Government of **Western Australia**
Department of **Mines, Industry Regulation and Safety**

Mine survey audit – guide

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Introduction

The scope of the 'mine survey' audit is designed to provide guidance to management and survey personnel on the safety and survey standards associated with the gathering, recording and keeping of accurate survey record information at the mine operations.

This audit was developed in 2016 then trialled by the Department of Mines, Industry Regulation and Safety (DMIRS). Some minor tweaks and the following standards (points) were added or updated in February 2017: Standards 1.6 to 1.9; 3.1; 4.1 to 4.3; and 6.5. After further trialling, some minor changes were made in March 2018 and the audit published on the Department website.

The survey audit is organized into the following sections:

- MSI Regulations 1995 - requirements
- Code of practice – general
- Code of practice – standards and procedures
- Mine plan requirements
- Emergency plan preparation
- Field work

For the purpose of the audit where the term "verify" is used in the guideline intent, that implies there is a regulatory requirement for compliance with the standard, and where the term "ensure" is similarly used then there is no mandatory requirement for compliance, but the standard sets out a recommended practice, which if followed, should minimise the potential for an incident associated with safety and maintaining poor survey information to occur.

List of abbreviations

AHD Australian height datum
DMIRS Department of Mines, Industry Regulation and Safety
GPS Global positioning system
LHD Local height datum
MGA Map Grid of Australia 1994
MSIA *Mines Safety and Inspection Act 1994*
MSIR Mines Safety and Inspection Regulations 1995
PPE Personal Protective Equipment
r. Regulation (of the MSIR)
s. Section (of the MSIA)
SME State Mining Engineer
SRS The Department of Mines, Industry Regulation and Safety's online Safety Regulation System

Supporting documentation

The 'Mines Survey - Code of Practice' provides guidance on meeting the requirements in the Mines Safety and Inspection Act 1994 and Mines Safety and Inspection Regulations 1995 relating to surveys at mining operations. This document is available from the DMIRS website.

http://www.dmp.wa.gov.au/Documents/Safety/MSH_COP_MineSurvey.pdf

The following Safety Bulletins have been issued with respect to survey incidents and information.

http://www.dmp.wa.gov.au/Documents/Safety/MSH_SB_057.pdf

http://www.dmp.wa.gov.au/Documents/Safety/MSH_SB_041.pdf

1 Mines Safety and Inspection Regulations 1995 - requirements

Requirements of the Mines Safety and Inspection Regulations 1995

Point	Standard	Guideline
1.1	The manager of a mine must cause a record to be made in the record book of the name of the mine surveyor appointed to make or draw the survey or plan of the mine and the day on which that person was appointed.	**Intent:** To verify that the mine has appointed and maintained a record of the person responsible for survey information. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine record book. Confirm that a competent surveyor is currently appointed at the mine. Refer to MSIR r. 3.46(3).
1.2	Mine surveys are carried out using instruments and equipment of precision equal to best current industry standards and technology unless approval is provided by the District Inspector of Mines that another standard is acceptable.	**Intent:** To verify that survey instruments are fit for purpose, calibrated and safe. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the survey equipment available at the mine. Refer to MSIR r. 3.49.
1.3	The mine surveys are carried out to a standard that accords with good engineering practice and is to an accuracy of not less than 1:5000 unless approval is provided by the District Inspector of Mines that another standard is acceptable.	**Intent:** To verify that accurate mine surveys have been carried out at the mine. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect mine surveys have been completed to an accuracy of 1:5000 or to another standard approved by the District Inspector. Refer to MSIR r. 3.49(1).
1.4	A datum station serving as the origin for the survey and co-ordinate system used has been established in terms of The Map Grid of Australia 1994 (MGA) and the Australian Height Datum (AHD).	**Intent:** To verify that the mine survey information is linked by means of a datum station to the Map Grid of Australia (MGA) and the Australian Height Datum (AHD). **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect that the required survey information datum station has been established with respect to the MGA and AHD. Refer to MSIR r. 3.50.

1.5	The relationship between any local grid system used and the MGA is established and documented.	**Intent:** To verify that any local grid system survey information used is linked to the Map Grid of Australia (MGA). **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect that the required survey information local grid system relationship has been established with respect to the MGA. Refer to MSIR r. 3.50.
1.6	Surveyors undertake adequate check surveys when workings are approaching each other to ensure that the breakthrough is coordinated and managed in a safe manner.	**Intent:** To verify that sufficient survey checks are carried out to prevent an unplanned breakthrough. **Personnel:** Registered Manager, Mine Surveyor, Underground Manager. **Method:** Inspect the mine breakthrough procedures. Confirm that the procedure outlines the survey checks to be carried out. Refer to MSIR r. 10.27(2).
1.7	Development overbreak trigger, action, response standards are determined and check survey measurements are regularly taken and reported to management for action.	**Intent:** To verify that the size of development openings is monitored and maintained within design and ground support capabilities. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey information. Confirm that the mine has a system in place to accurately monitor and manage development overbreak. Refer to MSIR r.10.28(3)(g)
1.8	Stope and void overbreak trigger, action, response standards are determined and check survey measurements are regularly taken and reported to management for action.	**Intent:** To verify that the size of stopes and other voids is managed to monitor the presence of sinkholes or potential breakthrough hazards to upper levels or the surface. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey information. Confirm that the mine has a system in place to manage the stope and void overbreak potential. Refer to MSIR r.10.28(3)(g)

1.9	A pit wall monitoring system with trigger, action, response standards and check survey measurements are taken and reported to management for action.	**Intent:** To verify that pit wall stability is effectively monitored to provide adequate notification to prevent wall failures endangering mine employees. **Personnel:** Principal Employer, any other employer, Registered Manager, Mine Surveyor. **Method:** Inspect the mine pit wall and survey monitoring information. Confirm that the mine has a system in place with trigger action response plans to monitor and manage pit wall stability. The trigger, action response plan should include continuous pit wall monitoring where progressive wall failures are present. Refer to MSIR r.13.8(2)(g)

2 Code of practice - general

Code of practice - general

Point	Standard	Guideline
2.1	There is a hard copy of a clearly labelled Survey Record Book.	**Intent:** To ensure that a hard copy of key survey information is available at the mine. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book.
2.2	The Survey Record Book documents the connection between the local Mine Grid and the MGA94, detailing pictorial and coordinated descriptions. Sufficient points of known coordinates in both the local mine grid and MGA94 must be provided to allow transformation of the mine plan onto the MGA94 grid. The datum reference points should be chosen to give a broad coverage of the mine lease area.	**Intent:** To ensure that that a connection between the local mine grid and MGA94 has been established. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book.
2.3	The Survey Record Book documents local false origin and height datum details.	**Intent:** To ensure that details on the local false origin and height datum are documented. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book.
2.4	The Survey Record Book documents efforts made to obtain all existing information about the extent and location of old workings.	**Intent:** To ensure that the dangers associated with historic workings have been fully considered. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book.

2.5	Old workings are shown on the corresponding working horizon of all digital and hard copy survey data plans, including annotations as to whether they contain water or fill.	**Intent:** To ensure that the dangers associated with historic workings are clearly marked on current survey data plans. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey data plans Confirm the plans show the location of any historic workings (including drill holes) and includes details on whether or not they contain water or have been filled.
2.6	Local data sets converted to MGA94 are documented and dated in the Survey Record Book when they occurred.	**Intent:** To ensure that accurate survey records are maintained. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book.
2.7	Technical symbols, sign conventions and definitions for strata shown on the mine plan are detailed in the Survey Record Book.	**Intent:** To ensure that information is available providing an explanation for the symbols, sign conventions and strata definitions used at the mine. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book. Confirm that a key is available for the symbols, signs and strata definitions
2.8	The Survey Record Book documents regular and appropriate servicing, checking and adjustment of all survey equipment.	**Intent:** To ensure that survey equipment is checked, calibrated and maintained at the mine. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book. Check the survey equipment records maintenance and/or calibration certificates are up to date and in accordance with manufacturer's requirements.

3 Code of practice - standards and procedures

Code of practice - standards and procedures

Point	Standard	Guideline
3.1	Closes and check surveys have been conducted and documented on an annual basis, with a rate of error comparable to industry standard.	**Intent:** To ensure that accurate survey information is maintained at the mine. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book. Confirm that closes and check surveys have been carried out at the mine on an annual basis.
3.2	The surface mine baseline is not less than 250 m in length has each end substantially marked. Mine baseline stations are permanent marks, tagged with the station name and set in concrete. A witness plate is placed adjacent to this mark. Permanent marks for a surface baseline are shown on the mine plans. Hard copies and electronic copies of all reference materials are recorded in the Survey Record Book.	**Intent:** To ensure that the surface mine survey baseline has been established permanently and is recorded in the current mine plans. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine baseline and Survey Record Book. Check the surface baseline is longer than 250 metres, permanently marked, secured in concrete and tagged with the station name. Also confirm that the baseline is clearly marked on the surface mine plan(s).
3.3	A baseline has been established in the underground workings of each level off a shaft or at least every 750 m of traverse in a decline access. The underground baseline is in a suitable position and is as long as is practicable (at least 100 m in length).	**Intent:** To ensure that an underground mine survey baseline has been established on each shaft level and decline access for survey reference purposes. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book and mine plan(s). Check that an underground baseline has been established on each shaft level and decline access as applicable.
3.4	Permanent baseline details are recorded on the mine plan.	**Intent:** To ensure that survey baseline information is accurately recorded on mine plan(s). **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey plan.

3.5	The instrumentation used for control surveys and traversing adheres to the following precision specifications: • angular measurements (horizontal and vertical) — maximum standard error of ± 5"; • distance measurements — maximum standard error of ± (3 mm + 5 ppm); • GPS positioning — maximum standard error of horizontal positioning of ± (10 mm + 10 ppm); and • levelling — maximum standard error of levelling per kilometre of double run of ± 4 mm.	**Intent:** To ensure that survey equipment meets the level of precision required. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey equipment. Check the survey equipment manufacturer's literature for precision and standard of error requirements. Refer to Mines Survey - Code of Practice, section 2.5
3.6	Each underground control station is adequately referenced and substantially marked. The station number is painted adjacent to the survey station and also on the adjacent wall. A durable tag indicating the station number is also attached. As far as practicable, they are in a position least likely to be disturbed by the effects of ground movement or mobile equipment. The stations are shown on the mine plans.	**Intent:** To ensure that the locations of underground survey stations are permanently established and identified for survey purposes. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the underground mine survey stations and mine plans. Check that the underground survey stations are numbered and tagged and clearly marked on the survey plan(s).
3.7	Correlation between surface and underground surveys are to the highest accuracy practicable. The correlation of surface and underground surveys are by: • traversing through an adit or a decline or incline ramp; • plumbing or plummeting one or more vertical shafts; • using a gyrotheodolite to establish azimuth; or • a combination of these methods.	**Intent:** To ensure that underground survey information is directly linked to surface survey information. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book. Check the method(s) used and accuracy achieved to correlate the surface and underground survey information.

3.8	Where an established mine uses a local height datum (LHD): • the relationship between the LHD and AHD should be detailed in the Survey Record Book • the relationship should also be shown on the mine plans as required under regulation 3.50(2).	**Intent:** To verify that the mine local height datum (LHD) is clearly identified and linked to the Australian height datum (AHD). **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book and mine plan(s). Confirm that the relationship between the LHD and AHD has been established at the mine. Refer to MSIR r.3.50(2)
3.9	Relative levels of forward stations are checked with redundant measurements. For conventional traversing, this could be either a re-survey or a level traverse.	**Intent:** To ensure that survey cross reference checks are carried out at the mine. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book. Check the survey equipment records maintenance and/or calibration certificates are up to date and in accordance with manufacturer's requirements.
3.10	All level traverses have been closed. The vertical closure rates of traverses are better than 12K mm, where K is the traverse length in kilometres (i.e. a closure rate of 12 mm/km).	**Intent:** To ensure that accurate mine survey traverses are completed. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey traverse information. Check that the survey traverses completed at the mine achieve an accuracy of better than 12 mm /km. Refer to Mines Survey - Code of Practice, section 2.7
3.11	Survey records are kept for surface surveys • surface levelling • underground control surveys (which should also be recorded in the Survey Record Book) • underground check surveys (which should also be recorded in the Survey Record Book) • surface check surveys • underground levelling • calculations	**Intent:** To ensure that survey information records are available for scrutiny and/or back analysis at the mine. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the Survey Record Book. Check that survey information and records are being kept at the mine.

3.12	Complete duplicate copies of survey records are kept and stored separately from the originals, on paper, microfilm, magnetic tape, disk or electronic medium, permanent physical medium, or off-site back-up facility or mechanism.	**Intent:** To ensure that a separate set of survey information is maintained at the mine in the event of a loss of the original information. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey information. Confirm that a duplicate set of information is stored in a separate location from the original.

4 Mine plan requirements

Mine plan requirements

Point	Standard	Guideline
4.1	The mine plan, whether digital or hard copy, shows the following regulatory particulars: • a plan of the mine lease or tenement • the datum station established as the origin of the survey; the relationship to the Map Grid of Australia 1994; and the relationship to the local grid system; • In relation to quarry operations, a plan showing the true size and shape of all excavations and sufficient cross sections showing advances made in the quarry operations and the areas reclaimed or again filled in; • so far as is practicable, sufficient cross sections or projections to a scale that accords with good engineering practice that clearly shows the ore bodies and the parts of ore bodies mined out; and • the date and certification when the plan was made.	**Intent:** To verify that key regulatory safety information is documented within mine plans. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey plans maintained at the mine. Check that the mine plans document the information required in law. Refer to MSIR r. 3.51(1).

4.2	The mine plan, whether digital or hard copy, shows the following regulatory particulars for an underground mine: • a general plan of any underground levels to a scale that accords with good engineering practice that shows, so far as is practicable, the true size and shape of all development openings, but a composite plan may be accepted if each level on that plan can be clearly seen; • if any underground drill holes at the mine contain potentially hazardous services including electrical power cables, compressed air lines or diesel fuel lines, details of the location of those holes; and • so far as is practicable, longitudinal sections or projections to a scale that accords with good engineering practice that shows all underground mining operations.	**Intent:** To verify that key regulatory safety information is documented within mine plans. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey plans maintained at the mine. Check that the mine plans document the information required in law. Refer to MSIR r. 3.51(1).

4.3	The mine plan, whether digital or hard copy, shows the following details in addition to the regulatory requirements: • mine lease boundaries • survey stations and their identification • mine shafts, adits and declines • grid lines and values • all workings in the deposit, including workings of adjacent mines within 50 m of the lease boundary • for underground mines, the boundaries of all old workings on the horizon being shown on that plan • for underground mines, a detailed outline of current or associated workings in any direction of any development shown on a level plan sheet or section sheet on the horizon being shown on that plan • underground service holes clearly annotated as to their use • boreholes on the horizon being shown on that plan.	**Intent:** To ensure that key additional safety information is documented within mine plans. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey plans maintained at the mine. Check that the mine plans document the additional recommended information.
4.4	The surface mine plan shows all streets, roads, reservoirs, swamps, water bodies and any other permanent features that, if disturbed by mining operations, could cause damage to or danger in the mine.	**Intent:** To ensure that comprehensive surface information is maintained on mine plans. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine plans. Confirm that the information required meets the standard.
4.5	A transparent surface overlay plan is available where underground mining operations are present.	**Intent:** To ensure that the surface mine plan(s) can be directly correlated with the underground mine plan(s). **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the surface mine plan(s). Confirm that the surface and underground plans can be overlain and compared.

4.6	Electrical plans showing the location and details of all high voltage cable and equipment, main switches and low voltage and high voltage cables installed in the ground are maintained at the mine.	**Intent:** To verify that the required electrical plans have been accurately maintained at the mine. **Personnel:** Registered Manager, Mine Surveyor, Electrical Supervisor. **Method:** Inspect the electrical plans maintained at the mine. Check that the plans are accurate and up to date. Refer to MSIR r. 5.13(1)(b).
4.7	Ventilation plans are kept updated at intervals not exceeding 3 months.	**Intent:** To verify that accurate underground ventilation plans are being maintained at the mine. **Personnel:** Registered Manager, Mine Surveyor, Ventilation Officer. **Method:** Inspect the ventilation plans maintained at the mine. Check that the plans are accurate and have been updated within a three monthly timeframe. Refer to MSIR r. 5.13(1)(b).
4.8	The direction course and volume of air currents and the position of ventilating fans, air doors, regulators, brattices, other ventilating devices and/or controls in use at the mine are recorded on the plans and sections of the mine.	**Intent:** To verify that comprehensive ventilation information is maintained on mine plans. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine plans. Confirm that the information required meets the standard. Refer to MSIR r. 9.28
4.9	Accident plan information includes: • the mine location within WA • the location of the accident within the mine • an outline of the mine workings at the accident site • the location of all fixed and mobile plant at the accident scene • the location of personal apparatus, equipment or clothing • sufficient annotation and labelling to clearly describe the condition and name of each object at the accident location	**Intent:** To ensure that comprehensive information is maintained on mine accident/incident plans. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine accident/incident plans. Confirm that the information required meets the standard.

4.10	A key is provided to explain any symbols used on the mine plan.	**Intent:** To ensure that comprehensive information can be understood on mine plans. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine plans. Confirm that a key is provided on each plan explaining the symbols used. There is consistent use of symbols used across mine plans.
4.11	Surface Mine Plans are certified by the person making the plan that the plan is correct.	**Intent:** To verify that surface mine plans have been certified by a competently qualified surveyor as being accurate. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey plans maintained at the mine. Check that the mine plans have been certified as being correct by the appropriate grade mine surveyor. Refer to MSIR r. 3.51(1)(h).
4.12	The underground Mine Plan(s) carries the following endorsement This is to certify that this survey has been done by myself (or by persons under my own supervision), subject to adequate inspection and field check, and is the actual result of the observations and measurements, and the survey and plan have been done in accordance with the requirements of the Mines Safety and Inspection Act 1994 and the regulations made under that Act. DATED the ..... day of ..... 20..... Authorised Mine Surveyor Grade Certificate No.	**Intent:** To verify that underground mine plans have been prepared by a competently qualified surveyor. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey plans maintained at the mine. Refer to MSIR r. 3.51(2).

4.13	The person certifying the underground mine plans holds the authorised mine surveyor's certificate.	**Intent:** To verify that mine plans have been authorised by a competently qualified and appropriately graded surveyor. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Check that the mine plans have been certified as being correct by the appropriate grade mine surveyor. Refer to MSIR r. 3.46.
4.14	A copy of the mine plan(s) has been submitted to the State Mining Engineer for: • Open Pit – Within 1 year of commencement. • Underground – Within 1 year of commencement and/or within the last 5 years.	**Intent:** To verify that the State Mining Engineer / DMIRS is in possession of the required mine plans for future use and reference. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey plans maintained at the mine. Check that the mine plans have been submitted to the State Mining Engineer within the applicable timeframe. Refer to MSIA s. 87(2) and MSIR r. 3.52.
4.15	Mine plans have been submitted to the State mining engineer in the approved form.	**Intent:** To verify that the mine plans submitted are in a form suitable for future use and reference. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine survey plans. Check that the mine plans have been submitted in the approved form required. Refer to MSIR r. 3.53.

5 Emergency plan preparation

Emergency plan preparation

Point	Standard	Guideline
5.1	The emergency plans are available in hard copy in the Survey Office, the Emergency Control Centre and the Incident Management Room.	**Intent:** To ensure that emergency plans are available in the event of a power failure. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that hard copy plans available at the required locations meet the standard.
5.2	The emergency plans are all plotted at the same scale, with the exception of the whole of mine cross section showing ladder-ways and primary vent flows.	**Intent:** To ensure that mine emergency plans are of comparable size. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the plans meet the required standard.
5.3	The emergency plans are plotted one plot to one piece of paper (NOT double sided).	**Intent:** To ensure that mine emergency plans can be scrutinised with ease. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.
5.4	The emergency plans have grid lines spaced at 100m intervals on the page.	**Intent:** To ensure that mine emergency plans can be scaled and measured where required. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.

5.5	The emergency plans have coordinates plotted at each end of each grid line and are labelled mN and mE.	**Intent:** To ensure that mine emergency plans can be linked to the MGA94. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.
5.6	The emergency plans have grid lines that extend across the full length and breadth of each plot.	**Intent:** To ensure that mine emergency plans can be orientated, scaled and measured where required. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.
5.7	The emergency plans have annotations that are of a large enough font to be read through the mask of breathing apparatus.	**Intent:** To ensure that mine emergency plans can be read and used by emergency rescue personnel wearing breathing apparatus during an emergency. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.
5.8	The emergency plans do not rely on colours to identify unique symbols.	**Intent:** To ensure that mine emergency plans do not pose any issue to colour blind personnel. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.
5.9	The emergency plans have a legend.	**Intent:** To ensure that mine emergency plans clearly identify the area depicted in the plan. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.

5.10	Current ventilation and survey information is maintained on special emergency plans which are maintained in readiness for dealing with an emergency.	**Intent:** To verify that accurate up to date ventilation plans are available in the event of an emergency. **Personnel:** Registered Manager, Mine Surveyor, Ventilation Officer. **Method:** Inspect the underground plans maintained at the mine. Check that the plans contain the required safety information, a key to the symbols used, and are maintained accurately and up to date. Refer to MSIR r. 9.5(h).
5.11	The emergency plans do NOT show features that are conceptual e.g. Geological features, proposed or actual mine design, decline centre lines etc.	**Intent:** To ensure that mine emergency plans only contain key information associated with dealing with an emergency. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard. The mine
5.12	The emergency plans all have north plotted in the same orientation on each page.	**Intent:** To ensure that mine emergency plans can be orientated together correctly. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.
5.13	The emergency plans are uniquely numbered or named.	**Intent:** To ensure that mine emergency plans can be easily identified. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.

5.14	The emergency plans show workings only once in the entire set of plans i.e. The same length of decline or level is NOT shown on two separate plots.	**Intent:** To ensure that mine emergency plans do not duplicate areas creating confusion in an emergency. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.
5.15	The emergency plans show the name of each adjoining working shown on the plan.	**Intent:** To ensure that mine emergency plans can be easily organised into the correct order and sequence. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.
5.16	The emergency plans are of a recognised standard scale between 1:500 and 1:2,000.	**Intent:** To ensure that mine emergency plans can be scanned with ease. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.
5.17	The emergency plans contain a longitudinal plan that shows the entire extent of the mine workings that is subdivided into labelled map sheets.	**Intent:** To ensure that mine emergency plans have an overview plan for emergency personnel to understand the mine layout. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.
5.18	The emergency plans show the map sheet in the title block.	**Intent:** To ensure that mine emergency plans can be easily identified. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.

5.19	The emergency plans show the location of refuge chambers, fresh air bases, first aid stations, underground telephone locations, any air quality or gas monitoring points, bad or inaccessible ground, accumulations of water, filled voids, and any information identified as necessary for dealing with an emergency at the mine.	**Intent:** To ensure that mine emergency plans provide useful information for internal and/or external rescue and firefighting teams to use in an emergency. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the mine emergency plans. Confirm that the emergency plans meet the standard.

6 Field work

Field work

Point	Standard	Guideline
6.1	A full risk analysis of all survey work has been carried out.	**Intent:** To verify that the risks associated with survey work have been adequately considered and controlled to prevent an accident/incident taking place. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the survey risk analysis. Confirm that a full risk analysis has been carried out at the mine. Refer to MSIA s.9
6.2	Safe work procedures have been developed and approved by the employer.	**Intent:** To verify that safe systems of work have been developed for undertaking survey work. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the survey procedures. Confirm that safety procedures are available for all types of survey work. Refer to MSIA s.9
6.3	Surveyors are inducted, trained and assessed competent in the survey procedures and the mining hazards associated with surface and underground operations.	**Intent:** To verify that survey personnel are trained and assessed competent in the site survey procedures. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the training records. Confirm that the survey staff have been trained and assessed competent in the applicable procedures relating to survey work. Refer to MSIA s.9 and MSIR r. 4.13

6.4	Suitable transportation is available for the surveyor(s) to carry out their work safely.	**Intent:** To verify that fit for purpose mobile equipment is provided for survey personnel to carry out their work safely. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the survey vehicle. Check that the vehicle is suitable for the mine conditions to safely transport the people and equipment while undertaking survey work. The vehicle should be in good mechanical condition and have operational seat belts, two way radio, firefighting equipment, overhead flashing light. Refer to MSIA s.9 and MSIR rr.10.37 and 10.48
6.5	All survey equipment is safely secured during transportation	**Intent:** To ensure that survey equipment does not pose a flying projectile hazard in the event of any foreseeable vehicle incident. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the survey vehicle. Check that all the survey equipment is secured within the vehicle.
6.6	Surveyors are equipped with the appropriate PPE, sunscreen and water to carry out their work safely.	**Intent:** To verify that survey personnel have sufficient PPE and occupational resources to carry out their work safely. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the survey PPE and applicable safety resources. Check that survey personnel have the applicable contaminant protection, ear plugs, eye protection, skin protection, high visibility clothing and water supplies are suitable for the mine conditions Refer to MSIA s.9 and MSIR rr.4.1 and 10.48

6.7	Surveyors are equipped with appropriate warning signage where any work is carried out within a road reserve or any other vehicle operating area on the surface or underground.	**Intent:** To verify that survey personnel have sufficient portable traffic controls to prevent a traffic accident and carry out their work safely. **Personnel:** Registered Manager, Mine Surveyor. **Method:** Inspect the traffic controls available to the survey personnel. Check that survey personnel have the applicable warning signage, cones, barriers and/or danger tape for the mine conditions Refer to MSIA s.9 and MSIR rr.4.1 and 4.10
6.8	Fixed Survey stations in the open pit area are provided with a safe means of access.	**Intent:** To verify that survey personnel have a safe access route to open pit fixed survey stations. **Personnel:** Registered Manager, Mine Surveyor, Quarry Manager. **Method:** Inspect the access to the fixed survey stations. Confirm that the route is graded and there are no barriers in the way. Refer to MSIA s.9 and MSIR r.13.7
6.9	Fixed survey stations at the open pit crest are provided with fall from height protection.	**Intent:** To verify that fall from height protection is provided at open pit fixed survey stations where a fall hazard is present. **Personnel:** Registered Manager, Mine Surveyor, Quarry Manager. **Method:** Inspect the open pit fixed survey stations. Confirm that handrails, fences and/or barricades are installed where a fall from height hazard is present. Refer to MSIA s.9 and MSIR r.4.4
6.10	Non-entry survey techniques, equipment and tools are used at working faces and any other areas where there is a significant danger of serious injury or loss of life.	**Intent:** To ensure that exposure to close quarter survey work posing a falling object hazard is minimised. **Personnel:** Registered Manager, Mine Surveyor, Quarry Manager. **Method:** Inspect the survey equipment and tools. Confirm that survey personnel are equipped with the latest electronic equipment and/or extension tools so that face measurement and mark-up can occur from a safe distance away from the falling object dangers.

6.11	Survey stations and areas where survey work is carried out underground are made safe prior to carrying out any work.	**Intent:** To ensure that exposure to underground falling object hazards is minimised. **Personnel:** Registered Manager, Mine Surveyor, Quarry Manager, Underground Manager. **Method:** Inspect the survey procedures. Confirm that survey personnel are competent in identifying and dealing with falling object hazards. Survey work should only be carried out in areas where the roof and sidewalls have been adequately supported with Shotcrete, mesh, some other form of surface protection or been scaled and made safe. Refer to MSB 41, MSIA s.9 and MSIR r.10.13 and 13.9(9)