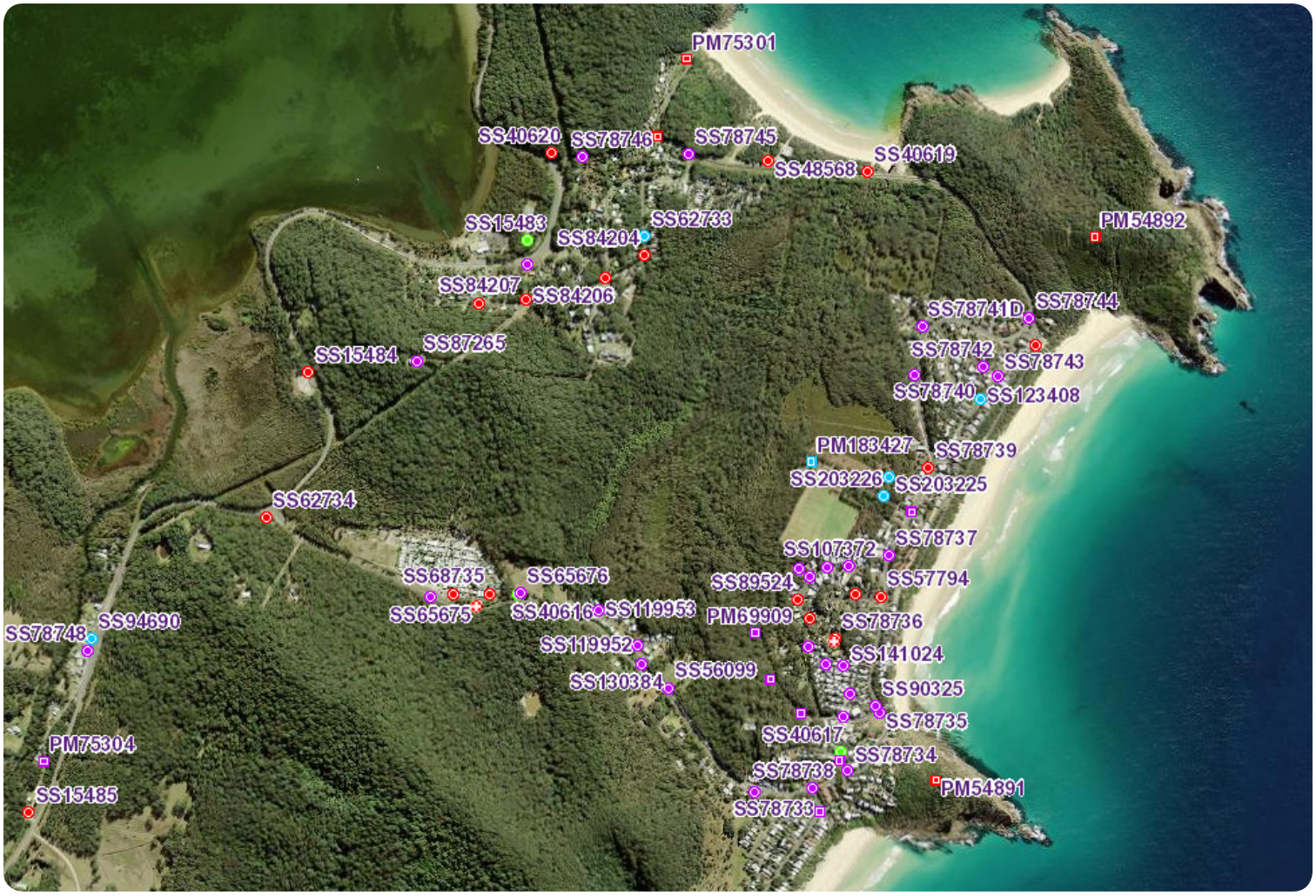


Surveyor-General's Direction

No. 4

Interpreting the Survey Control Information Management System (SCIMS)

NSW GOVERNMENT

SURVEYOR GENERAL NEW SOUTH WALES

Title: Surveyor-General's Direction No. 4
Using the Survey Control Information Management System (SCIMS)

Published by

Spatial Services
A Unit of the Department of Customer Service
346 Panorama Avenue
BATHURST NSW 2795
Tel: (02) 6332 8287

www.spatial.nsw.gov.au

Cover photograph shows a SCIMS Online report

Enquiries

Any enquiries regarding this Direction should be forwarded to:

Phone:	1300 211 253
Email:	SCIMS@customerservice.nsw.gov.au
Mail:	SCIMS & CORS Unit Office of the Surveyor-General Department of Customer Service - Spatial Services Level 14 2 - 24 Rawson Place HAYMARKET NSW 2000

Spatial Services (B) P19/10/037

Document Control Sheet

Record of Document Issues

Version No.	Issue Date	Nature of Amendment
1.0	November 1993	Initial Release
1.1	October 1994	Minor Revision
1.2	August 1997	Minor Revision
1.3	January 1999	Minor Revision
2.0	March 2000	Introduction of GDA94
2.1	December 2009	Minor Revision – *Surveying and Spatial Information Regulation 2006*
2.2	June 2016	Minor Revision – Departmental restructure
3.0	July 2019	Introduction of GDA2020

Document Approval:

Approved By:

Narelle Underwood
Surveyor-General of NSW
Date of Approval: July 2019

Contents

1. Introduction

The Survey Control Information Management System (SCIMS) is a database of coordinates, heights and related attributes of Permanent Survey Marks (PSMs) constituting the State Control Survey established under the direction of the Surveyor-General of NSW. This information is collected through the operation of the *Surveying and Spatial Information Act 2002* (*S&SI Act 2002*) and the *Surveying and Spatial Information Regulation 2017* (*S&SI Reg 2017*). SCIMS is maintained for the purposes of cadastral boundary definition, engineering surveys, mapping and a variety of other spatial applications.

SCIMS stores coordinate information in both the Geocentric Datum of Australia 1994 (GDA94) and the Geocentric Datum of Australia 2020 (GDA2020). Height information is stored in relation to the Australian Height Datum 1971 (AHD71) and Ellipsoidal Height for marks surveyed in the 3D State GDA2020 adjustment. Limited information is maintained in the former Australian Geodetic Datum 1966 (AGD66).

The coordinate values of survey marks in SCIMS are provided as easting and northing values on the Map Grid of Australia (MGA2020 or MGA94) projection or as latitude and longitude (geographic).

SCIMS Online is the application by which the public can obtain information from SCIMS. Access to SCIMS Online is via the SIX Spatial Services Portal (http://six.nsw.gov.au).

Results of all SCIMS Online searches may be viewed on screen, printed or downloaded in a number of common file formats. SCIMS Online is the authoritative source for coordinate information on PSMs in NSW. Any coordinate or height for a PSM to be quoted on a plan must come from SCIMS Online as it carries with it a transaction number that is legally traceable for audit processes.

2. SCIMS Online Support Guide

This Direction is intended to be used in conjunction with the SCIMS Online Support Guide, which guides SCIMS Online users on how to search for, order and download coordinates, Locality Sketch Plans (LSPs) and other information about PSMs. A link to the SCIMS Online Support Guide can be found at https://www.spatial.nsw.gov.au/surveying/scims_online.

3. Interpretation of Output

This section explains the details of the information supplied from SCIMS Online outputs and assists in determining the usability and appropriateness of PSMs for the desired outcome of the survey.

3.1 SCIMS Abbreviations

PSMs come in a variety of forms and styles as prescribed in the *S&SI Act 2002*. All PSMs are uniquely identified by using a Mark Type and Mark Number. To simplify the display of information in SCIMS Online the following terms, abbreviations and legends are used.

3.1.1 Mark Type, Number and Name

TS – **T**rigonometrical **S**tation

SS – **S**tate **S**urvey Mark

PM – **P**ermanent **M**ark

CR – **C**adastral **R**eference Mark

GB - **G**eodetic **B**ench Mark

MM – **M**iscellaneous Survey **M**ark

CP – Mapping **C**ontrol **P**oint

Followed by a number in the range 1 – 999999. This may or may not be followed by a witness / eccentric mark number in the range 1 - 9. Mark Numbers above 87,200 are not duplicated. Cadastral Reference Marks are only in the range from 500,000 – 599,999.

Cadastral Reference Marks (CRs) are recorded in SCIMS using a coordinate of known CLASS and a height of known CLASS. CRs do not have a Locality Sketch Plan to help surveyors find the mark. The Deposited Plan or Crown Survey Plan will be needed to assist in the location of the mark.

Name In addition to the Trig Station mark type and number, a name is also used for all Trig Stations. If [P] appears at the end of the description, the station is monumented with a concrete or steel pillar.

Alias Used for cross-reference to mark identifiers issued by other organisations. Most Miscellaneous Marks will have an Alias recorded, usually referencing the identifier supplied by the organisation that originally placed the mark (e.g. MM 5807 at Uralla has an Alias "MR9/6301").

3.1.2 Status

SCIMS Online provides additional stored information, if known, in relation to the Status of the mark as shown in Table 1:

Table 1 - Survey Mark Status Descriptions

Code	Status Description	Remarks
(D)	Destroyed	Evidence was found that the mark is destroyed
(F)	Found	Mark was found in good condition
(N)	Not Found	Mark was searched for, not found, but no evidence exists to indicate that it was destroyed
(R)	Restricted	Mark is in a restricted area and requires special permission for occupation. Use the Comments or Access Details found in the SCIMS Report for more information
(S)	Subsidence Area	Mark is located in an area identified as being subject to movement
(U)	Uncertain	Mark was found, however it was in an unstable condition or there was evidence that it had been disturbed or moved. Status will remain "uncertain" until verified by survey

3.1.3 Coordinate Information

Height In metres related to the Australian Height Datum (AHD71) or GDA2020 Ellipsoidal Height.

Coordinates May be expressed in terms of coordinates (Eastings and Northings) projected from the Map Grid of Australia (MGA) or geographic coordinates (Latitude and Longitude).

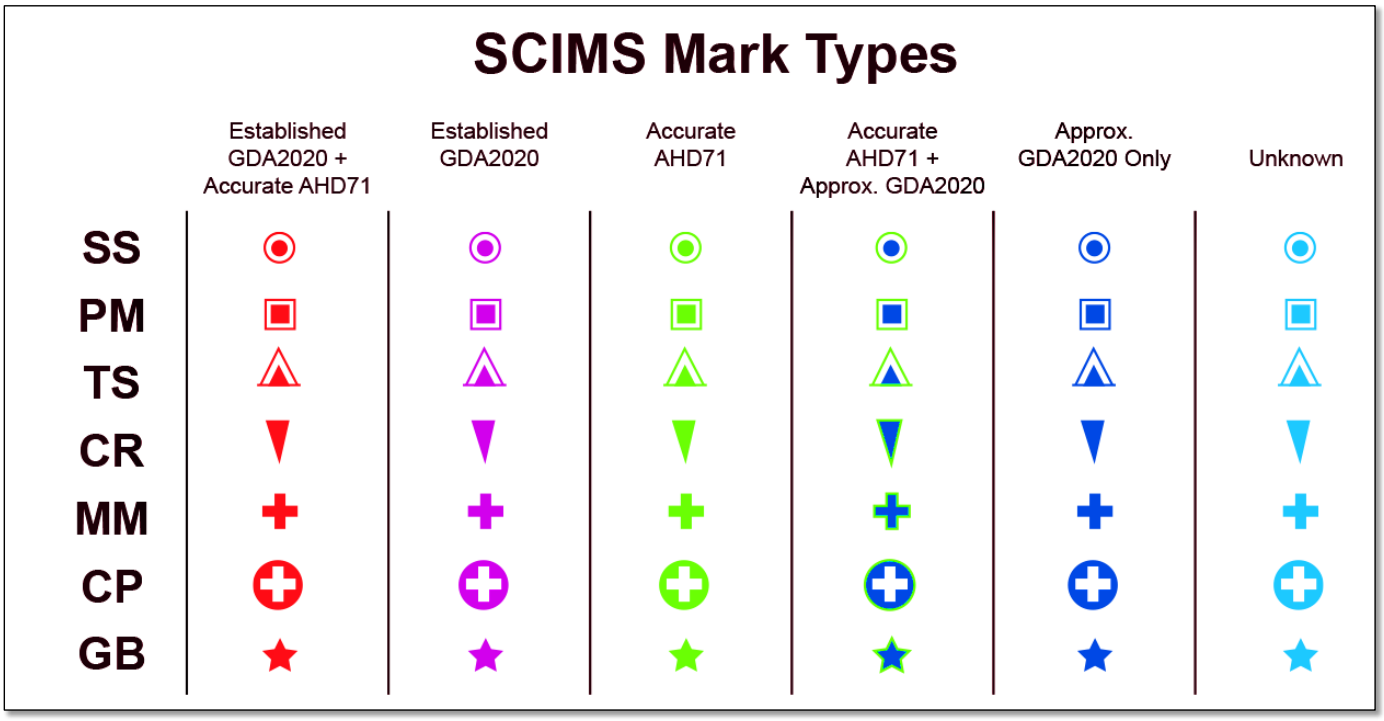
Zone Map Grid of Australia (MGA) Zones, (for both GDA94 and GDA2020).

Source A unique number identifying the adjustment source that created the coordinate and/or height. This relates to the determination of the coordinate and accuracy (Section 3.3) of the mark. All adjustment sources in GDA94 are in the 200,000 series and GDA2020 adjustments in the 300,000 series.

3.2 Legend

The symbology for each mark type is depicted in Figure 1 and coloured according to CLASS. Established and Accurate are terms used in accordance with the *S&SI Reg 2017* (see also Section 3.3).

Figure 1 - SCIMS Online Legend



3.3 Accuracy of Marks

The *S&SI Reg 2017* defines the Standards and Practices for Control Surveys as the document titled *Standards and Practices for Control Surveys (SP1) Version 1.7*, published by the Intergovernmental Committee on Surveying and Mapping (ICSM).

The accuracy of horizontal coordinate and height values of a PSM in SCIMS is denoted by the mark's Class and Order, if GDA94 is selected, or the mark's Class, Positional Uncertainty (PU) and Local Uncertainty (LU), if GDA2020 is selected, as classified by SP1 (v1.7).

Under the *S&SI Reg 2017*, an "established survey mark" is any survey mark described in SCIMS has having a horizontal position equal to or better than Class "D". This includes any mark with an indicated Class of 3A, 2A, A, B, C or D. Accordingly for heights, where "accurate height" is to be determined, only marks that have a vertical CLASS of L2A, LA, LB, LC, LD, 2A, A or B should be used for the adoption of AHD. Approximate positions are CLASS "E" only and a mark with an unknown Position or Height are CLASS "U" only.

3.3.1 CLASS

SP1 (v1.7) defines CLASS as:

> "CLASS is a function of the planned and achieved precision of a survey network and is dependent upon the following components:
>
> - the network design;
> - the survey practices adopted;
> - the equipment and instruments used; and
> - the reduction techniques employed,
>
> all of which are usually proven by the results of a successful, minimally constrained least squares network adjustment computed on the ellipsoid associated with the datum on which the observations were acquired".

Table 2 refers to Class codes as they apply to coordinates in the SCIMS database and should not be used for any other purpose.

Table 2 – Horizontal Class Classifications

CLASS	Typical Applications
3A	Special high precision surveys
2A	High precision national geodetic surveys
A	National and State geodetic surveys
B	State survey control networks
C	Cadastral control surveys
D	Cadastral and other surveys
E	Approximate and lower Class surveys
U	Unknown or unreliable surveys

For more information on the determination of Class please refer to SP1 (V1.7).

3.3.2 Order

Order is only shown for GDA94 coordinates. SP1 (v1.7) defines ORDER as:

> "ORDER is a function of the CLASS of a survey, the conformity of the new survey data with an existing network coordinate set AND the precision of any transformation process required to convert results from one datum to another.
>
> Stations in horizontal control surveys are assigned an ORDER commensurate with the CLASS of the survey and the conformity of the survey data with the existing coordinate set.
>
> The ORDER assigned to the stations in a new survey network following constraint of that network to

the existing coordinate set may be:

a) not higher than the ORDER of existing stations constraining that network; and

b) not higher than the CLASS assigned to that survey".

ORDER is only shown for PSMs with coordinates in the GDA94 datum, this includes ORDER for heights in AHD71 (i.e. Heights in GDA2020 will show PU and LU).

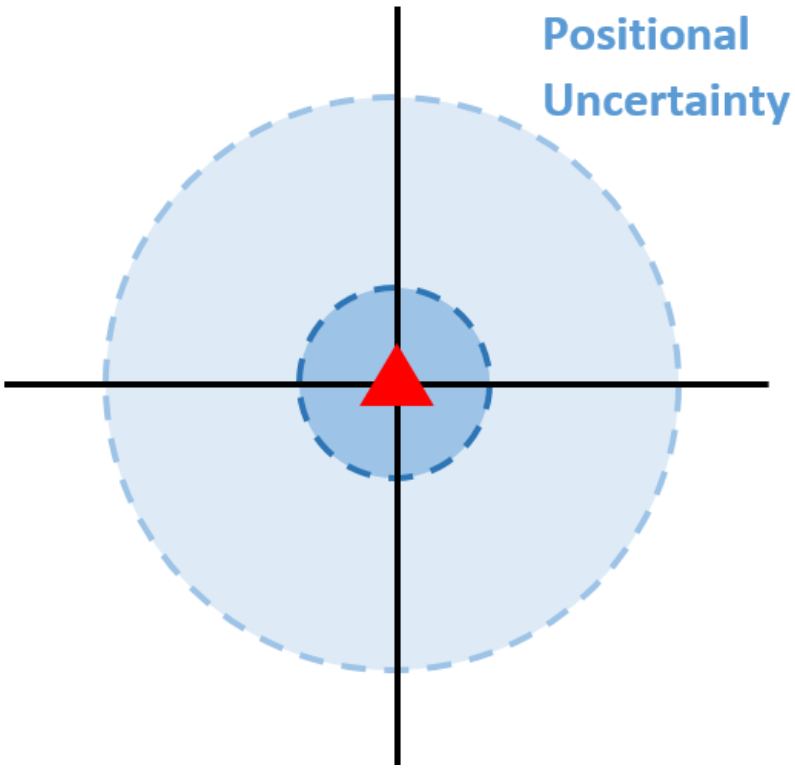
For more information on the determination of ORDER please refer to SP1 (v1.7).

3.3.3 Positional Uncertainty (PU)

Positional Uncertainty (PU) and Local Uncertainty (LU) replace ORDER for coordinate accuracy information in GDA2020. SP1 (v1.7) defines PU as:

"the uncertainty of the co-ordinates or height of a point, in metres, at the 95% confidence level, with respect to the defined reference frame".

Figure 2 - Positional Uncertainty describes the accuracy of a point with respect to datum



To make interpreting the values published for PU, SCIMS applies the following rules:

- PU or LU values **<** 1 metre: Round up to the nearest centimetre (i.e. 0.01)
- PU or LU values **≥** 1 metre and **<** 10 metres: Round up to the nearest decimetre (i.e. 1.1)
- PU or LU values **≥** 10 metres: Round up to the nearest metre (i.e. 10)

3.3.4 Local Uncertainty (LU)

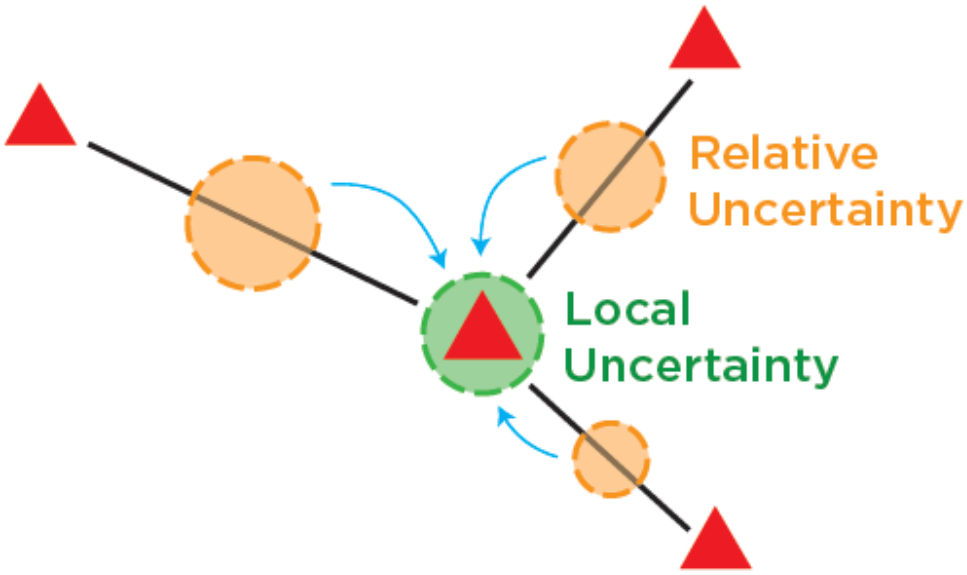
Local uncertainty is defined in SP1 v1.7 as:

> "the average measure, in metres at the 95% confidence level, of the relative uncertainty of the coordinates, or height, of a point(s), with respect to the survey connections to adjacent points in the defined frame".

Local Uncertainty provides a general indication of how accurate a mark is with respect to the surrounding connected marks.

The same rules for rounding as applies to PU have been applied to LU.

Figure 3 - Local Uncertainty describes the relative accuracy of a point derived from the survey connections to adjacent points



3.3.5 Height Accuracy

It is accepted that some heighting techniques such as differential levelling propagate errors in proportion to the square root of the distance. Other techniques such as GPS and trigonometric levelling propagate errors mainly in proportion to the distance. This is particularly apparent on distances greater than 1 km. Therefore different types of class and order are assigned according to the heighting technique used. Refer to SP1 (v1.7) for details of observation techniques.

Table 3 refers to vertical Class codes as they apply to heights in the SCIMS database and should not be used for any other purpose.

Table 3 - Heighting Class Classifications

CLASS	Typical Applications
L2A	Precise levelling (Forward & backrun misclose <2√d)
LA	1st order levelling (Forward & backrun misclose <4√d)
LB	2nd order levelling (Forward & backrun misclose <8√d)
LC	3rd order levelling (Forward & backrun misclose <12√d)

CLASS	Typical Applications
LD	Levelling (Forward & backrun misclose <18√d)
LE	Levelling (Forward & backrun misclose <36√d)
2A	Precise trigonometric or GPS heighting. (Standard deviations of observations < 3(d+0.2) mm)
A	Trigonometric or GPS heighting for state survey control. (Standard deviations of observations < 7.5(d+0.2)mm)
B	Trigonometric or GPS heighting for cadastral control. (Standard deviations of observations < 15(d+0.2)mm)
C	Trigonometric or GPS heighting. (Standard deviations of observations < 30(d+0.2)mm)
D	Trigonometric or GPS heighting. (Standard deviations of observations < 50(d+0.2)mm)
E	Trigonometric or GPS heighting. (Standard deviations of observations < 100(d+0.2)mm)
U	Unknown or unreliable
"d" refers to distance in kilometres	

As per horizontal coordinate accuracies, ORDER for heights is only shown for those marks whose horizontal datum is in GDA94. For marks where the horizontal datum is in GDA2020, PU and LU replace ORDER. This applies to marks with Ellipsoidal Heights as well.

3.4 Grid Convergence and the Combined Scale Factor

Grid convergence and the Combined Scale Factor reported by SCIMS can be utilised by reference to existing literature and tools.

Grid convergence at a point is the angle between grid north and the tangent to the arc of the meridian at that point. From the ICSM GDA94 and GDA2020 technical manuals, grid bearing and grid convergence are related by the following equation:

Grid bearing = Azimuth + Grid convergence

Azimuth is the horizontal angle measured from the meridian, clockwise from true north.

The Combined Scale Factor (CSF) is, as the name suggests, a combination of scale factors that describes the ratio of the plane (grid) distance to the ground distance. The CSF can be calculated for either a line or a point. The basic equation describing the relationship between the CSF, the ground distance and its corresponding plane (grid) distance is:

Plane (Grid) distance = Ground distance × Combined Scale Factor

For explanation of grid bearings, Combined Scale Factors and their usage, please refer to the technical paper "Surveying and Spatial Information Regulation 2017: GNSS and plan requirements" available for download in the "Technical Papers" section of Spatial Services' website.

For calculation of grid bearings and combined scale factors, please download the GridCalc (GDA94) for NSW spreadsheet package from ICSM's GitHub repository (GridCalc_GDA94_NSW.xlsm will require Microsoft Excel 2007 or later).

3.5 AUSGeoid

The AUSGeoid model provides correction values (N) between Ellipsoidal Heights and AHD71. Depending on the Datum selected, the AUSGeoid model will change.

- GDA94 → AUSGeoid09
- GDA2020 → AUSGeoid2020

For a detailed explanation of AUSGeoid models and their application please refer to the Technical Manuals for the respective Datums available from the ICSM publications.

4. Destroyed or Disturbed Marks

If a mark is disturbed, destroyed, not found or found intact when displayed in SCIMS Online as otherwise, then the correct information must be reported as soon as possible. Only by having up-to-date survey mark status can it be possible for SCIMS Online users to search for the correct survey marks and plan survey activities. Therefore, it is essential that all SCIMS Online users who find an anomaly in SCIMS Online data report the anomaly as soon as possible.

Marks that have been destroyed, disturbed or that have an incorrect mark status can be reported to Spatial Services using the online SCIMS Status Report form.

It is also a requirement of all registered surveyors under Clause 39 of the *S&SI Reg 2017* that all PSMs that have been placed, removed, damaged, destroyed, displaced, or are in a state of disrepair are reported to the Surveyor-General. The report can also be made using the SCIMS Status Report form.

5. Contact Details

For further information or assistance regarding SCIMS Online, please contact:

SCIMS Customer Support
Department of Customer Service - Spatial Services
Telephone: 1300 211 253
Email: SCIMS@customerservice.nsw.gov.au

End of Direction