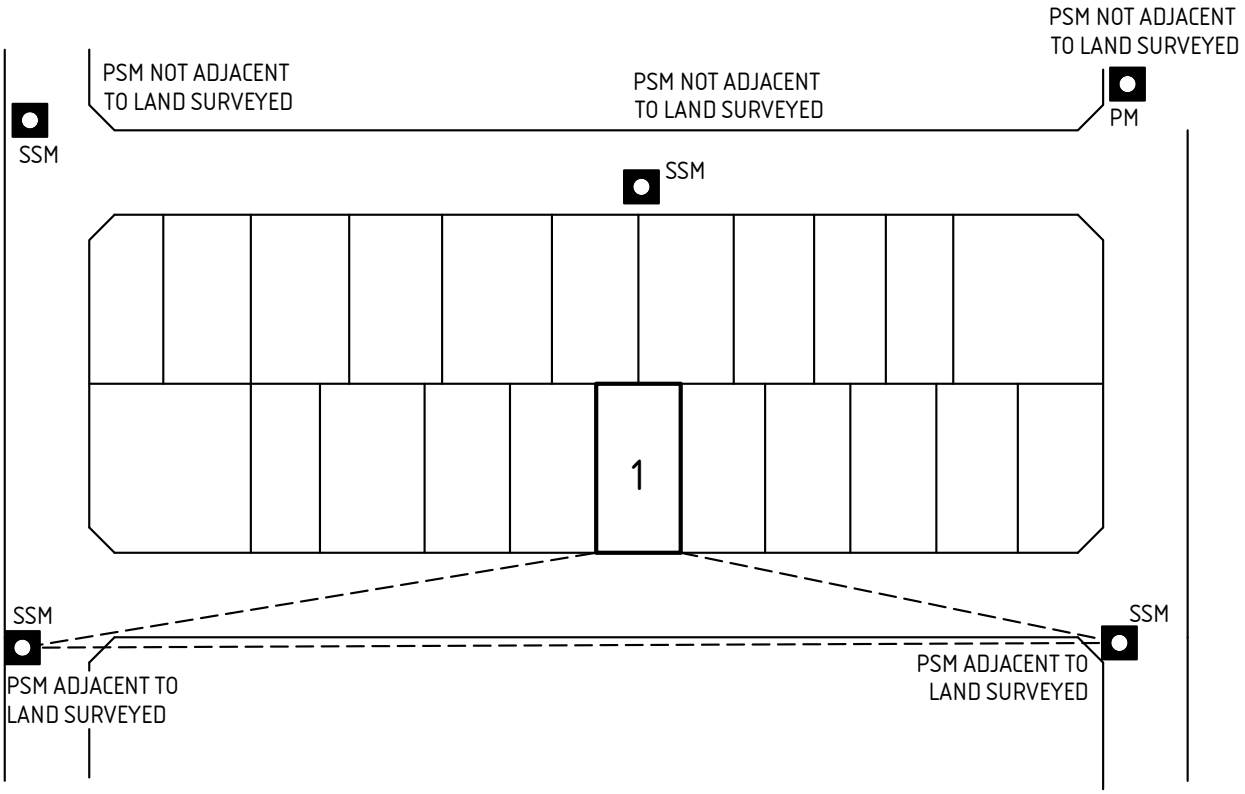


Diagram 10 – Urban survey examples of compliance with Section 42 and Section 61 of the Regulation.

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

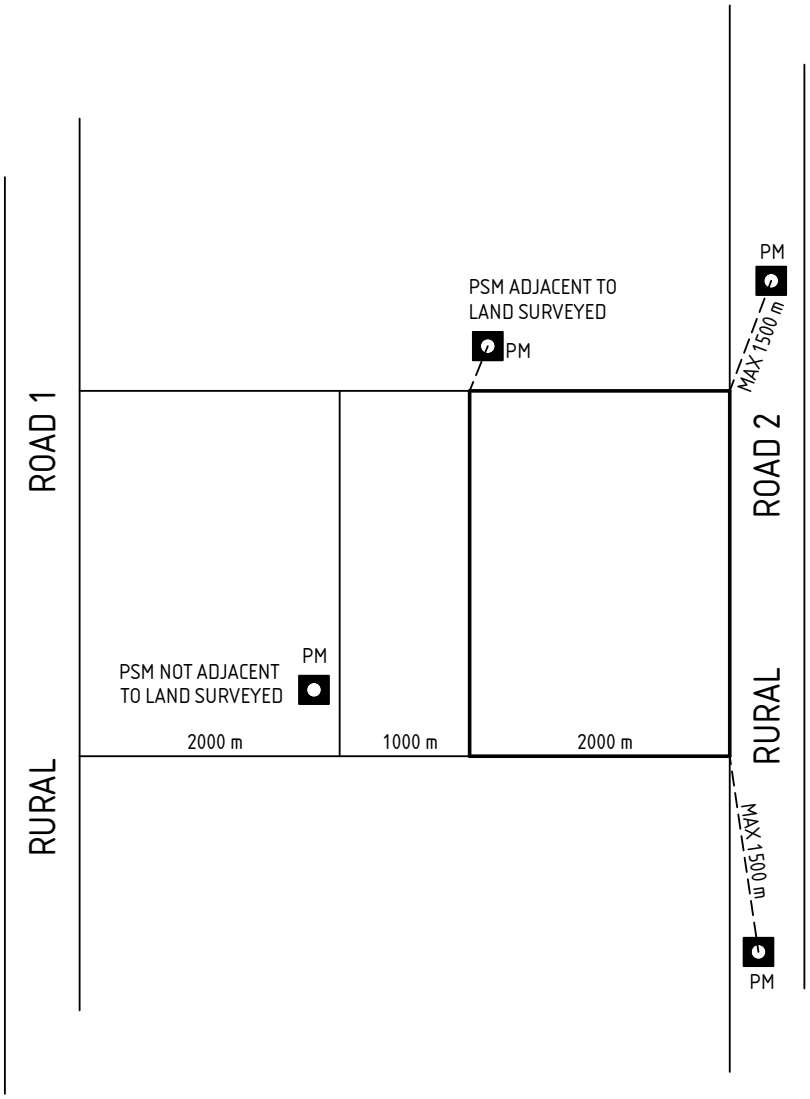


Diagram 11 – Urban survey examples of compliance with Section 42 and Section 61 of the Regulation.

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

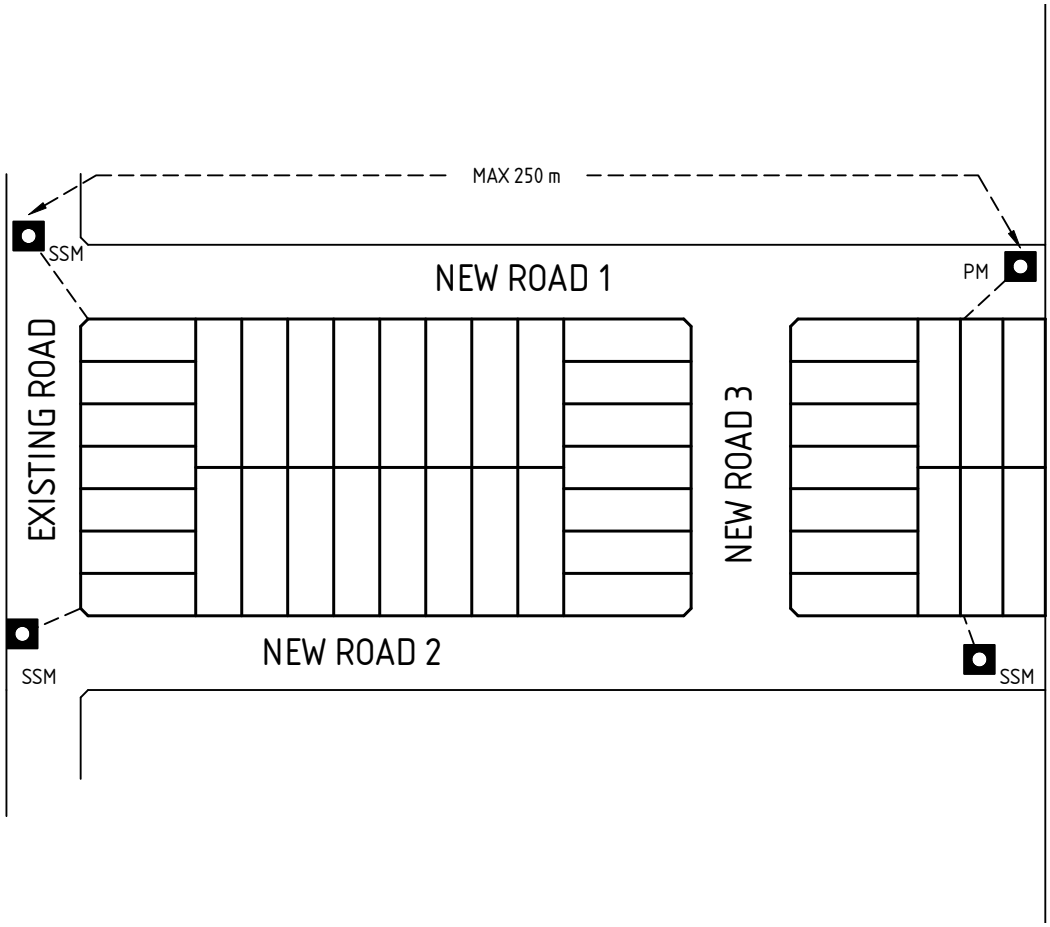


Diagram 12 – Urban survey examples of compliance with Section 42 and Section 61 of the Regulation.

Note: Only dimensions and details relevant to this example are shown. All other requirements must be shown in accordance with the Regulation.

Section 44(2) is a clarification that PSMs used for the purpose of complying exclusively with Sections 29 or 37 do not need to be connected by closed survey to the land surveyed. That is, if the PSM in question is connected to the land surveyed by height difference only, then that PSM does not need to be connected horizontally by closed survey to the land surveyed. All obligations under the Regulation for horizontal connections to the survey will still apply; that is, the surveyor will still have to horizontally connect the same amount of PSMs required by the Regulation. All PSMs must be connected to the survey.

7.11 Section 45 – Surveys for Identification or Re-marking

All remarking and identification surveys must use appropriate equipment and field techniques so that boundaries are accurately measured (Part 3), redefined (Part 5) and relevant boundaries marked (Part 6) as required by the survey instruction. All land surveys are required to have a signed survey certificate appropriate to the survey (Part 9 and Schedule 8 Form 2). Any survey that shows land boundaries and identifies the land is a land survey. This includes but is not limited to identification surveys, remark surveys, detail surveys, Works As Executed (WAE) surveys and any other survey that shows land boundaries.

Reference should be made to the BOSSI publication 'What is a 'Land Survey''.
https://www.bossi.nsw.gov.au/__data/assets/pdf_file/0007/232792/2409_What_is_a_Land_Survey.pdf

7.12 Section 46 – Surveys Not Requiring Strict Accuracy

Any survey under this section must have a written agreement documenting the agreed tolerances and marking requirements to be met by a survey not requiring strict accuracy. The agreed tolerances must be stated on the plan or report as the outcome of the survey to enable any other person to understand the measurement quality of the work undertaken.

Any survey or plan registered with a public authority requires approval from the Surveyor-General. This enables the Regulation flexibility to cater for new technology and differing land uses, if a survey of land results on a plan being lodged on public record, the Surveyor-General has the flexibility of setting standards that are more appropriate to the survey technique used and the land use involved.

Surveys that are of a kind approved by the Surveyor-General that do not require strict accuracy have been approved in *Surveyor-General's Directions 13* (SGD No.13) and are found on the DCS Spatial Services website on the Surveyor-General Directions page. Any other kind of survey will require a specific approval from the Surveyor-General.

All surveys undertaken under this section are required to be certified using Schedule 8 Form 3.

8. Part 6 – Marking

8.1 Section 47 – Forms and Styles of Survey Marks

The forms and styles of all survey marks are shown in Schedules 1 – 4 of the Regulation. Each schedule outlines the specification for each mark type and how they must be placed (or inserted) to ensure good performance of the survey mark.

The respective schedules are:

Schedule 1 Bench marks

Schedule 2 Boundary marks

Schedule 3 Reference marks

Schedule 4 Permanent survey marks

For mining surveys – under Schedule 1 bench marks the form, style and requirements for inserting a bolt or nails may not be practical. In this case a 'specific point' mark may be considered.

For mining surveys - refer to the Surveyor-General's Direction '*Survey and Drafting Directions for Mining Surveyors 2020 (NSW Mines)* for clarification on the type of marks to be used for control surveys and subsidiary surveys (Section 3.2).

8.2 Section 48 – Boundary Marks

8.2.1 Obstructed Boundary Corners

Section 48(3) refers to boundary corners where a surveyor is not able to place a mark. If it is not possible to place a boundary mark on a corner, a surveyor has two options:

1. Place a RM within 30m of the relevant corner and note on the survey plan the reason the corner was not marked, or;
2. If the corner that cannot be marked is within the material of a structure or does not have a surface accessible for marking, the surveyor can show the corner on the survey plan using the obstructed boundary corner symbol in Schedule 5 and doesn't need to place a RM or state a reason on the survey plan.

Option No. 2 above refers to situations which include (however, are not limited to):

- Corners within a dividing wall (e.g. a party wall) where the face of the wall is not the boundary, and the top of the wall cannot be practically accessed for marking.
- Corners that are permanently underwater and do not fall on a structure such as a jetty, dolphin or other post. However, if it is possible a line mark should be placed near the edge of the water in a safe and durable location to allow the boundary to be relocated in the future.
- Stratum boundary corners that lie within the floor/ceiling of a building where a face of the floor/ ceiling is not the boundary.
- Stratum boundary corners that lie within solid underground substrate.

Option No. 2 above does not refer to situations which include (however, are not limited to):

- Fence posts that lie on a corner to be marked
- Low brick or concrete walls that lie on a corner to be marked
- Corners fronting a natural feature boundary
- Corners that lie on the face of a wall (e.g. the end of a party wall)

If a survey mark is able to be placed on the corner, the surveyor is expected to mark the corner; if there exists any doubt as to what constitutes 'does not have a surface accessible for marking', the surveyor should seek further direction from the Cadastral Management Unit of DCS-Spatial Services.
(see **Appendix C** – contact information).

8.2.2 Arc Boundaries

The intent of Section 48(4) is to provide marking around the curved boundary where the curve is greater than a quarter of a circle contained in a single lot.

Each end of the arc is to be marked and additionally one boundary mark for each quadrant or part thereof. Hence, a boundary: (see diagrams below)

- Less than a quarter of a circle requires - 2 boundary marks (each terminal of the arc).
- More than a quarter but less than a half - 4 boundary marks (inc. the terminals).
- More than a half but less than three quarter - 5 boundary marks (inc. the terminals).
- More than three quarters and including a full circle – 6 boundary marks (inc. the terminals).

This requirement should have minimal impact on the average survey as very few lots have more than a quarter of a circle as a boundary and should not impact cul-de-sac heads unless they are defined within the residue lot before the subdivision of the lots occurs.

If long arcs are used consideration should be given to line marking to aid the client, owners and utility providers knowing the location of the boundary and to aid the fencing of the boundary.

This does not apply to rounded cut off corners at street intersection where the terminals of the arc must be marked because that is the end of a straight line.

Case 1: Less than $\frac{1}{4}$ of the circumference.

Case 2: More than $\frac{1}{4}$ and less than $\frac{1}{2}$ of the circumference.

Case 3: More than $\frac{1}{2}$ and less than $\frac{3}{4}$ of the circumference.

Case 4: More than $\frac{3}{4}$ of the circumference.

Diagram 13 – Marking of arc boundaries

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

8.2.3 Unfenced Rural Boundaries

If a rural boundary is unfenced, the lines that form the boundary must also be marked with boundary marks and lockspits placed in the direction of the boundaries that extend from each corner along the line of the boundary.

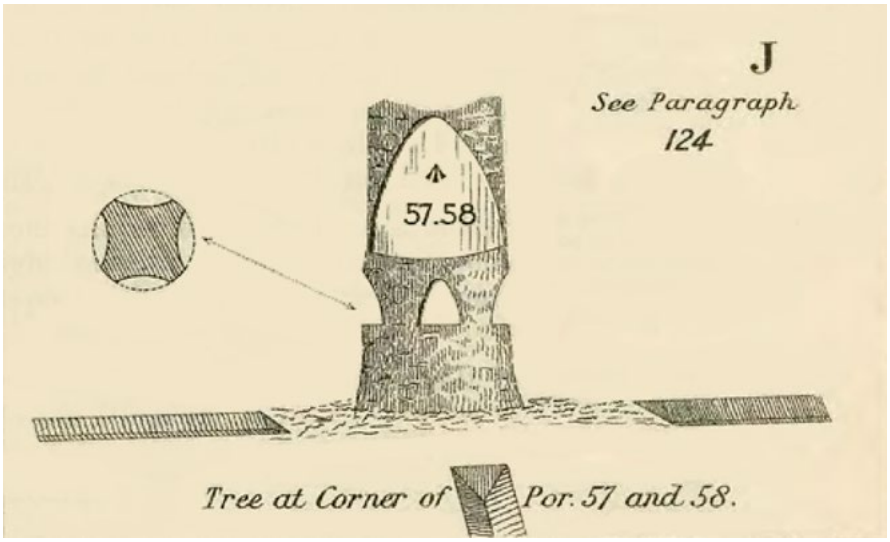


Diagram 14 – Construction of lockspits

Extract of the Regulations for the employment of licensed surveyors 1886.

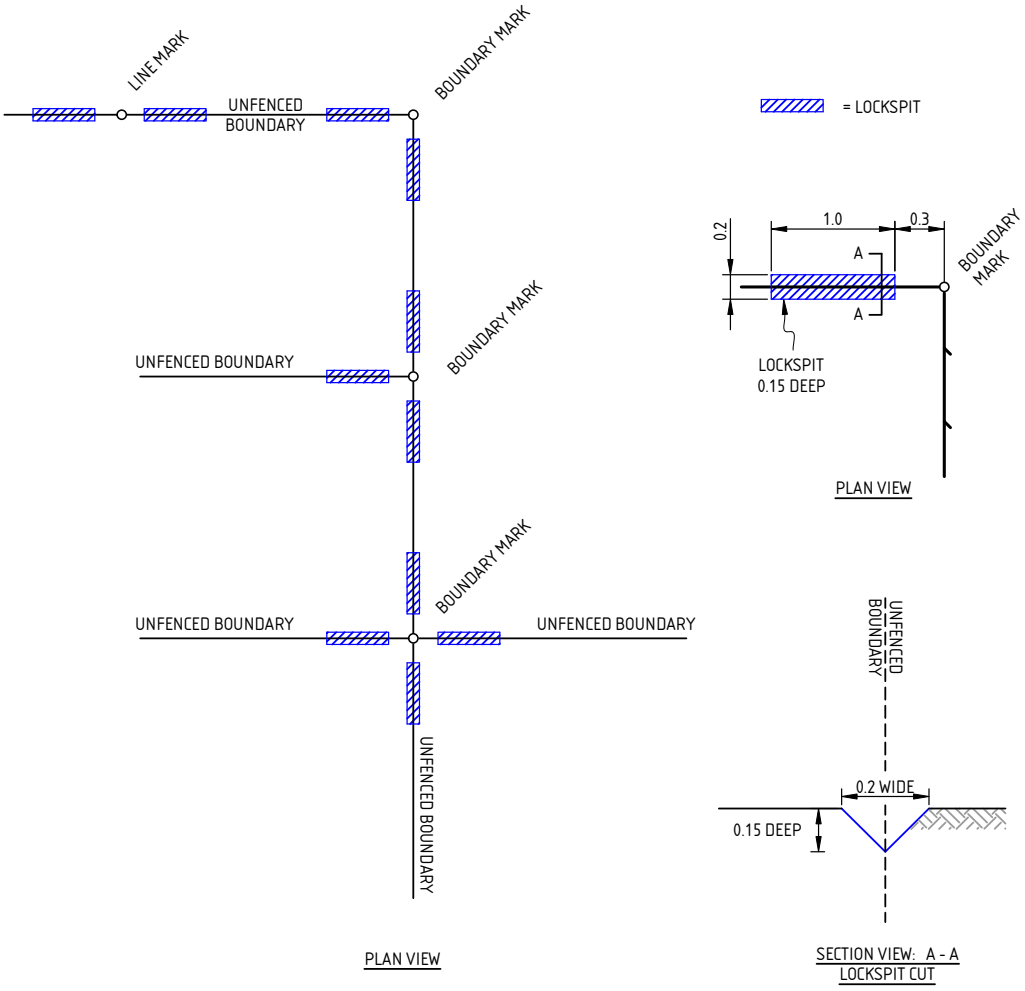


Diagram 15 - Lockspit placement

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

The requirement to clear boundary lines and blaze trees has been removed from the 2024 Regulation due to environmental legislative concerns. The following information remains as guidance to the interpretation of blazes that may be found while undertaking a rural survey.

Diagram 16 - Blazed trees near boundary line shows how blazes on trees within 500mm of the boundary line were placed.

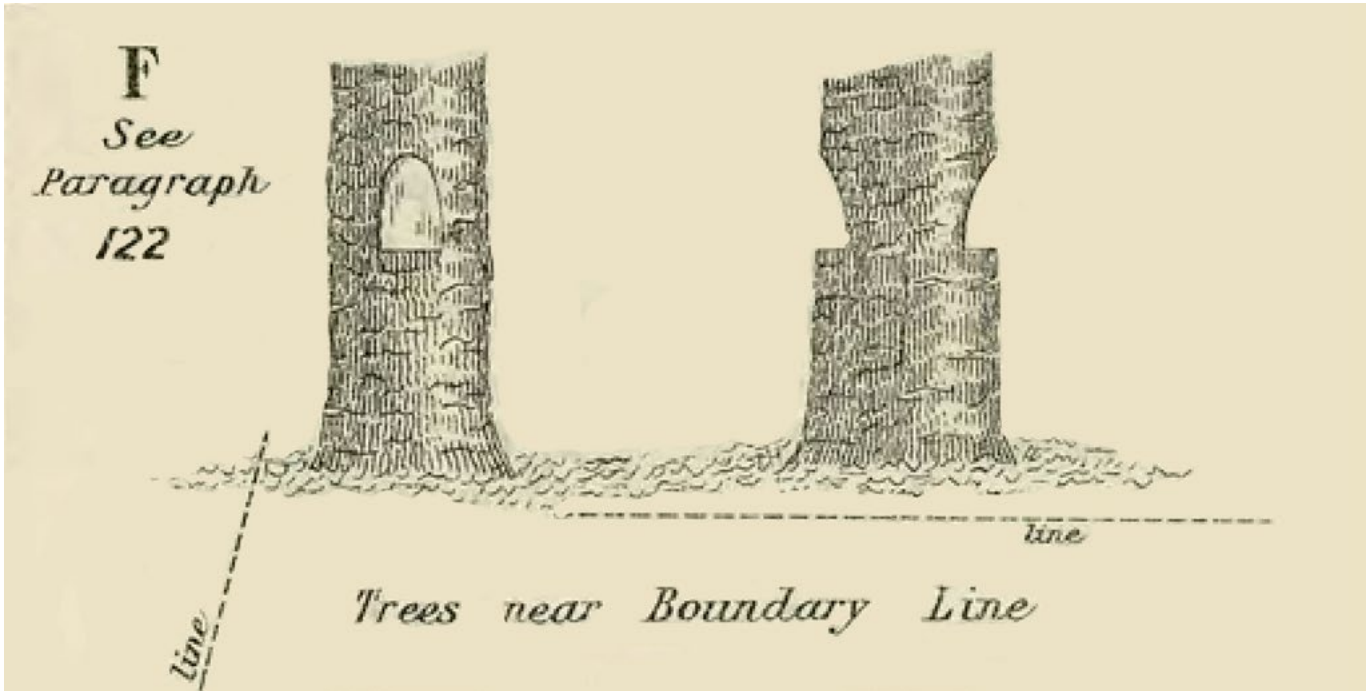


Diagram 16 – Blazed trees near boundary line

If the boundary line passes through the trunk of the tree, then the tree was double blazed.

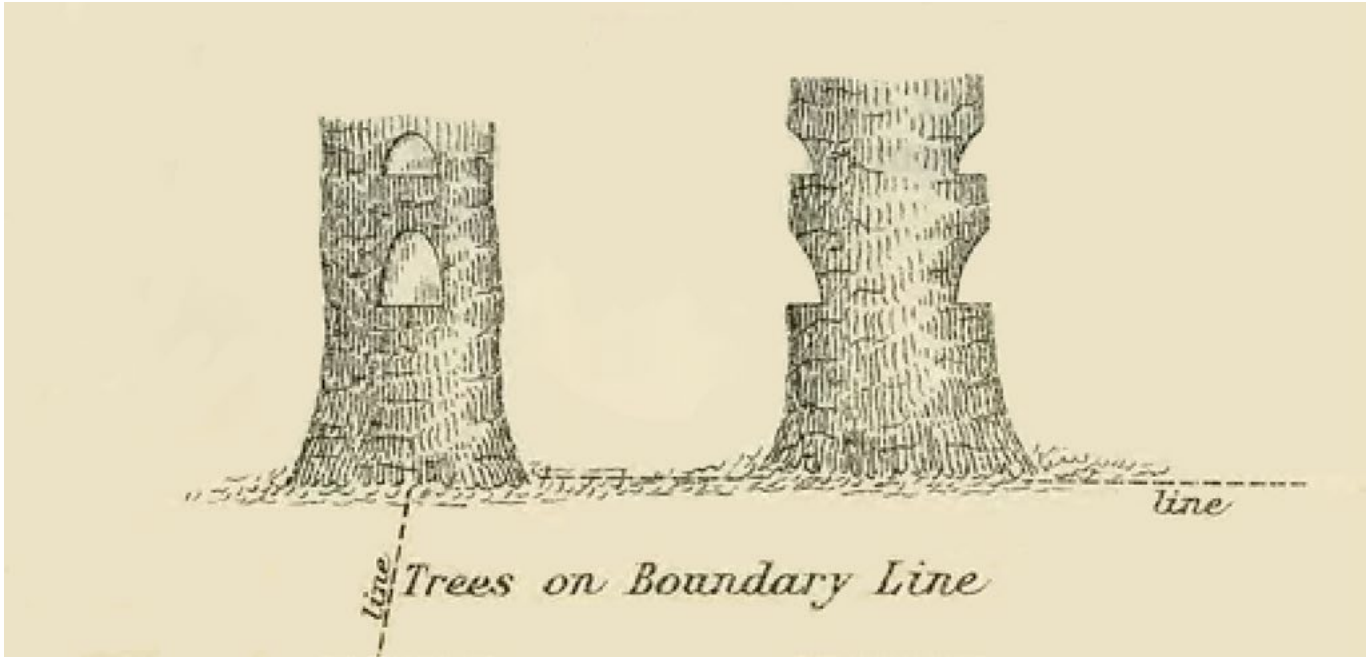


Diagram 17 – Blazed trees on boundary line

There are some general exclusions as to when boundary marking is required. These are:

- In an active mining area - when undertaking a mining tenure survey. This exclusion does not include the whole of the site and is strictly limited to areas of active mining operation at the time of the survey where the boundary mark is liable to being disturbed by machinery undertaking the mining operations. This should only occur when a mining operation exists over two separate mining leases.
- Line marking is not required for mining tenure surveys. In consultation with the Resource Regulator, only the corners of mining tenure surveys are required to be marked.
- Unformed Crown roads – there has been a long-standing practice that unformed Crown roads that pass through a single parcel have not been marked. The Regulation formalises this practice as the land is being occupied and used as if the road does not exist. However, it must be noted that the road boundaries exist, and these must be shown on the plan with dimensions for both sides of the road if the road has ever been surveyed. Even though the last plan may show the road by dashed lines that does not mean the road has not been surveyed, a full search is required. If the surveyor's plan shows an un-surveyed road, a report should be lodged to justify the basis of that conclusion and to identify that the original Crown plan shows the road as un-surveyed and there has been no subsequent survey of the road. Otherwise, there is doubt (Section 77) as to whether there has been a survey or not (the majority of roads have been surveyed at some time).
- A survey to acquire land for road purposes - where the physical road exists and is to be widened as would have occurred under the previous Policy 5 'Land Acquisition Surveys under the *Roads Act 1993*' (LASRA) Exemption. This exclusion applies only to the marking of the boundary of the existing road, being the common boundary of what will become the two road lots. The critical boundary that must be marked and referenced is the new common boundary between the new road and the residue lot.
- The boundaries for surveys for affecting interests do not require to be marked unless the client requests them to be marked. There are some occasions where it is advantageous to mark the boundaries such as in acquisition surveys to ensure that everyone is aware what land is included or excluded.

8.3 Section 49 – Marking of Natural Feature Boundaries

A natural feature boundary does not need to be marked because the natural feature is ambulatory, liable to accretion or erosion, and there is no stable and durable surface that allows marking. The natural feature is the boundary.

This section also allows discretion on where to place boundary marks near mean high-water mark or bank boundaries. If the foreshore is liable to erosion, the surveyor may place the boundary mark on the side boundary at a safe distance to avoid disturbance by erosion. If this is the case the RM should reference the survey mark placed as that is the critical point that needs to be redefined to allow the natural feature surveyed at that time to be located.

8.4 Section 51 – Reference Marks Generally

A surveyor is only permitted to mark the land that is the subject of the survey. However, it is also acceptable to duplicate RMs (as this does not change the cadastre). The RM must be adopted and not be re-referenced, the original mark must be in existence at the date of the survey and the mark type should be different to avoid confusion. It is a new requirement that a duplicate RM must be placed when an RM Tree is found.

RMs are placed to ensure that the cadastre can be reinstated if and when boundary marks are disturbed or destroyed. To ensure there are adequate RMs every survey must relate to a minimum of two RMs. There are no exceptions to this requirement.

The RM must be located in a place that is unlikely to be disturbed. If there is construction occurring or the survey is pre-construction for a site, negotiations or a conversation must occur with the project manager to ensure the marks are protected. Exemptions will not be granted for construction reasons.

An RM must be within 30m of the point and cannot reference more than one point. A concession to this rule is if there is another point that must be referenced that is also within the prescribed distance of 10m urban or 30m rural (same side of the road). Then the RM may reference two points. If more than two points were to be reference to a single mark, there would be a considerable risk to the cadastre if that mark is destroyed.

It is important to note that the RM, not the corner it refers to, must be within 10m of the new point being referenced. In such a case, a new RM need not be placed, and the existing reference mark may be referenced to the subject survey. This is the only case in which it is acceptable to reference an existing RM to two separate corners on two separate plans. The reference should be shown on the plan to the effect of 'additional reference by me' along with the plan that originally placed the RM.

This is to prevent too many RMs being placed in an area and causing confusion which mark relates to which point. If there is a need to place RMs close together it is advisable to make each RM of a different form e.g. one DH&W, one GIP or one RM Token. Care should be taken to ensure that there are not too many corners close together unless there is a sound reason. If the cadastre is complicated and many marks are required, then it is important that mark diversity is increased.

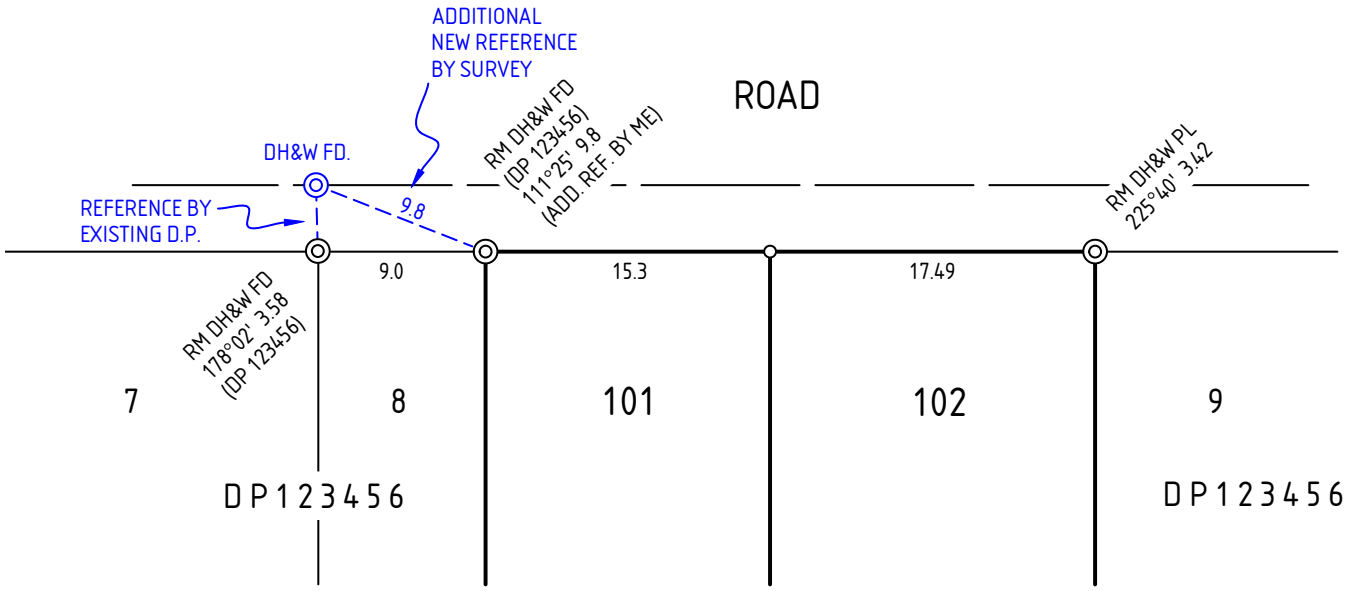


Diagram 18 – Existing reference mark within 10m

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

Any time a 'specific point' type RM is used for a corner of land that abuts a road, a second RM is required to be placed in the road corridor. The position of the specific point must be adequately described so that the same point is easily identifiable, e.g. corner of brick wall is not adequate. A more specific description such as 'the top left corner of the third course of brick wall' or placing a small wing to indicate which brick was used will make identification much easier. As this is very difficult to show on a survey plan it should be used sparingly i.e. if it is possible to show the building without making it a RM for the corner.

8.5 Section 52 – Reference Marks for Boundaries

The placing of RMs for boundaries is extremely important however should not come at the expense of placing RMs for the roads. If there is an option to not place a RM, the priority should be placing the RM that defines the road alignment. Noting a surveyor is only permitted to mark the land that is the subject of the survey, if the angle is beyond the title being surveyed the surveyor is not permitted to mark it.

The placing of RMs that define the road assists every survey definition by defining the road with more certainty. Trying to redefine a road alignment by the best fit of marks along the straights and intersecting the angle points is substantially more difficult and prone to error than adopting the marked angle points and confirming the straights by other marks.

Generally speaking, the majority of urban surveys have a minimum of 2 extremities where the subject land abuts a road, therefore the surveyor must place or connect RMs so as to refer to all of these extremities. An extremity of an urban survey abutting a road also refers to the junction or intersection of roads; therefore, for example, an urban survey that subdivides a lot that lies at the intersection of two roads must place RMs so as to refer to the intersection of the roads and the extremities of the survey abutting each of the two roads. Similarly, if the subject land fronts a lane or pathway, as these are also classified as roads, they must have a RM placed at each extremity of the subject land with the lane or pathway.

Any survey that does not abut a road must place two RMs per parcel of land surveyed.

For rural surveys the Regulation requires the placement of a RM at the extremity of the land surveyed where the land abuts a road. In addition, if a boundary line exceeds 2400m in length (regardless if the boundary includes one or more bends) RMs must be placed at intervals of not more than 1500m.

If the land surveyed has frontage to a stream where that frontage is greater than 500m, then RMs must be placed so as to refer to each intersection of the stream bank with side boundaries. Section 66(1)(e) requires a direct connection between the terminals of the subject land fronting a natural feature (i.e. MHWM or bank).

8.6 Section 53 – Reference Marks along Roads

Any survey that creates, re-defines or widens a road is required to place RMs for the road surveyed in the plan. Likewise, any survey that defines a lot that abuts a road must place RMs as if it is a road survey for the frontage of the subject lot/s. There is the requirement to define enough of the road to ensure that the road is re-instated correctly and does not move or have steps created in it without the consent of the road authority.

RMs must be placed along a road frontage of an urban survey that has intervening side boundaries so that the distance between corners referenced does not exceed 100m. There is a requirement for a PSM to be placed or connected to the land surveyed, every 250m, these PSMs may be used as RMs.

Section 53(6) requires two (2) DH&Ws (dual DH&Ws) to be placed as a single RM if they are used to define a road being created or to re-define a road for road purposes. This means if the subject of the survey includes road/s or is an acquisition of land for road purposes and a DH&W is used to define any road boundary, dual DH&Ws are required as a single RM. This is contrasted against undertaking a survey of land adjoining a road where the road is not the subject of the survey and only one (1) DH&W is required if that type of RM is used. For example, a subdivision of land that adjoins a road and creates new roads must place dual DH&Ws along the roads. However, if a subdivision of land that adjoins a road only subdivides the land and has no road actions, single DH&Ws are required.

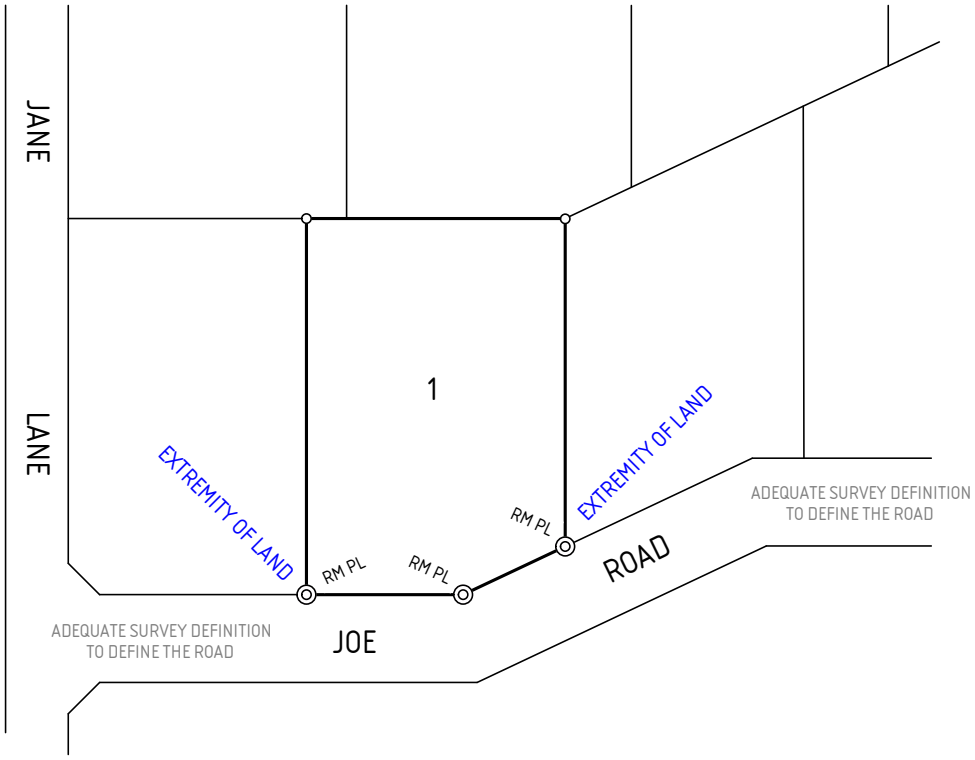


Diagram 19 – Reference marks along roads Section 53(2)(a)

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

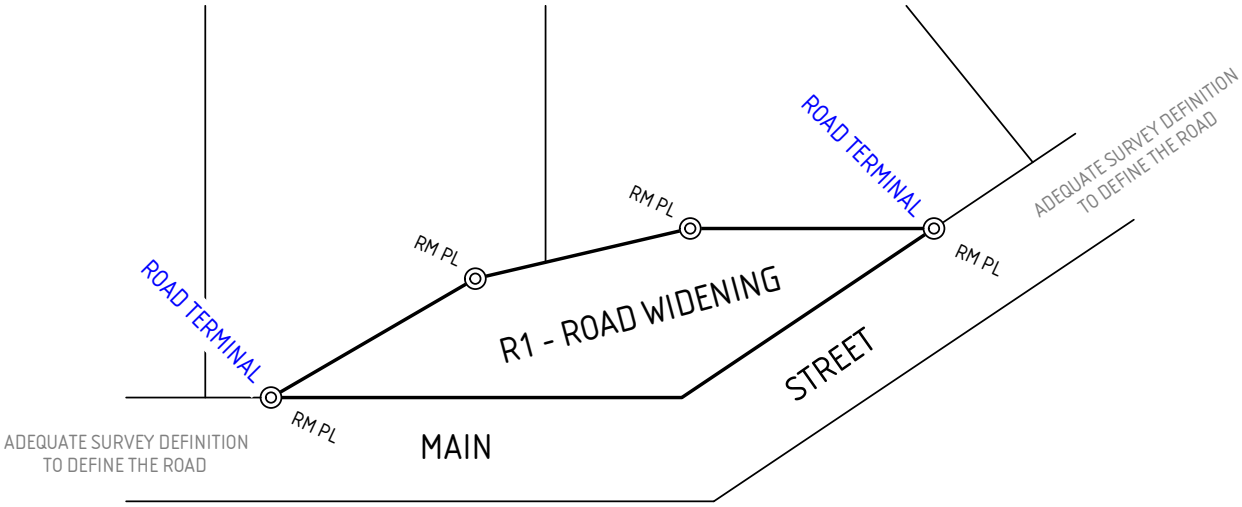


Diagram 20 – Reference marks along roads Section 53(2)(b)

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

8.7 Section 54 – RMs for Affecting Interests

The intent of this section is to provide RMs to locate the affecting interests on the ground. If the survey is a subdivision, there should be enough RMs being placed as part of the subdivision to relocate any affecting interest. If the survey is over assets that move or the precise location is not known, it is not possible to place a RM in relation to the unknown or variable location.

If there are multiple coincident (touching or overlapping) affecting interests, they should be treated as one affecting interest.

If there are multiple separate affecting interests (meaning many affecting interests that have no relationship to each other or are not directly touching or overlapping) they should be treated as separate affecting interests.

8.8 Section 55 – New Permanent Survey Marks

8.8.1 Placement of Permanent Survey Marks General Requirements

The Regulation states the placement of a new PSM is required for any connection where an existing PSM is not available.

Section 55 requires that new PSMs must be located in positions suitable for their stability and protection from disturbance, and inclusion in the State control survey. However, consideration should be given to the use by GNSS survey techniques. In order to achieve this, they must be placed at road junctions, intersections, angles or crests of hills as to be intervisible and also safe to use. Section 73 stipulates that the PSM must be identified in a sketch plan (locality sketch plan).

Section 43 of the Regulation requires stratum surveys and all urban surveys that place a PSM to propagate accurate AHD71 values to all connected PSMs if two or more existing PSMs already have accurate AHD71 values and are within 250m of the land surveyed.

Note that surveyors cannot determine an 'accurate AHD value' as part of the definition of 'accurate AHD value' requires the value to be in SCIMS. Only the Surveyor-General can enter values into SCIMS.

The AHD71 values so determined by the surveyor under Section 43(2) must:

- have an accuracy equal to or better than Class 'B' or Class' LD', and
- be verified by closed height difference between any two (2) of the PSMs used in the survey that have 'accurate AHD values'.

The survey plan must show the AHD71 values in the approved height schedule and the height differences between survey marks in the approved height difference schedule.

There is no requirement (unless the survey falls under Section 43, i.e. is a stratum survey) to propagate the AHD71 values for PSMs placed in rural surveys. If the height can readily be propagated for a rural survey, then it would be prudent to do so.

8.8.2 Placement of type 4 and type 6 Permanent Survey Marks

The Regulation requires a survey that creates more than 10 lots, to have a mixture of PSM types.

If only one PSM is required to be placed, there are two scenarios.

- One (1) existing PM (Type 4 or type 6) adjacent to the land surveyed. The surveyor is required to place a new Type 4 PSM (or Type 6 if applicable).

- No existing Type 4 or 6 PSMs. The surveyor is required to place 2 Type 4 PSMs (or Type 6 if applicable).

If the surveyor is required to place 2 PSMs or more, the surveyor must place a minimum of 2 or a quarter of the marks are placed as Type 4 PSMs. Refer to the table below.

Number of PSMs placed	Number of Type 4 or type 6 PSMs required
2 - 11	2
12 - 15	3
16 - 19	4
20 - 23	5
24 - 27	6
28 - 31	7
32 - 35	8
36 - 39	9
40 - 43	10

Table 4 – Number of Type 4 or Type 6 PSM placement requirements

This is a new requirement in the Regulation and has been introduced to help preserve survey infrastructure by ensuring a mixture of PSM types and locations.

9. Part 8 – Formal land survey plans

9.1 Section 61 – Requirements for Formal Survey Plans

Locality or suburb: The Geographical Names Board (GNB) of NSW assign the name and extent of localities or suburbs within NSW. Usually, the assigned suburb or locality name (i.e. placename) is available via the CRE (Cadastral Records Enquiry) or by using the identify tool available in SDT Explorer or in the Spatial Collaboration Portal. If a name is not provided, a Name Search can be undertaken via the GNB web site.

Road names: Roads are named by the relevant road's authority and the *Roads Regulation 2018* outlines the naming process. It is common for the relevant road authority to be either Transport for New South Wales or the Local Council.

Street address: An address describes a property's location and should include a house number, road name, road type and a locality. It is the local council's legislative responsibility to allocate a new address for a lot when it is being created.

A table of new addresses as required by Section 61(1)(c) must be provided on the administration sheet for each lot where titles will be created for the lots.

For strata plans the address for each lot (including the common property) must be included.

In situations where a lot will not have an address e.g. road widening, then the address should have a 'N/A' recorded for that lot.

For more detailed information regarding allocation of addresses see the NSW Address Policy and User Manual.

Examples of the table to be included on the administration sheet are detailed below in and **Table 6**.

Lot Number	Sub-Address Number	Address Number	Road Name	Road Type	Locality Name
1		22	Linda	Street	Bathurst
2		24	Linda	Street	Bathurst
3		2	John	Road	Bathurst
4		6	John	Road	Bathurst
5	1	8	John	Road	Bathurst
6	2	8	John	Road	Bathurst
7		10	John	Road	Bathurst
8		N/A	John	Road	Bathurst

Table 5 – Street address schedule – deposited plan example

Lot Number	Sub-Address Number	Address Number	Road Name	Road Type	Locality Name
CP		22A	Linda	Street	Bathurst
1	101	22A	Linda	Street	Bathurst
2	102	22A	Linda	Street	Bathurst
3	103	2	John	Road	Bathurst
4	104	2	John	Road	Bathurst

Table 6 – Street address schedule – strata plan example

Section 61(2) states that the first page must include all the references to the title/s of land being surveyed in the plan. This specifically applies to road acquisition plans and any other plans that have multiple lots affected that will not fit into the plan heading box as is the normal practice for plans.

On very large plans with many titles, the first page is usually an overview of the whole survey and network diagram of PSMs. Having all the title references on the first page provides a uniform location for the information and allows anyone using the plan to be able to identify all of the land involved in the plan.

Section 61(3) requires the equipment/methods used for the survey to be identified in the approved schedule which is located on the LRS Deposited Plan Lodgment Checklist. This forms part of the chain of traceability and is linked to the field notes and reporting parts of the Regulation. Table 7 Approved equipment schedule identifies the types of techniques used for the survey and whether the equipment was verified or validated. The field notes will identify the exact instrument used in the survey if the company uses multiple instruments.

Only include the equipment and methods used on the survey. If the Surveyor-General requests the reports for the specific instruments used, a full and complete report for each instrument will be required.

Equipment Schedule

Equipment / Method	Tested
EDM / prism	verified
EDM / reflectorless	validated
GNSS / static, NRTK, RTK, AUSPOS	validated
Tape or band	verified / validated
Laser scanner	validated
Level (automatic / digital)	validated

Table 7 – Approved equipment schedule

9.2 Section 62 – Method of Recording Datum Line

The recording of the datum line of orientation of a survey on the survey plan is of fundamental importance as it is the basis from which all bearings shown on the survey plan have been derived; it also, for the majority of survey plans, describes the basis of alignment with the Map Grid of Australia (MGA). It is an important consideration as data shown on a survey plan will be used to upgrade the Digital Cadastral DataBase (DCDB) and State control network, benefiting the survey industry, government and the people of NSW.

The datum line of orientation is also the first consideration for future surveyors wanting to accurately place their survey on the horizontal datum of the subject survey.

A quality statement of the datum line must be included on the survey plan so that future users can assess the veracity of the orientation adopted. This is referred to as the 'confirmation' of the datum line.

The survey marks adopted that are the terminals of the datum and confirmation lines are required to be uniquely identified on the plan. Where those marks are recorded in the State control survey, the identification of the marks given by the State control survey (usually sourced from SCIMS) are sufficient as unique identifiers. Where the marks are not State control survey marks (e.g. a RM galvanised iron pipe), then the terminal must be given an identifier unique within the survey plan.

Comparisons of measured bearings and distances with those calculated from the accurate MGA coordinates of survey marks must be shown on the survey plan for the datum line and all confirmation lines as per Section 62.

Section 62(h) requires the surveyor to state the horizontal datum adopted on the survey plan. The horizontal datum adopted, and its source should be placed immediately adjacent to the north point of the plan, in accordance with the common usage of survey plans. See below for selected examples of north points.

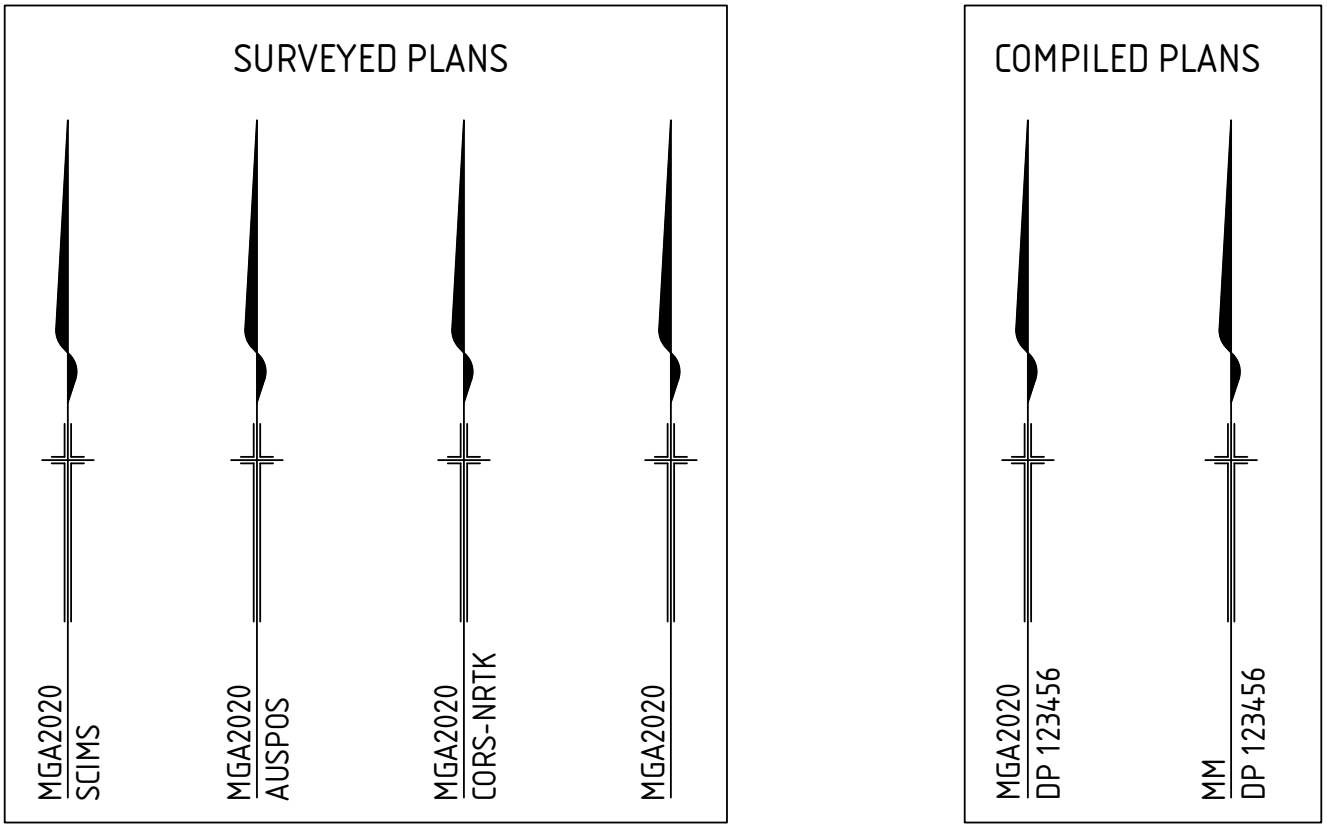


Diagram 21 – Example north points

The datum line and any verifying lines must be shown as direct connections between the datum points in a closed loop. This means that the datum line and all confirmation lines must be in a closed horizontal loop without going through the cadastre.

The datum line must be related to the survey by closed connection. This means that the datum line must be in a closed horizontal loop from the first datum point to the land surveyed, through the cadastre of the land surveyed and connected to the second datum point. The two datum points are connected due to the previous requirement.

For a survey plan adopting a SCIMS MGA orientation, comparisons must be shown on the survey plan, for the datum line and all the confirmation lines, of the measured bearings and distances with those calculated from the SCIMS MGA coordinates.

In the case where the orientation of the survey is adopted from a grid bearing derived from accurate MGA coordinates, it must be determined using an approved GNSS method, of 3 PSMs or RMs. The survey plan must show the grid bearing adopted and also the details of the confirmation of the 3 datum/confirmation lines. The distance comparison must be shown on the datum line itself. This datum line distance should be confirmed by EDM measuring equipment if possible due to the significance of the datum line.

Note that the bearings calculated from the MGA coordinates for adoption of the datum line orientation and comparison on the confirmation lines must be MGA grid bearings, not plane bearings. Grid bearing = plane bearing - (arc-to-chord correction).

Where the orientation of a compiled plan is adopted from a plan filed or recorded by the Registrar-General, the survey plan must adopt the orientation from the parent plan and show bearings and distances (if practicable) from the plan being adopted.

9.3 Section 63 – Method of Showing Boundaries Generally

It is paramount that the survey plan contains complete dimensions and the facts and evidence relating to occupations and structures that are on a boundary, near a boundary or relevant to a boundary. In this regard it is important to correctly and completely describe the nature and construction material of structures, occupations and the relationship to the boundary. The age of fencing is always required, and the age of other structures or occupations may be required if it is relevant to the definition.

9.3.1 Direct Connections between Permanent Survey Marks

Not to be confused with datum marks, all PSMs that are on the plan must be shown by direct connections to the adjacent mark in a closed loop. The plan may have two loops, one of the datum marks and one of the remaining PSMs. The two loops will have common points.

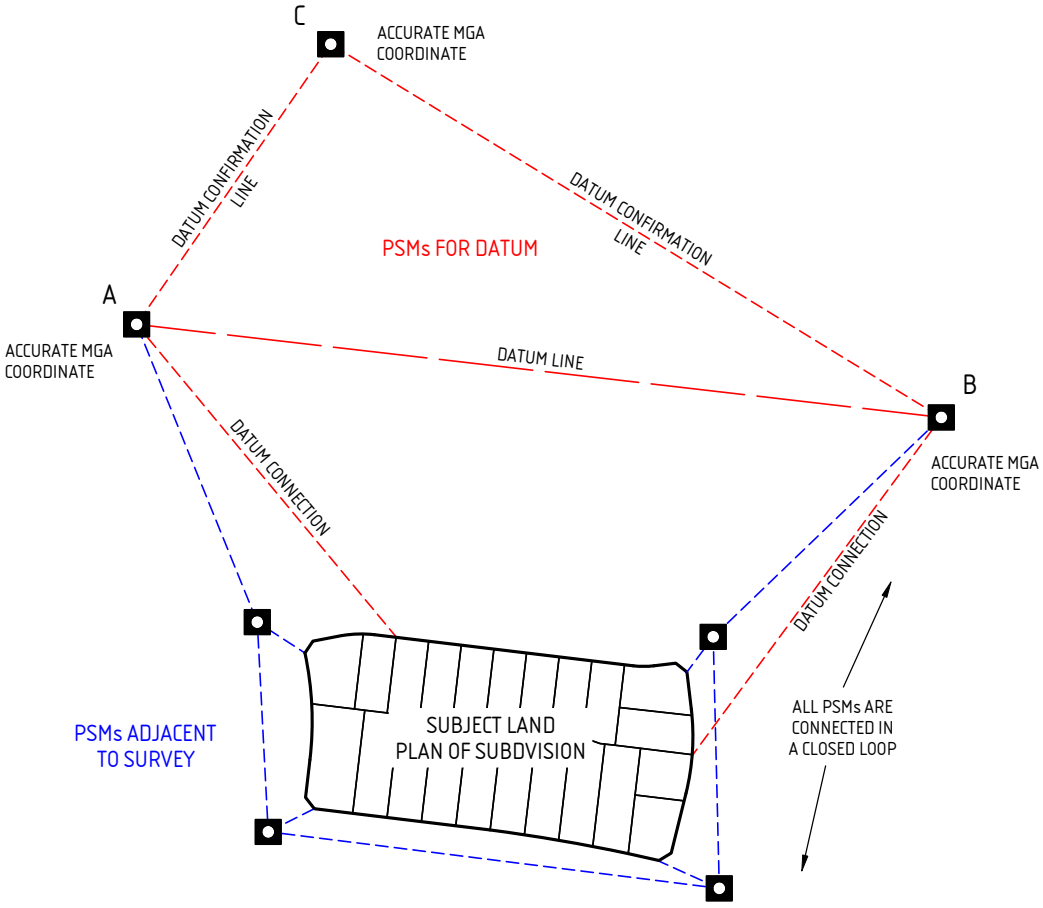


Diagram 22 – Permanent survey mark connections

Note: Only dimensions and details relevant to this example are shown. All other requirements must be shown in accordance with the Regulation.

9.3.2 Complete Dimensions

Greater attention to detail is required to ensure that the lodgment of digital plans via NSW LRS can deliver and assess whether information is complete, accurate, current and included within the survey plan.

In this regard, Sections 63(1)(f) & 63(2)(a) require that the surveyor must include complete dimensions, including by calculation from parent plans (of the subject lot) on public record. Note some lots and roads have never been surveyed and therefore some dimensions are not available.

Crown plans show some roads as a solid line on one side and a dashed line on the other. The solid line was the side traversed however, both sides of the road were pegged at the time. Surveyors are required to bring this information forward on to current plans to show complete dimensions for the land being surveyed.

This ensures complete dimensions are transferred from the current title to the proposed title. This includes complete dimensions of Crown roads that have been surveyed at some point in history, regardless if they are not on the prior plan or current plan. The complete dimensions must also 'close' within specified limits of Section 26 appropriate to the application on the plan.

Note the formalised concession to marking the internal unformed road boundaries as detailed in **Section 8.2** of this document.

If dimensions are quoted from another source the surveyor must identify the source of the measurement by quoting the plan number. Per Original (PO) is not acceptable as it is not clear if the parent plan, the portion plan or some other plan is being quoted.

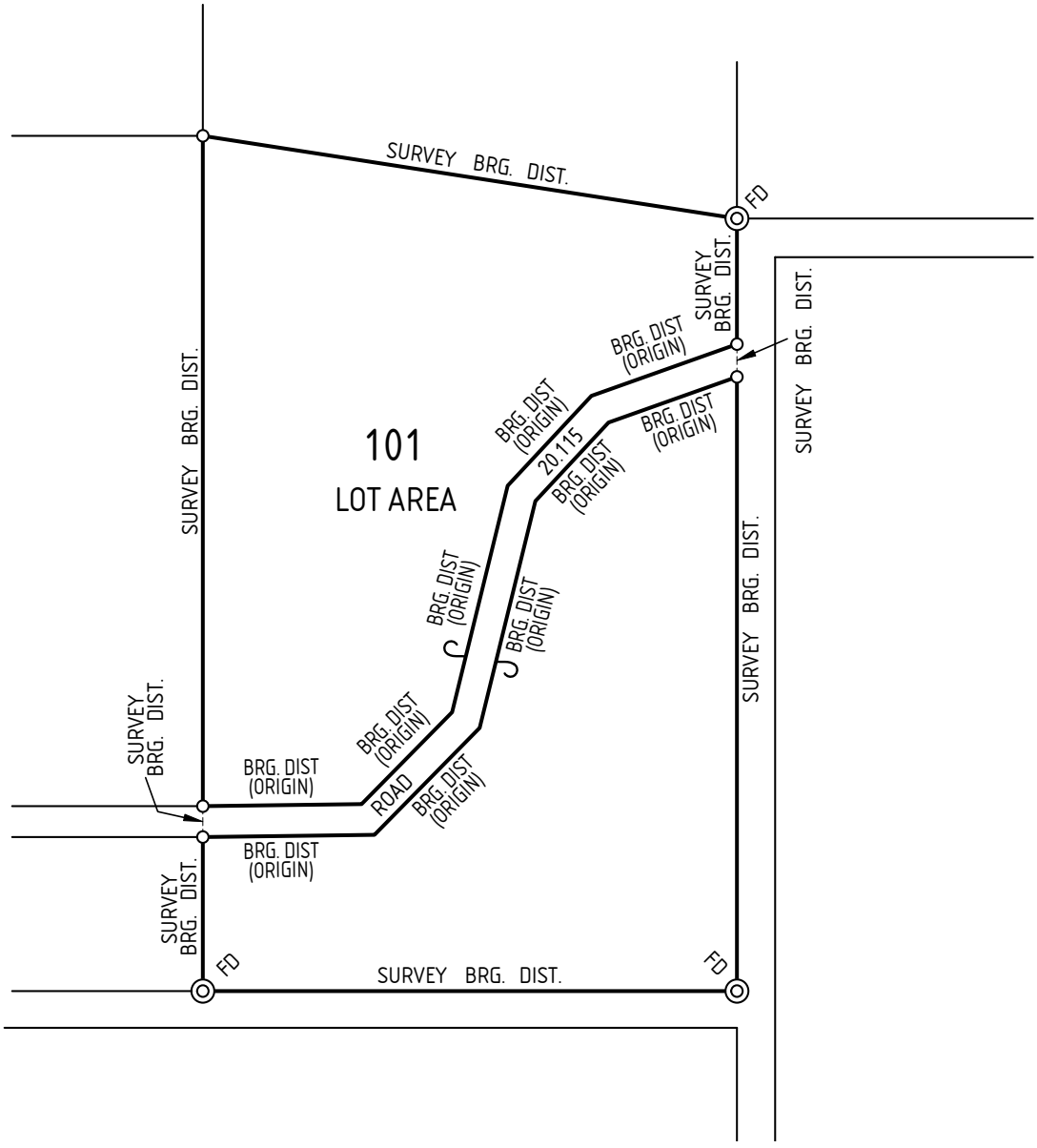


Diagram 23 – Showing unformed Crown roads

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

9.3.3 Description of Occupations

It is important for the surveyor to accurately describe the nature and/or construction material of fencing or walls on or near boundaries. Do not describe fencing as 'P & W' or 'Post & Wire' as almost all fencing is comprised of posts and wire, rendering this description unhelpful for subsequent users. The surveyor must describe what type of wire and how many of each, i.e. plain wire, barbed, netting etc. The guidelines shown below in Table 8 - Fence types shows abbreviations for fence types that should be used:

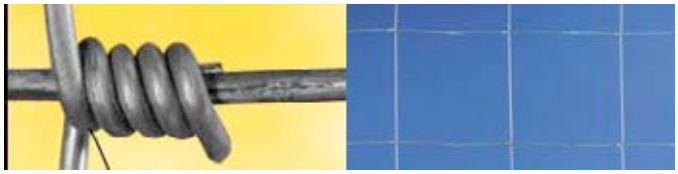
Full Description of Fencing	Abbreviation	Example
Plain Wire	P	
Barbed Wire	B	
Netting	NETT	
Hinge Joint	H/J	
Ring Lock	R/L	
Chain Link	C/L.	

Table 8 – Fence types

An example abbreviated description of a 3 plain wire, 2 barbed wire and hinge joint fence about 25 years old would be '3P 2B H/J (25 yrs)', however, the format of the description is at the discretion of the surveyor.

Section 9(1)(c) of the *Survey Practice Regulation 1990* was amended in October 1994 to emphasise the location of substantial structures near boundaries. Substantial structures in this context are fences, walls, buildings etc. Eaves and gutters are generally not considered to be substantial structures. However, if they encroach over a boundary, then the plan **must** be noted accordingly.

Section 9(3) of the *Survey Practice Regulation 1990* was amended in October 1994 to emphasise that walls must not be called 'Party Walls' unless there are easements for support already existing, as referred to in the *Conveyancing Act 1919*, or there is an intention to create such easements.

If there are no easements and there is no intention to create easements, then the wall must not be referred to as a 'party wall'. In this case it may be called centre of wall or face of wall etc.

9.3.4 Historical Classifications – Age of Fencing

To aid surveyors in interpreting older survey plans, the classifications for describing the age of fencing as shown in the *NSW Dept of Lands – Survey Directions 1963* are reproduced below in Table 9:

Age Description	Abbreviation
New - 1 - 10 Years	N
Fairly New - 11 - 20 Years	FN
Fairly Old - 21 - 30 Years	FO
Old - 31 - 40 Years	O
Very Old - Over - 40 Years	VO

Table 9 – Historical classifications - age of fencing

Surveyors should not use the above table of abbreviations as notations on current survey plans to be lodged with the Registrar-General or a public authority. It is reproduced here only as an aid for interpretation of older survey plans.

9.3.5 Aligned Roads and Kerb As Laid (K.As.L)

Where land being surveyed abuts an aligned road, the road boundary alignment must be reinstated by either:

- The location of original monuments such as alignment posts, pins or stones as shown on the alignment plans or,
- The adoption of original kerb as laid to define the kerb line from the alignment survey or,
- The use of connections from structures contained in original alignment field books or,
- From the adoption of other monuments and occupations shown on plans on public record that can be traceable to the original alignment.

Under Section 63(1)(i) and 63(1)(k) if existing kerbs are adopted as part of the road alignment definition they must be shown on the plan of survey as they show the nature of the boundaries at the time of survey and they are to be considered relevant to the boundary definition being shown.

Any survey which has a frontage to an aligned road must, at the extremities of the surveyed land, show the relationship of the existing constructed kerb as laid in relation to the kerb line as determined by survey.

Where existing kerbs are adopted to define the kerb line, existing kerb as laid must be shown at the following locations:

- Where the kerb is being adopted to define the kerb line for the road,
- At any point on the kerb which has been used to support the definition of the kerb line,
- the extremities of the land being surveyed abutting the aligned road,

Kerb as laid may also be shown at any point on the kerb line at the discretion of the surveyor undertaking the survey where it supports the definition being shown.

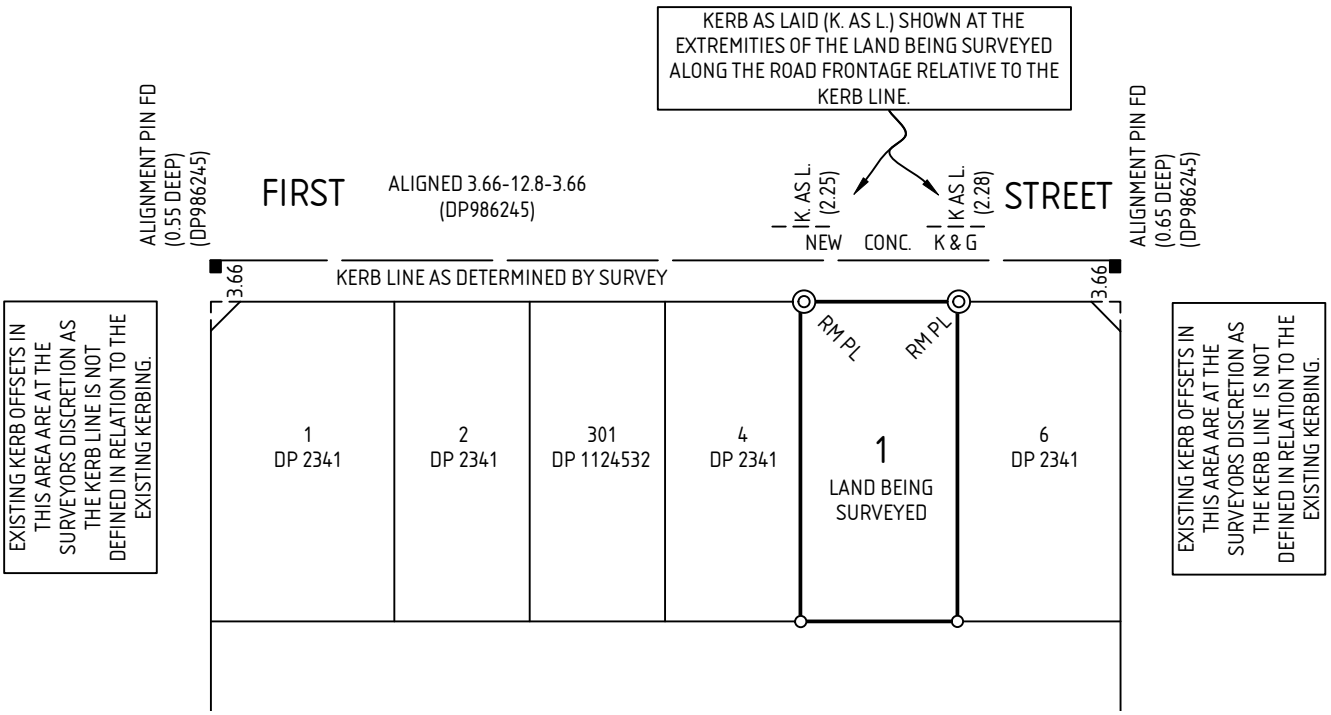


Diagram 24 – Aligned road definition from alignment marks and showing kerb as laid (K. As L.)

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

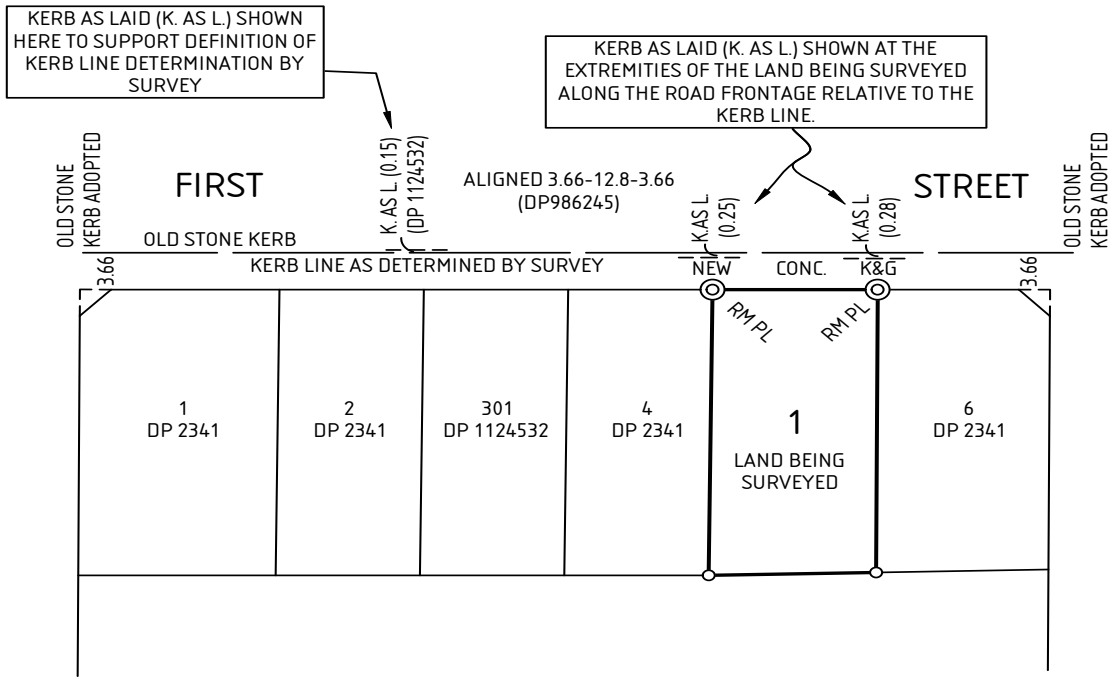


Diagram 25 – Aligned road definition from original kerb as laid and showing existing kerb as laid (K. As L.)

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

9.3.6 Island Parcels

Section 63(1)(h) describes how to show 'island parcels'. This is where one parcel is wholly contained within another parcel and shares no common boundaries or intersecting boundaries. Hence, there is no connection from one parcel to the other parcel. As such the inner parcel will not have a road frontage and will require two RMs. As all survey marks must be connected by measurement there must be two connections from the inner parcel to the surrounding parcel. This also allows a closed loop to be formed connecting the two parcels ensuring no errors are contained within the plan.

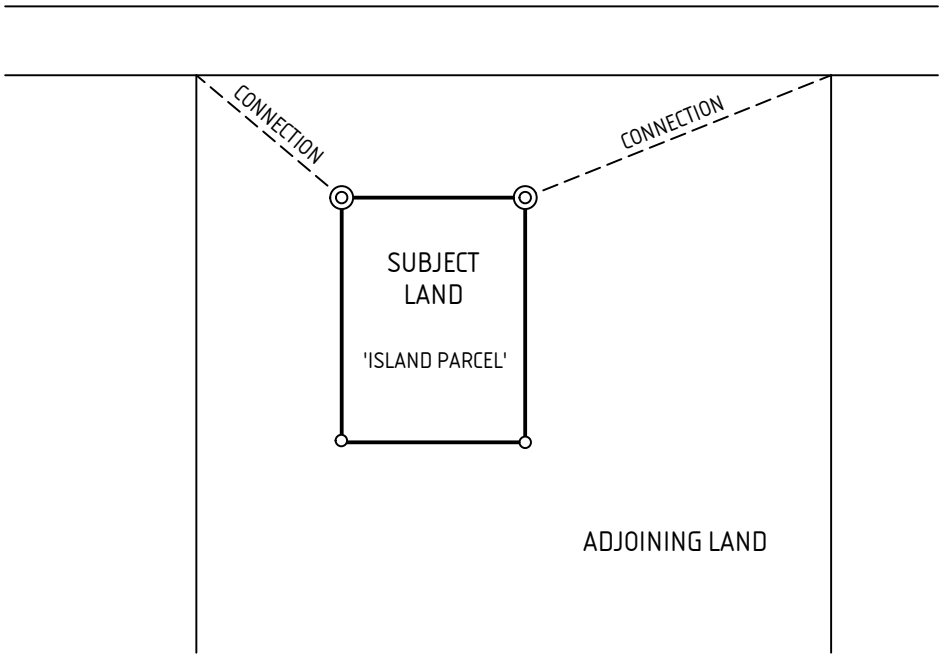


Diagram 26 – Island parcels

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

9.4 Section 66 – Natural Feature Boundaries

All natural features that form boundaries must be described on the survey plan as follows:

- A description of the type of natural feature must be shown on the survey plan; this should be done by the addition of a notation immediately adjacent to the natural feature. Examples of such a notation are:
  - 'MHWM' or 'Mean High-Water Mark is Boundary'.
    'Left bank is boundary' or 'Right bank is boundary' - the plan must also show the direction of flow of the stream or river,
  - 'Centre of river is boundary'

Note: if the plan is adopting another definition (without a new approval) the plan that is being adopted must be stated next to the description. If a new approval has been supplied, it applies to the whole natural feature boundary defined in that plan.

- The natural feature and natural feature boundary must be graphically represented on the survey plan by a spline curve (i.e. a 'smooth wriggly line'). Straight lines with fillets are not acceptable.
- The position of the natural feature and the natural feature boundary at the time of survey (i.e. the 'snapshot' of its position) is to be shown as a table of sequential bearings and distances that accurately locate each change in direction of the natural feature or boundary.

- If the natural feature and the natural feature boundary are not coincident, they must be both shown on the plan.
- For each lot (or part lot) that abuts the natural feature, a direct connection must be shown between the terminals of the natural feature as pertain to the subject lot (or part lot). That is, each subject lot (or part lot) that abuts the natural feature will have two terminals of the natural feature within that lot (or part lot); the surveyor is required to show a direct connection between those two terminals (see 66(1)(e)).

The term 'spline' is considered the geometric entity best suited for the graphical representation of a natural feature boundary. An acknowledged usage of the word is 'spline curve'.

Note that the use of a spline refers to the graphical representation of the natural feature or natural feature boundary only (i.e. the plan drafting of the natural feature), not its legal definition. The definition of a natural feature boundary has not changed and remains the feature itself, subject to the doctrine of accretion and erosion and other provisions within the common law and legislation.

The requirement to represent natural feature boundaries as a spline or 'smooth wriggly line' is to avoid the repeat of past cases where natural feature boundaries have been confused with right-line boundaries where the natural feature boundaries were depicted as straight line chords (as per advice from the Office of the Registrar-General).

9.4.1 Spline Curve – Examples

The diagrams below show examples of a spline curve. The spline curve given in the definition is an 'interpolating cubic' spline; that is, a spline of degree 3.

When drafting the spline curve to graphically represent the spline curve on the plan of survey, the spline curve must pass through the surveyed points that define the position of the natural feature at the date of survey. The fixed points of a spline (in this case, the surveyed points of the natural feature) are mathematically termed 'knots'.

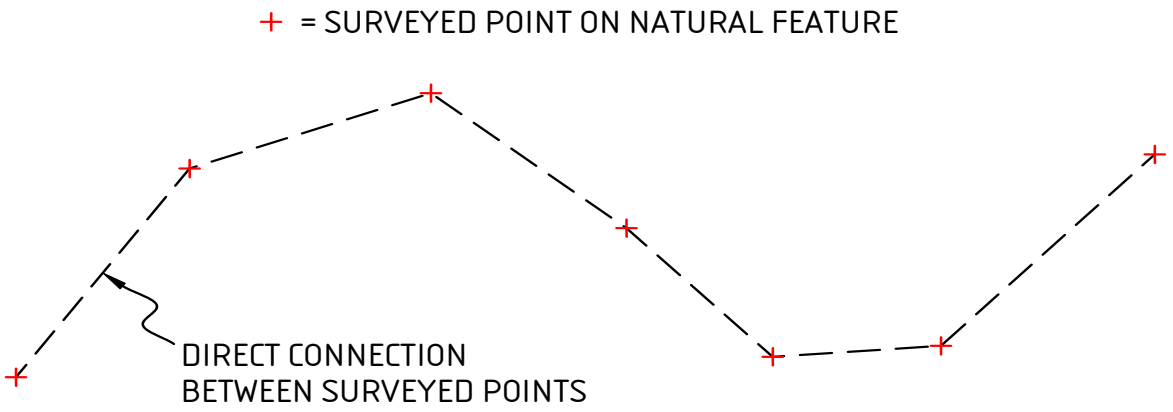


Diagram 27 – Surveyed points on natural feature

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

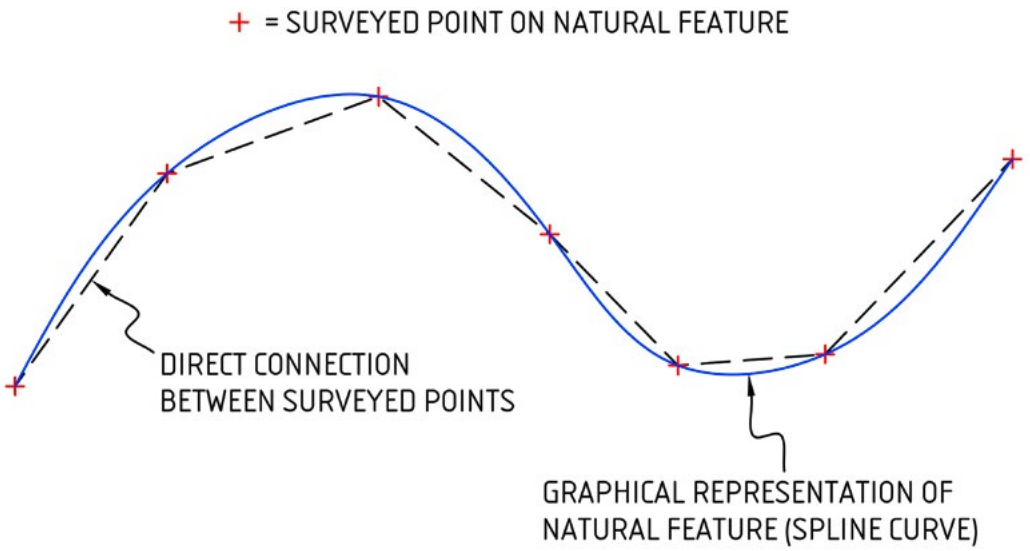


Diagram 28 – Spline passing through surveyed points

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

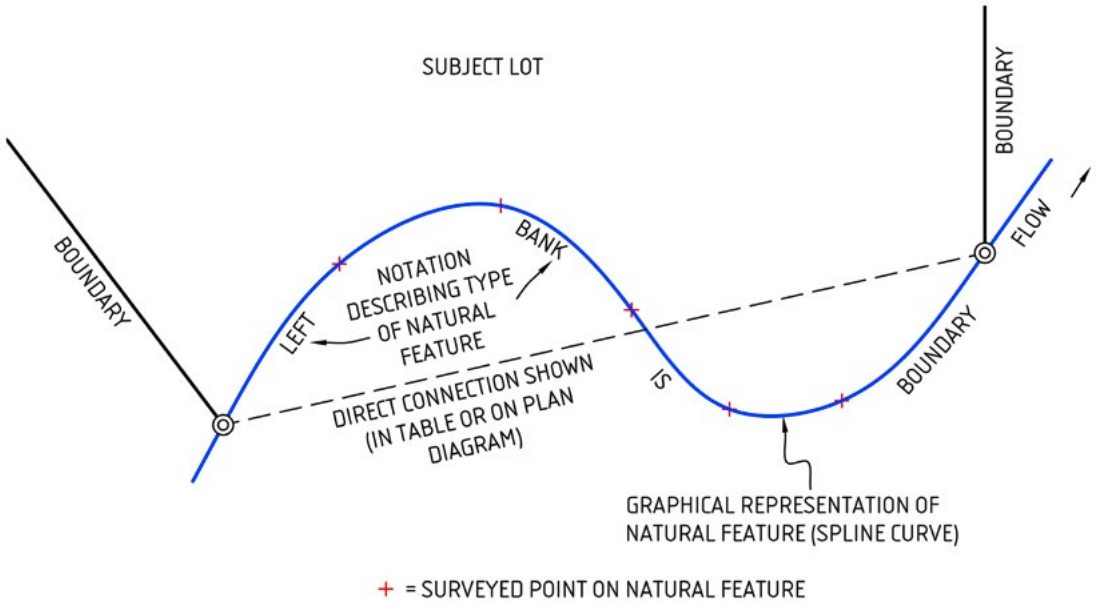


Diagram 29 – Natural feature boundary - required plan elements – concept

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

As can be seen from the diagrams **27** to **29**, it is important for a surveyor to measure sufficient points to describe the changes in direction of the natural feature as per Section 41(2). It is important to locate the natural feature at a few locations past the extremity of the subject land to ensure the graphical representation is correct.

Some CAD packages will allow the user to select the direction of the start and end tangents of the spline; the user must select the direction of the start and end tangents so that the spline best depicts the natural feature.

The plan must not show straight lines joining the changes in direction. A table is used to allow plotting of the spline for calculation. The use of numbers to indicate the approximate position of each line is only required at significant points along the boundary such as the start and end points (it is important to show which way the boundary is presented or where there is a significant feature or change i.e. a boat ramp or jetty or a lot (side)

boundary or where two water features meet etc. There is no requirement to notate every line number as this clutters up the plan and provides no relevance or benefit to the user.

Section 66(1)(d) requires that the tabulated bearings and distances accurately locating each change in direction of the natural feature boundary must be sequential. If the bearings and distances are not sequential, the following undesirable situations occur:

- If the bearings and distances are not numbered or indexed and out of sequence, the table does not correctly and completely describe the boundary and computed areas will be erroneous or,
- If the bearings and distances are numbered or indexed and out of sequence, the table is extremely difficult to interpret, giving increased scope to errors in interpretation.

9.4.2 Practical Example Natural Feature Boundary.

The following diagrams provide some examples of how to show a natural feature boundary on a plan of survey in compliance with Section 66 of the Regulation.

The diagram below is based on multiple situations combined into one diagram. Included are MHWM and non-tidal surveys where the bank of a non-tidal creek is the title boundary being surveyed. This can easily be adapted for survey plans which have other types of natural feature boundaries such as cliff face boundaries.

The following diagram shows how to show an ad medium filum aqua centre of creek natural boundary on a survey plan.

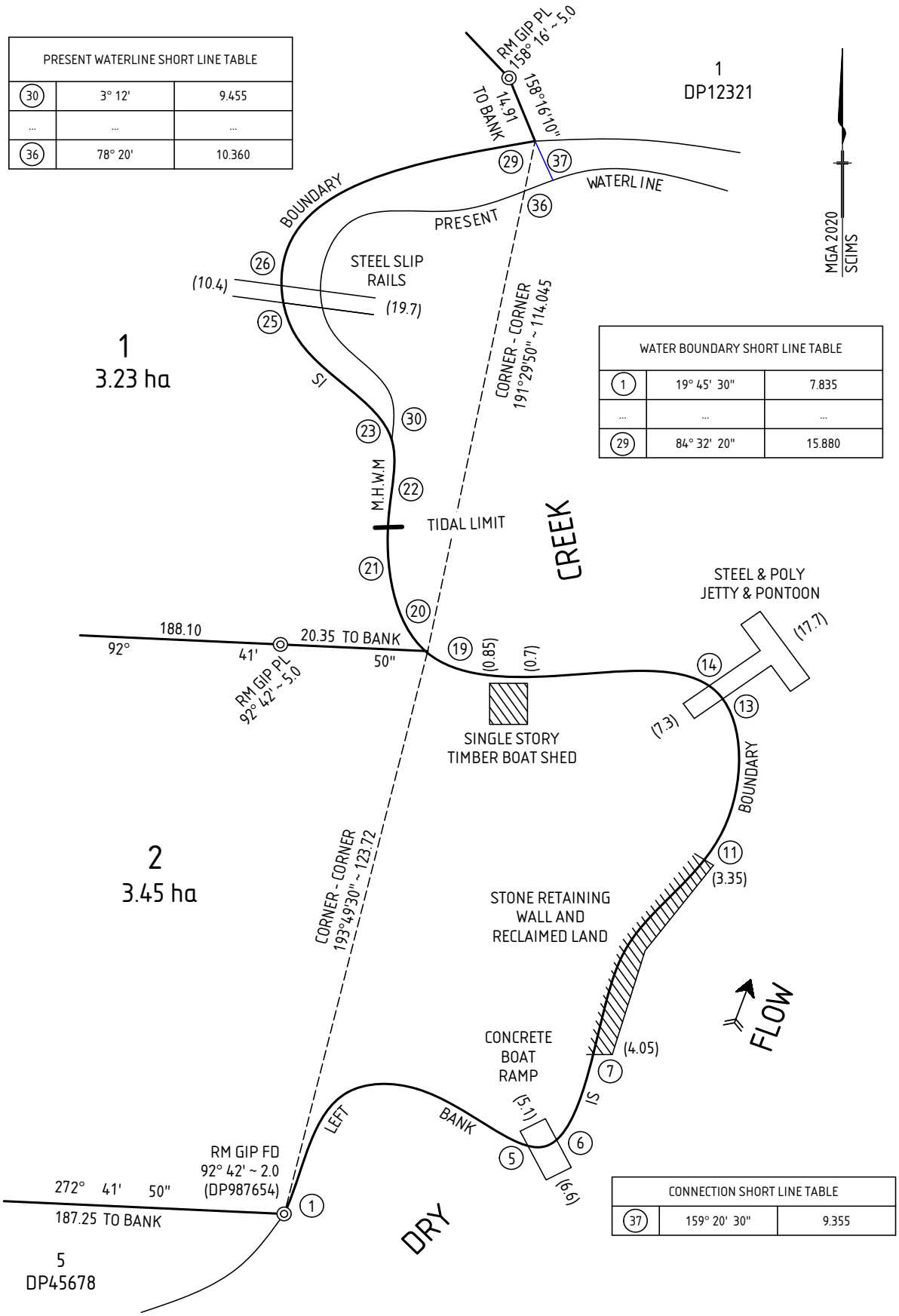
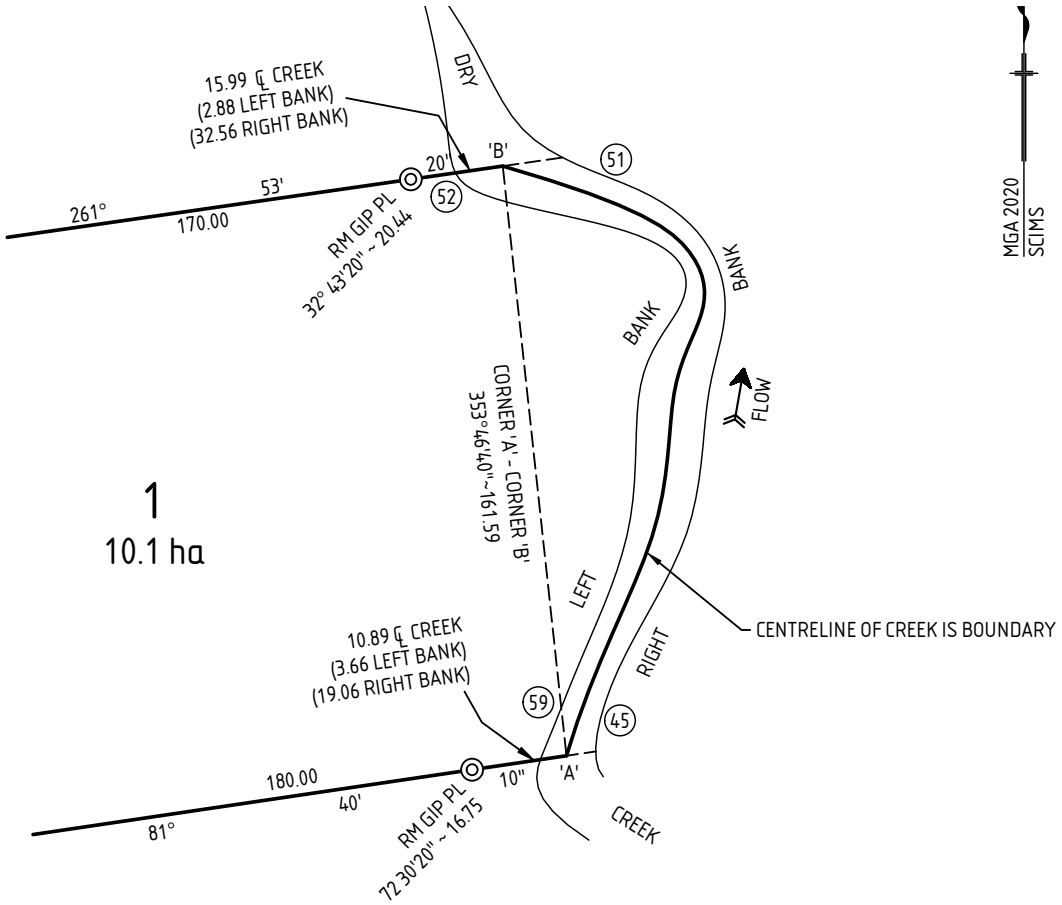


Diagram 30 – Natural feature practical example

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.



SCHEDULE OF LEFT BANK SHORT LINES

52	353°41'40"	11.53
53	279°24'00"	49.325
54	301°01'30"	18.79
55	4°24'00"	12.695
56	43°24'10"	23.26
57	354°17'50"	41.135
58	24°57'00"	40.98
59	20°48'50"	27.695

SCHEDULE OF ℄ CREEK BOUNDARY SHORT LINES FROM CORNER 'A'-'CORNER B'

16°35'00"	26.46
30°33'00"	42.70
357°05'00"	40.20
33°30'00"	21.70
355°20'00"	16.40
307°08'00"	21.70
284°03'00"	44.20

SCHEDULE OF RIGHT BANK SHORT LINES

45	192°06'40"	25.65
46	215°40'20"	44.795
47	179°59'40"	39.365
48	202°27'10"	20.875
49	169°41'50"	20.365
50	131°45'40"	24.795
51	109°52'20"	39.44

Diagram 31 – Natural feature practical centreline of creek

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

9.5 Section 67 – Height Difference, Coordinate & Height Schedules.

Surveyors are required to show height differences, MGA coordinates and heights in approved schedules. Use of schedules that are not in the same form as those that are approved will attract a requisition upon lodgment of the survey plan; elements of the approved schedules that must be adhered to are:

- Heading of the schedule
- Number of columns, the column designation and the column order
- Information regarding the date of SCIMS coordinates, the MGA zone, MGA datum, Combined Scale Factor (CSF) and height datum which must be shown at the bottom of the schedules.

The height schedule, height difference schedule and coordinate schedule must appear as separate schedules on the survey plan (i.e. they cannot be merged into one schedule). This is to facilitate digital capture and manual examination of the survey plan.

The requirement for the height difference, coordinate and height schedules as per Section 67 to be approved schedules (i.e. of the form specified by the Surveyor-General) has been continued for several reasons:

- Data in a standardised form means that the information is always given in a specific format, thus enabling LandXML digital lodgment automated checking procedures and ingestion
- Surveyors should be the subject of fewer requisitions regarding the form of the schedule required if a standardised form is specified and adhered to.
- Reduces clutter on the plan and specifies a particular place where certain information is contained, thus making manual examination and interpretation easier.

The definition of approved is that shown in Schedule 9 of the *Surveying and Spatial Information Regulation 2024* which states:

'Approved means approved by the Surveyor-General.'

A drawing template for the approved schedules required under Sections 67 in Autocad .dwg and .dxf formats is available from the DCS-Spatial Services – Surveyor General's Directions webpage.
https://www.spatial.nsw.gov.au/surveying/publications/surveyor_generals_directions

9.5.1 Height Difference and Height Schedules

The height datum needs to be propagated for infrastructure management and development; the State control survey is essential public infrastructure, in just the same way as sewer, stormwater drainage, electricity, communication and data services. Height is an important component of State control survey.

The survey plan is being used as the delivery mechanism for height from the surveying industry for several reasons:

- All necessary survey information is contained in one location, allowing for the easier integration with digital plan validation and allows the Surveyor-General to collate, ingestion and improve the State control survey and DCDB.
- In specifying both height differences and height values to be shown, the survey plan becomes self-describing and self-checking. This can be considered analogous to showing MGA coordinates and horizontal bearings and distances. One can be used to check the other.
- Avoids duplication of effort by different surveyors having to propagate height from a remote origin for differing stages of the same development.

The requirement to determine AHD71 heights has not changed since its introduction in the *Survey Practice Regulation 1990*.

A flowchart has been prepared to enable users to determine when a height schedule & height difference schedule are required under the Regulation. A separate PDF version of the flowchart is available from the DCS-Spatial Services – Surveyor General's Directions webpage.

In the instance that the Regulation does not require a height difference schedule and a height schedule to be shown on the survey plan, a surveyor may, if they so choose, show the height difference schedule only on the survey plan, or both schedules where AHD71 heights are available. The height schedule cannot be shown without the height difference schedule.

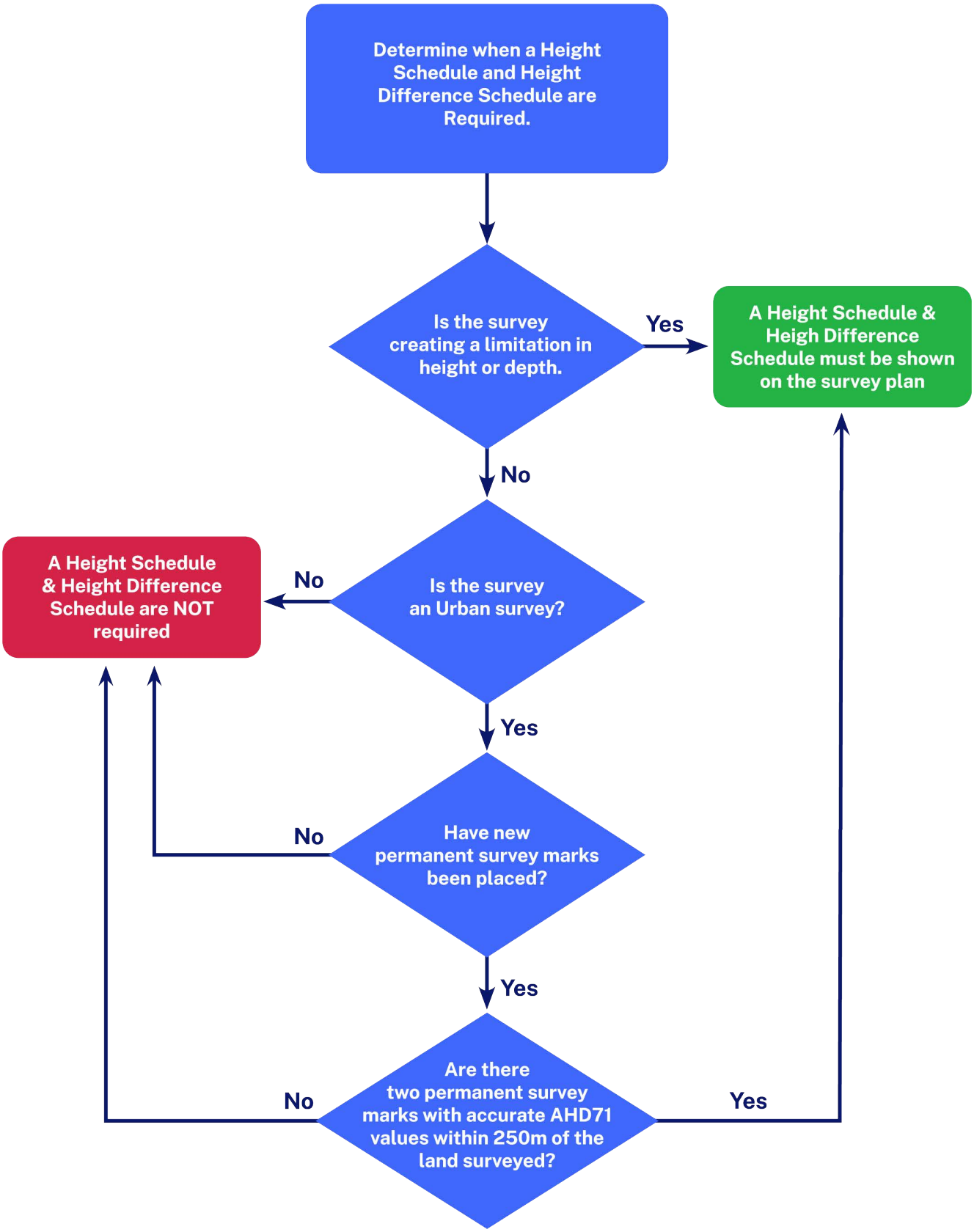


Diagram 32 – Flowchart to determine when a height schedule and height difference schedule are required.

9.5.1.1 Height Difference Schedule Requirements

The height differences must be shown as a closed sequence (that is, a closed 'loop' or 'loops'). There must not be any height difference shown that is not part of a closed sequence (i.e. a 'hanging' height difference).

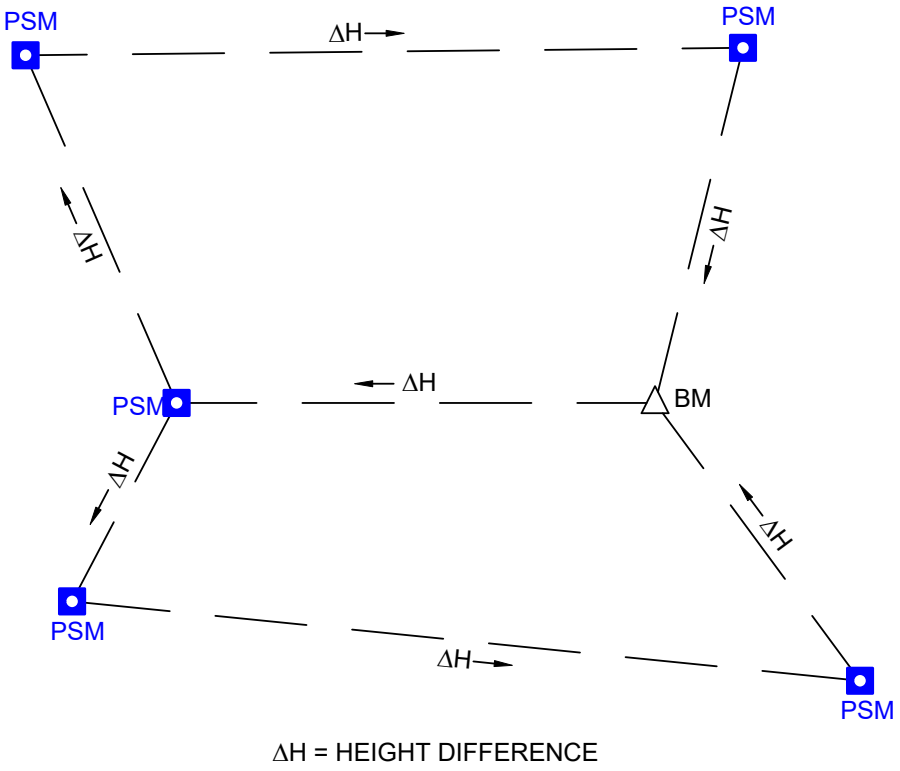


Diagram 33 – Height difference - closed sequence

Note: Only dimensions and details relevant to this example are shown.
All other requirements must be shown in accordance with the Regulation.

The marks between which height differences must be shown will be either PSMs or BMs unless as otherwise approved.

If a mark defining the terminal of a height difference has an identification designated by the State control survey (in most cases this will be recorded in SCIMS), then that identification must be shown on the survey plan. Otherwise, identification unique to the subject survey plan must be used.

The method used to determine height differences shown on the plan must be stated in the appropriate column of the approved schedule; the height differences must attain a Class 'B or Class LD accuracy or better, regardless of the method used.

The height differences shown in the height difference schedule should be taken from the adjusted height difference components of the survey adjustment output; they should not be calculated directly from the height schedule drafted on the survey plan. This method provides an independent check of the drafted plan height difference values when comparing both the height difference and height schedules.

All height differences must be relative to the same datum and must be AHD71 unless otherwise exempted. That is, a surveyor cannot state gravimetric height differences relative to AHD71 and non-gravimetric height differences (e.g. ellipsoidal height differences) relative to an approved datum within the same survey plan.

Height Difference Schedule

FROM	TO	HEIGHT DIFFERENCE	METHOD
PM 3570	PM 3571	+11.107	DIFFERENTIAL LEVELLING
PM 3571	PM 1653	+1.726	TRIGONOMETRIC HEIGHTING
PM 1653	PM 3570	-12.833	TRIGONOMETRIC HEIGHTING
PM 3570	TS 5517	+51.279	STATIC GNSS
TS 5517	GB 2465	-17.273	DIFFERENTIAL LEVELLING
GB 2465	BM 2	+3.791	DIFFERENTIAL LEVELLING
BM 2	BM 1	-3.436	DIFFERENTIAL LEVELLING
BM 1	PM 43390	-5.717	DIFFERENTIAL LEVELLING
PM 43390	PM 3570	-28.644	TRIGONOMETRIC HEIGHTING
HEIGHT DATUM: AHD71			

Table 10 – Approved height difference schedule

A drawing template for the approved height difference schedule in Autocad .dwg and .dxf formats is available from the DCS-Spatial Services – Surveyor General's Directions webpage.
https://www.spatial.nsw.gov.au/surveying/publications/surveyor_generals_directions

9.5.1.2 Height Schedule Requirements

The marks for which heights must be shown will be either PSMs or BMs, unless as otherwise approved.

If a mark for which a height is shown has an identification designated by the State control survey (in most cases this will be recorded in SCIMS), then that identification must be shown on the survey plan. Otherwise, identification unique to the subject survey plan must be used.

For the height schedule, the survey technique used to derive the AHD71 value is not needed as it will be a derivative of the method shown in the height difference schedule.

The heights shown in the height schedule should be taken from the adjusted heights of the survey adjustment output; they should not be calculated directly from the height difference schedule drafted on the survey plan. This method provides an independent check of the drafted plan height values of marks when comparing both the height difference and height schedules.

The height datum confirmation is required to be shown for all marks in the height schedule that have an 'accurate AHD value'

The height datum confirmation comprises:

- The SCIMS AHD71 value adopted to derive the AHD71 values for marks not having an accurate AHD value. This AHD71 value must be designated 'SCIMS adopted' in the height datum confirmation column of the approved height schedule. Only one AHD71 value in the height schedule can be given the designation 'SCIMS adopted'.
- The marks used to confirm the accurate AHD value of the single mark adopted. There must be at least one such mark; the marks used for height datum confirmation must be given the designation 'from SCIMS – datum confirmation' and the height as recorded by SCIMS must be shown in the height schedule. It is expected that this will usually mean a minor disparity, within the specified tolerance, when the measured height differences within the height difference schedule are used to check the SCIMS heights shown in the height schedule.

Marks that do not have accurate AHD values:

- cannot be designated as 'SCIMS adopted' or 'From SCIMS – datum confirmation'
- if shown in the height schedule, must be shown with the height value as determined by the surveyor to Class B or LD or better

The height datum confirmation is critical information describing what the height values determined by the surveyor are based on and what was used to confirm that basis.

The state of the marks must be shown which can only be shown as either 'found', 'placed' or 'disturbed' (disturbed marks with a height shown must be stable and have an unambiguous measurement point).

The date of the SCIMS AHD71 values must be shown; all SCIMS AHD71 values must have been obtained or verified from SCIMS at the same date.

All heights must be relative to the same datum. That is, a surveyor cannot state gravimetric heights relative to AHD71 and non-gravimetric heights (e.g. ellipsoidal heights) relative to an approved datum within the same survey plan.

Height Schedule

MARK	AHD VALUE	CLASS	PU	HEIGHT DATUM CONFIRMATION	STATE
PM 3570	680.182	LA	0.01	SCIMS ADOPTED	FOUND
PM 3571	691.290	LA	0.01	FROM SCIMS - DATUM CONFIRMATION	FOUND
TS 5517 'MULLEY'	731.465	LC	N/A	FROM SCIMS - DATUM CONFIRMATION	FOUND
PM 1653	693.015	B	0.03		DISTURBED
PM 43390	708.830	LB	N/A	FROM SCIMS - DATUM CONFIRMATION	FOUND
GB 2465	714.190	LC	N/A	FROM SCIMS - DATUM CONFIRMATION	FOUND
BM 1	714.543	LD	N/A		PLACED
BM 2	717.979	LD	N/A		PLACED
DATE OF SCIMS AHD VALUES: 1-1-2020				HEIGHT DATUM: AHD71	

Table 11 – Approved height schedule

A drawing template for the approved height schedule in Autocad .dwg and .dxf formats is available from the DCS-Spatial Services – Surveyor General's Directions webpage.
https://www.spatial.nsw.gov.au/surveying/publications/surveyor_generals_directions

9.5.2 Coordinate Schedule Requirements

The coordinate schedule must show the MGA coordinates of:

- Any mark used to define an accurate MGA orientation (i.e. PSMs and/or RMs)
- Any permanent survey mark found or placed, or
- Any bench mark found or placed.

Additionally, particulars of the mark and its MGA coordinates must also be shown, specifically,

- The identity of the mark.
- The accuracy of the mark.
- The survey method used to determine the MGA coordinates.
- The state of the mark, which can only be shown as either:
    - Found.
    - Placed.
    - Disturbed (disturbed marks with a coordinate shown must be stable and have an unambiguous measurement point).
- The date of the MGA coordinates all MGA coordinates must have been obtained or confirmed at the same date.
- The Combined Scale Factor (CSF).
- MGA Zone.

Section 67(1) requires that MGA coordinates shown on the survey plan must be within the same MGA zone and be derived from the same datum. This prevents surveyors from using coordinates from different coordinate systems (different datums and map projection zones) on the same plan (e.g. GDA94 and GDA2020) which may result in incorrect spatial positioning and incorrect datum line orientation.

If a mark for which coordinates are shown has an identification designated by the State control survey (in most cases this will be recorded in SCIMS), then that identification must be shown on the survey plan. Otherwise, identification unique to the subject survey plan must be used.

Regarding the accuracy of the MGA coordinates required to be shown in the coordinate schedule:

1. If the mark is an established survey mark and the values in SCIMS have been adopted, then the MGA coordinates that must be shown are those recorded in SCIMS.
2. If the survey has adopted an accurate MGA orientation (excepting those marks in (3) below), then the surveyor must show the MGA coordinates of the mark to an accuracy of Class D or better or a Positional Uncertainty (PU) of 0.1m or less.
3. If the mark is not an established survey mark and has been used for complying exclusively with for height requirements (that is, is connected to the survey by height difference only), then the MGA coordinates need only be determined to a PU of 3m or better.

Coordinate Schedule

MARK	MGA COORDINATES EASTING	MGA COORDINATES NORTHING	CLASS	PU	METHOD	STATE
TS 5517 'MULLEY'	738 668.404	6 298 132.250	2A	0.02	SCIMS	FOUND
GB 2465	738 705.138	6 298 195.369	D	0.02	SCIMS	FOUND
PM 1653	738 520.845	6 299 164.103	D	0.05	CADASTRAL TRAVERSE	DISTURBED
PM 3570	738 727.326	6 299 302.728	B	0.02	SCIMS	FOUND
PM 3571	738 544.177	6 299 161.049	A	0.02	SCIMS	FOUND
PM 43390	738 606.451	6 298 196.270	B	N/A	SCIMS	FOUND
GI PIPE A	738 598.524	6 298 083.327	D	N/A	CORS NRTK GNSS	PLACED
DH&W B	738 591.617	6 298 061.751	D	0.03	AUSPOS	PLACED
STAR PICKET C	738 600.552	6 298 091.414	D	0.05	AUSPOS	PLACED
DH&W D	738 572.753	6 298 038.178	D	0.03	CORS STATIC GNSS	FOUND
BM 1	738 627.439	6 297 977.148	C	N/A	CADASTRAL TRAVERSE	PLACED
BM 2	738 672	6 298 059	U	3	HAND HELD GNSS	PLACED
DATE OF SCIMS COORDINATES: 1-1-2020		MGA ZONE: 55			MGA DATUM: GDA2020	
COMBINED SCALE FACTOR:1.000187						

Table 12 – Approved coordinate schedule

A drawing template for the approved coordinate schedule in Autocad .dwg and .dxf formats is available from the DCS-Spatial Services – Surveyor General's Directions webpage.

https://www.spatial.nsw.gov.au/surveying/publications/surveyor_generals_directions

The requirement to show a coordinate schedule is considered necessary and beneficial for the following reasons:

- The coordinate schedule spatially enables the survey plan without reference to any external databases, spatial information systems or plans. This enables the end user of the plan to determine the position of the survey without recourse to any of the aforementioned resources.
- In the case where an accurate MGA orientation has been adopted, the coordinate schedule will describe the fundamental information that forms the basis of the horizontal datum adopted. This is a fundamental outcome of a survey plan and will be increasingly important in future when horizontal coordinate datums are updated and many such former datums will exist. Should the coordinate schedule not be placed on the survey plan, the end user will have to make assumptions as to what fundamental information was used.
- The above two points emphasise that the survey plan is self-describing and self-checking. This is an important attribute as it requires access to far fewer, if any, external information sources to use the survey plan.

9.5.3 Determination of Class and Positional Uncertainty

Generally speaking, 'Class' is the quality of the survey and PU is the quality of a coordinate or height with respect to the fundamental reference frame (e.g. GDA2020).

Requirements for accuracies to be shown in the coordinate and height schedule on a survey plan are:

- For established survey marks (if SCIMS values adopted), the Class and PU as shown in SCIMS is required to be shown; if the PU is reported in SCIMS as null (empty), 'N/A' should be shown for PU.
- For survey marks with MGA coordinates or heights determined by the surveyor, Class is required to be shown. The surveyor should show PU in the case where AUSPOS is used to derive the MGA coordinate as explained below. For all other Approved GNSS methods 'N/A' should be placed in the PU column.

AUSPOS MGA coordinates: The AUSPOS report gives a PU for the respective coordinate and height solutions. The PU for MGA coordinates should be that shown as the Horizontal PU for the GDA2020 datum within the AUSPOS report.

9.6 Section 68 - Nature and Position of Survey Marks

Section 68 requires that a surveyor must indicate on the plan of survey the nature, position and source of all survey marks found, and all survey marks placed that are not pegs. The source is the plan number of the survey that originally placed the mark or the earliest plan of survey which adopted the mark.

Regarding RMs, the following requirements must be followed when denoting the source of the mark:

- The survey plan on which the RM first occurs must be shown.
- The survey plan from which the subject survey has adopted the bearing and distance to the referenced corner must be shown.
- Where the reference bearing and distance has been adopted from a survey plan different from the survey plan on which the mark first occurs, both the survey plan on which the mark first occurs and the survey plan from which the reference has been adopted must be shown.
- Where the RM is gone the plan must state the mark type and origin of the mark that is gone e.g. RM GIP GONE (DP123456).

9.7 Section 69 - Showing Discrepancies

To help facilitate the assessment of discrepancies shown on a survey plan, a threshold tolerance of 40mm + 200ppm has been set (see Section 22). It is four times the rejection criteria of the current length tolerance and two to three times that of older surveys. If a surveyor discloses differences of more than 40mm+ 200ppm then a report must be supplied (as there is a reportable doubt Section 77) with the survey plan upon lodgement with the Registrar-General.

The plan is required to justify the discrepancy by showing the additional survey undertaken to determine that there is an issue, and that the surveyors work is sound, accurate, confirmed and that there is sufficient land available. The plan must also provide enough information to ensure that a hiatus or overlap is not unintentionally been created if monuments are missing.

10. Part 9 - Certificates

All land surveys must have an appropriate certificate signed by a registered surveyor. A land survey is any survey that shows land boundaries. See BOSSI publication 'What is a Land Survey' https://www.bossi.nsw.gov.au/__data/assets/pdf_file/0007/232792/2409_What_is_a_Land_Survey.pdf

This includes but is not limited to:

- Formal land surveys (i.e. Deposited Plans or Strata Plans) such as a redefinition, subdivision, consolidation or any other plan lodged with the Registrar-General for titling purposes.
- Identification and re-marking surveys that are prepared for a client to describe the land in a title and result in a diagram and or report.
- Detail, Works As Executed (WAE) surveys that show boundary lines. While the primary purpose of the survey is not to define the boundaries the fact that the boundaries are identified makes these surveys land surveys.
- Surveys of lesser accuracy that show land boundaries, these surveys are a special category of survey that allow the boundaries to be defined to a lesser extent because the boundary is very far away from the activity of interest but there needs to be an indication that the activity is on the correct parcel or there are Surveyor-General Directions that permit this type of survey to occur such as SGD No 13 Aquaculture Lease Surveys.

There are different certificates for each type of land survey, see Schedule 8 Forms.

- Form 1 is for formal land surveys,
- Form 2 is for identification and re-marking surveys; this includes detail and WAE where necessary.
- Form 3 is to be used for surveys of lesser accuracy.

All surveys prepared under supervision are required to be signed by the supervising registered surveyor as they are responsible for the survey.

The misclose vector tolerance required by Section 26(3) is required to be shown in the survey certificate when a partial survey is undertaken. (e.g. 500ppm for a partially surveyed parcel that is over land surveyed between 1862 – 1975 and includes level to undulating terrain)

The consent certificate (Form 4) – is to allow a surveyor to sign the plan once the boundary definition is complete but before all the survey marks are placed allowing multiple consenting authorities to process the plan simultaneously while the marking is being undertaken. This is to provide a level of accountability that the plan is true and correct, and the boundaries will not change after approval has been given.

This allows the development pipeline to be streamlined reducing the timeframe required to get a plan prepared, approved and registered. When seeking consents on the basis of the consent certificate (Form 4), surveyors should identify on the plan it accompanies where survey marks will be placed (for example an RM symbol with the text 'RM to be Placed'). A notation on the plan should state 'All survey marks will be placed prior to the plan being lodged for registration with NSW LRS.'

The consent certificate (Form 4) is not a substitute for Form 1 or Form 3 survey certificates. Form 4 is a temporary certificate to allow business processes to occur with confidence until Form 1 or Form 3 is signed. Consenting parties may choose not to provide their consent on the basis of a consent certificate (Form 4). No plan is to be registered by the Registrar-General or NSW LRS without a Form 1 or Form 3 certificate.

11. Part 10 - Reporting

11.1 Section 72 - Records of Verification, Validation and Confirmation

The surveyor is required to undertake verification, validation and confirmation processes under the Regulation. As a part of this process the surveyor is required to keep the records that prove this occurred. These records relate to every survey undertaken within the 12-month period after the testing and report is completed.

Each report must identify the instrument tested and associated equipment such as barometer & thermometer, the method used to test the instrument, the results of the test and the outcome of the test.

11.2 Section 73 – Permanent Survey Marks

Once a PSM is placed, the surveyor must forward the Locality Sketch Plan (LSP) to SCIMS@customerservice.nsw.gov.au or via the Customer Hub, within 2 months of placing the mark or before the plan is lodged with NSW LRS.

The LSP must be prepared to an approved standard (see *Surveyor-General's Direction No. 2 – 'Preparation of Locality Sketch Plans'*) and must include MGA coordinates of the mark to a PU equal to or better than Class D or 3m (as appropriate).

A surveyor is required to notify the Surveyor-General if they become aware that a PSM has been removed, damaged or destroyed. Likewise, if a PSM is found during the survey but marked 'N' (Not Found) in SCIMS this should also be notified. This is achieved by written notification through the Customer Hub Portal – Survey Mark Status Report or through the NSW Survey Marks Mobile App.

PSMs marked 'N' (Not Found) in SCIMS are not established survey marks.

11.3 Section 74 – Natural Feature Boundaries

Once the survey is completed a report is required to be prepared and lodged with the plan. These reports are available from NSW-LRS upon request to assist with the next survey. The report should be lodged with colour images and diagrams in a PDF format.

A template and a sample report are available in the resource pack associated with this direction.

The report must include:

The basis and method used to determine the position of the boundary. The basis means a clear description of what physical feature was surveyed such as the Mean High-Water Mark (MHWM) or the top of the bank (depending on the case). The method used to determine where that feature was, meaning the range ratio method or other recognised method to determine MHW or the method used to determine which bank to adopt. This is to allow the next surveyor to be able to identify the same feature to allow a consistent comparison.

A description of the evidence used that justifies the outcome and the reasoning that satisfies the doctrine of accretion and erosion if there has been any change. Consideration must also be given to the application of the requirements set out in Section 28 of the *Coastal Management Act 2016* as they apply to Mean High-Water Mark surveys within the coastal zone. Further a clear statement as a summary if there is a change and that it complies with the doctrine of accretion and erosion or not or that there is no change.

As many images as is required to demonstrate where the boundary has been located on the ground and what the physical circumstances of the site are that affect the vicinity of the natural feature. The use of traffic cones, bipods, a bright tape placed on the ground between points greatly assist the explanation of what was located and how it conforms with the natural feature.

Real-time water data from Water NSW is very useful to obtain a history of flow and flow events for a stream. The Water NSW website supplies daily water levels at individual the required stream gauge. (Some gauges have many years of continuous data). The data from the Water NSW website data is freely available. and can be used to assist in the justification of the definition (the data is only relevant for non-tidal streams).

The report should contain a diagrammatic comparison of the current plan to the surveyed position of the natural feature as adopted for the plan. If the position adopted is not the present waterline the relationship between all these features should be shown clearly. Any other plans or consideration may be shown in this diagram.

Only the position of the natural feature boundary as adopted (and the present waterline if required) are to be shown on the plan. Each of these must be shown as a spline with a short line table describing the lines that represent the spline.

11.4 Section 76 – Partial Surveys

If a lot is the subject of a partial survey and the un-surveyed boundaries of the lot do not close within the allowable tolerance as set in Section 26(3)(b), a report is required. As there is a requirement to determine a closing dimension between the terminals of the partially survey land by survey and by compiled lines, the complied part of the lot should close within acceptable limits or there is an obvious issue with the description of the land.

If a partially surveyed lot exceeds the tolerance specified in Section 26(3) a report is required outlining why an additional survey is not required to resolve the issue in this case (taking into account that the specified tolerances are 4 times the misclose allowable at the time that the previous survey was undertaken).

The report must also provide the misclose vectors of the partial surveyed and compiled areas and the allowable tolerance as specified in Section 26(3)(b). This is to allow all the information to be reported in one location to allow for easy comparison.

Part (b) of the survey certificate (Form 1) requires the applicable tolerance quoted from Section 26(3) for partial surveys to be shown with the certificate. For example, if the parent survey plan was surveyed in 1948 and covers level to undulating terrain, then the applicable tolerance from Section 26(3) is 500ppm.

11.5 Section 77 – Doubts and Difficulties

The Regulation requires the surveyor to disclose and describe any differences in cadastral redefinition or measurements compared to SCIMS. If the discrepancy is greater than 40mm + 200ppm (Section 22) then a report must be furnished with the survey plan. This is because there is a reportable doubt due to the discrepancy being larger than the allowable tolerance.

Discrepancies are shown on the plan as these are a simple comparison of the outcome of surveyed verses documented value. However, doubts and difficulties are much harder to show on a plan and hence a report is required. If doubts or difficulties were encountered in a land survey, a report must be prepared and lodged with the plan.

The report must describe the doubts and difficulties encountered by the surveyor. It should also outline what was undertaken to investigate any doubts and what extra work was undertaken to resolve any difficulties or differences. The report should also explain the effect that these issues had upon the outcome of the survey and how these issues were addressed.

12. Part 13 - Miscellaneous

12.1 Section 96 – Removal of Survey Marks

Applications under this section to remove survey marks, being PSMs, RMs and BMs should be made in writing with appropriate documentation via DCS Spatial Services Customer Hub.

Refer to *Surveyor-General's Direction No. 11* - 'Preservation of survey infrastructure' for instructions detailing the requirements of such an application.

13. Schedules

13.1 Schedule 9 – Dictionary

13.1.1 Accurate AHD value

An accurate AHD value or height for the purposes of the Regulation is a survey mark with an AHD71 value recorded in SCIMS with a vertical Class of L2A, LA, LB, LC, LD, A or B (see *Surveyor-General's Direction No. 4* – Using SCIMS). SCIMS is the Survey Control Information Management System.

Survey marks recorded in SCIMS with a Vertical Class of LE, C, D, E, U or 'Null' are not accurate AHD71 values. The SCIMS mark status must be appropriate for the use of the mark.

Only the Surveyor-General can determine an accurate AHD value, part of the definition of accurate AHD71 value requires the value to be recorded in SCIMS.

13.1.2 Accurate MGA orientation

An accurate MGA orientation means an orientation of a survey adopted from either:

- the grid bearing derived from the MGA coordinates of 2 established survey marks, where the MGA coordinates are obtained from SCIMS, or
- the grid bearing derived from the MGA coordinates, determined using an approved GNSS method, of 2 PSMs or RMs, where the coordinates so determined have an accuracy of Class D or better, or a PU of 0.1m or less.

An MGA orientation adopted from a plan filed or recorded by the Registrar-General or a public authority is not an accurate MGA orientation in such a case, state the horizontal datum adopted as orientation on the survey plan as per Section 62(h), the number of the plan from which the MGA orientation is being adopted (usually a registered Deposited Plan) should be stated adjacent to the north point of the survey plan along with the notation MGA2020-DP123456. This is only applicable for compiled plans.

In the case where a survey adopts an accurate MGA orientation, the survey plan should show MGA2020 adjacent to the north point and the origin of the MGA coordinates.

In the case where a survey adopts an accurate MGA orientation from established survey marks, the survey plan should show MGA2020-SCIMS adjacent to the north point and the origin of the MGA coordinates.

13.1.3 Established survey mark

An established survey mark is any survey mark (TS, PM, SS, MM, CR etc.), recorded in SCIMS as having a horizontal position equal to or better then Class D. The horizontal Class must be one of the following: 3A, 2A, A, B, C or D (see *Surveyor-General's Direction No. 4* – Using SCIMS).

Survey marks with horizontal Class of E or U are not established. SCIMS MGA coordinates with a horizontal Class of E or U cannot be used to adopt an accurate MGA orientation.

13.1.4 Parcel

While the term Parcel is not defined in the Regulation, it takes on the general English meaning for use under the *Surveying and Spatial Information Act 2002* and the Regulation.

- 'a quantity or amount of something, especially as dealt with in one commercial transaction.'
  Source: Oxford Languages.
- 'an area of land.'
  Source: https://dictionary.cambridge.org/dictionary/english/parcel.
- 'A land parcel is an area of land with defined boundaries, under unique ownership for specific real property rights.'
  Source: https://www.anzlic.gov.au/resources/foundation-spatial-data-framework/fsdf-themes-datasets/land-parcel-and-property#:~:text=A%20land%20parcel%20is%20an,or%20personal%20property%20(chattels).

For the use within the Regulation the holistic meaning is required to be used as it applies to the marking and area of roads, easements and other affecting interests, as well as freehold land.

The accuracy, close, dimensioning and other requirements of the Regulation apply to every parcel of land surveyed and no distinction should be made whether it is a single 'lot' or another area of land defined or the intended use of the land.

Note: The term 'parcel' as used in the Regulation and Direction does not apply to any other Act, Regulation or Guidelines.

13.1.5 Positional uncertainty

Positional uncertainty means the uncertainty of the coordinates or height of a point, in metres, at the 95% confidence level, with respect to the defined reference frame, as described in the *Standards and Practices for Control Surveys (SP1*) Version 1.7, published by the Intergovernmental Committee on Surveying and Mapping (ICSM).

PU that is used to refer to a coordinate determined to a PU of 3m or better, being the PU that is considered to approximate the quality of a coordinate obtained by current hand-held GNSS devices.

The definition of established survey mark does not use PU as not all marks within SCIMS have been given a PU.

13.1.6 Reference Mark

A RM as defined by Section 5 of the Regulation is a survey mark of the kind referred to in Schedules 3 or 4 of the Regulation. Simply, a RM is a survey mark that takes the form and style of a mark as detailed in Schedules 3 and 4 of the Regulation and is shown on a survey plan filed or recorded by the Registrar-General or a public authority.

The actual usage of a RM, being prescribed in other sections of the Regulation, is not part of the definition of the RM itself.

Therefore, any survey marks on a survey plan filed or recorded by the Registrar-General or a public authority taking the form and style of a RM as described in Schedules 3 or 4 the Regulation are RMs; consequently, removal of such marks after placement requires authorisation from the Surveyor-General as per Section 96 of the Regulation.

Regarding the symbology to be shown on the plan, Section 61(4) of the Regulation states that:

> 'A surveyor must use the conventional signs and symbols specified in Schedule 5 in preparing a formal land survey plan.'

Schedule 5 shows the symbol to be used to refer to a RM (a 'double circle') on a survey plan. On survey plans that define cadastral boundaries, for a RM that is referenced to a cadastral boundary corner under Sections 51-54, the Registrar-General's Guidelines state that a double circle 'must be shown at the corner to which it references not at the actual position of the mark'. This does not preclude the use of the double circle to show the actual position of RMs not referencing a cadastral boundary corner in other situations (e.g. datum line terminal, position of a RM in a Plan for Survey Information Only etc.).

13.1.7 Road

The definition of a road has been expanded to include accessways within community schemes.

Surveyors who are in doubt as to whether they need to mark part of a survey to comply with the requirements of the Regulation as regarding roads should apply the following: if the part of the survey in question is, to all intents and purposes, primarily used for the foot or vehicular traffic of members of the public, then the best approach is to mark that part of the survey as a 'road' to negate the possibility of future requisitions.

13.1.8 Spline

A spline means a continuous curve that:

- is constructed so as to pass through a given set of points, and
- has continuous first and second derivatives (has minimum curvature)

The term spline is referred to in Section 66(1)(b) as the method of showing a natural feature boundary on the survey plan.

It is important to note that the use of a spline in Section 66(1)(b) refers to the graphical representation of the natural feature only (i.e. the plan drafting of the natural feature), not its legal definition. The definition of the natural feature boundary remains the feature itself, subject to the doctrine of accretion and erosion and other provisions in the Regulation.

The definition of spline refers to a commonly used form of a spline, that being a piecewise polynomial known as an interpolating cubic spline also known as a piecewise polynomial of degree three. Many popular CAD programs have the functionality to produce a spline.

14. Appendices

14.1 Appendix A - Exemption by Surveyor-General

The *Surveying and Spatial Information Act 2002* was amended on 30 October 2023 to move Clause 91 'Exemption by the Surveyor-General' from the Regulation to the Act. This became Section 33B of the Act without changing the practical process of applying for an exemption. This had the effect that all Policy Exemptions ceased with the commencement of the Regulation on 1 March 2025.

If the Surveyor-General approves a request that it is not practicable or necessary to comply with a requirement of the Regulation, an exemption in writing will be provided, applying only to the conduct of the relevant survey.

Further, an exemption may only partly exempt the surveyor from compliance with a section of the Regulation (i.e. it may only apply to a part of the subject survey); an exemption may also be granted subject to conditions under Section 33(3). If the surveyor does not comply with those conditions, then, as per Section 33B(4), the exemption granted does not take effect and the surveyor must comply with the entirety of the Regulation.

Each survey plan subject to an exemption should have its own unique exemption number; Section 33B(5)(a) requires that number to be shown on the survey plan; this notation is usually placed adjacent to the surveyor's reference. Only the exemption number is to be shown on the survey plan; the requirements of previous Regulations no longer apply whereby the surveyor had to show the section or sections to which the exemption applies as well as the exemption number.

Where a survey plan to which an exemption applies is lodged with the Registrar-General or a public authority, the Registrar-General or that public authority must be furnished, at the time of lodgement, with a copy of the exemption (Section 33B(5)(b)). As above, exemptions are often issued referring to only part of the survey and subject to one or more conditions. When a survey plan subject to an exemption is lodged with the Registrar-General or a public authority, it is considered critical for the examination process that the surveyor lodges a copy of the exemption so that a plan examiner can:

- Be aware of which part or parts of the survey plan the exemption applies to, and
- Determine whether the conditions, if any, which apply to the exemption have been met.

Exemptions have a one-to-one relationship to a plan. Exemptions will not be granted on a multi plan, project basis or blanket exemption approach. Exemptions are only given for the field component required for each survey hence, there must be a sound survey reason that justifies why the exemption should be granted. It is assumed that the field component is accurately reflected in the survey plan.

14.1.1 Applying for an Exemption

A surveyor may apply to the Surveyor-General to seek an exemption from the requirements of the Regulation. This is achieved by lodging an application through the DCS-Spatial Services Customer Hub. https://ss-customerhub.atlassian.net/servicedesk/customer/portals

14.1.2 Exemption History

A historical account of Exemptions and Policy Exemptions can be found on the DCS Spatial Services website.

14.2 Appendix B – Deferment of Survey Mark – Placement Claim

I ..... (*Surveyor registered under the Surveying & Spatial Information Act 2002*)
insert name

of .....

.....
organisation/address

hereby certify that the deferred survey marks under Section 38 have been placed in accordance with the *Surveying & Spatial Information Regulation 2017* and the conditions of Approval Number DM_____/_____.

Details of the Deferred Mark approval are as follows:

1. DP Number .....
2. Deferred Mark number .....
3. Name of Road/Roads .....
   .....
4. Locality .....
5. LGA .....
6. Surveyor's Reference .....
7. No. of Deferred Marks placed.....

I request the 85% refund of the $..... security deposit lodged with your office.

.....
Signature

Date ____ / ____ / ____

14.3 Appendix C – Contact information

DCS Spatial Services
Head office

346 Panorama Avenue
Bathurst NSW 2795
1300 789 866

Application for exemption

Surveyors wanting to apply for an exemption should do so through the online application form:
https://customerhub.spatial.nsw.gov.au/servicedesk/customer/portals

Application for survey mark removal

Person/s wanting to apply for approval to remove survey mark/s should do so through the online application form:
https://customerhub.spatial.nsw.gov.au/servicedesk/customer/portals

Surveyor-General's Directions

The current Surveyor-General's Directions are available through the DCS-Spatial Services online portal.
https://www.spatial.nsw.gov.au/surveying/publications/surveyor_generals_directions

DCS Spatial Services
Office of the Surveyor-General
Cadastral Management Unit

E-mail: CMU@customerservice.nsw.gov.au

End of Direction