PUATEA002B, CPPSIS3001A,
CPPSIS3005A, CPPSIS4006A
AND CPPSIS4015A

Mapping Team Member

LEARNER
GUIDE

AFAC Limited (ABN 52 060 049 327)
Level 5, 340 Albert Street
East Melbourne Victoria 3002
Telephone: 03 9419 2388
Facsimile: 03 9419 2389

Email: afac@afac.com.au
Internet: http://www.afac.com.au

Table of Contents

Acknowledgements

The Australasian Fire and Emergency Services Authorities Council (AFAC) is deeply indebted to the officers of the following member agencies of the Emergency Management Spatial Information Network of Australia (EMSINA), who provided material and advice to assist with the development of this publication.

EMSINA consists of representatives from state and territory state GIS User Groups and three federal Government agencies.

ACT Emergency Services Agency

Australian Federal Police

Australian Maritime Safety Authority

Bureau of Meteorology

Country Fire Authority (Vic)

Country Fire Service (SA)

Department of Agriculture, Fisheries and Forestry

Department of Defence, Defence Imagery and Geospatial Organisation

Department of Environment and Conservation (WA)

Department of Primary Industries, Parks, Water & Environment

Department of Sustainability and Environment (Vic)

Emergency Management Australia

Emergency Services Telecommunications Authority

Fire and Emergency Services Authority (WA)

Geoscience Australia

NSW Police

NSW Rural Fire Service

NSW State Emergency Service

QLD Fire and Rescue Service

QLD Police

Tasmania Fire Service

Learning context

This Learner Guide is part of the Mapping Team Member Training Resource Kit (TRK) intended to train members of Australasian fire and emergency service agencies in the knowledge and skills required to perform the role of Mapping Team Member in the Australasian Inter-service Incident Management System (AIIMS) during an emergency response.

The TRK for Mapping Team Member comprises the following parts:

- Facilitator Guide
- Learner Guide
- Assessment Guide.

The Mapping Team Member TRK can only be implemented by a Registered Training Organisation (RTO) in accordance with the requirements of the Australian Quality Training Framework standards for RTOs.

The training has been designed to meet the needs of the Australasian fire and emergency services and is intended to be delivered within the context of emergency management.

This Learner Guide covers only the underpinning knowledge for Mapping Team Member training and needs to be supported through supervised instruction and practice using the agency's Geographic Information System and related technology.

At the completion of the Mapping Team Member training, trainees should be able to:

- Work under limited supervision as a member of the Mapping Team during emergency response
- Collect basic data using information technology and equipment within a spatial information handling framework.
- Interpret (i.e. to identify, analyse and evaluate) information from various types of image data.
- Apply GIS software correctly to resolve problems and use spatial and aspatial data in an integrated manner.
- Create a map, as required by the agency, with the aid of a GIS system.

The principles and concepts covered in this training are aligned to the following units of competency.

PUA00 Public Safety Training Package - Industry Wide Competency Standards

- PUATEA002B Work autonomously

CPP07 Property Services Training Package - Spatial Information Services Units of Competency

- CPPSIS3001A Apply map presentation principles
- CPPSIS3005A Collect basic spatial data
- CPPSIS4006A Read and interpret basic image data
- CPPSIS4015A Apply GIS software to problem-solving techniques

RTOs should note that, if applied within the fire context, learners are to possess PUATEA001B Work in a team, which is a pre-requisite to the unit PUATEA002B Work autonomously.

Section

1

The Mapping Team in AIIMS

Section
1

The Mapping Team in AIIMS

This topic covers the role, purpose and structure of the Mapping Team in the Australasian Inter-service Incident Management System (AIIMS) during an emergency response.

AIIMS overview

AIIMS is a management framework used by emergency management agencies to assist with the effective and efficient control of an incident. AIIMS can be used either by a single organisation, or by two or more organisations working together.

AIIMS is scalable in that it can be applied across a whole range of incidents from small to large and provides the basis for an expanded response as an incident grows in size or complexity.

AIIMS has been adopted by all Australian fire and land management agencies, the Australian Council of State Emergency Services and the National Biosecurity Committee.

The principles of AIIMS

AIIMS is based on three key principles:

- Functional management;
- Management by objectives; and
- Span of control.

Functional management

In the context of AIIMS, functional management means the use of specific functions to manage an incident. AIIMS uses the following five functions:

- Incident Control – the overall management of all activities necessary for the resolution of the incident;
- Operations – the management and supervision of operational resources and activities;
- Planning – planning to control the incident and keeping a record of the incident situation and resources;
- Public Information – the dissemination of information to the public and other stakeholders, including warnings and alerts; and

- Logistics - provision and maintenance of resources, facilities, services and materials.

The people appointed to be responsible for the functions of Control, Planning, Operations, Public Information and Logistics are the Incident Management Team (IMT). The functions are denoted by the colours white (Control), yellow (Planning), red (Operations), brown (Public information) and blue (Logistics).

The IMT operates from the Incident Control Centre (ICC).

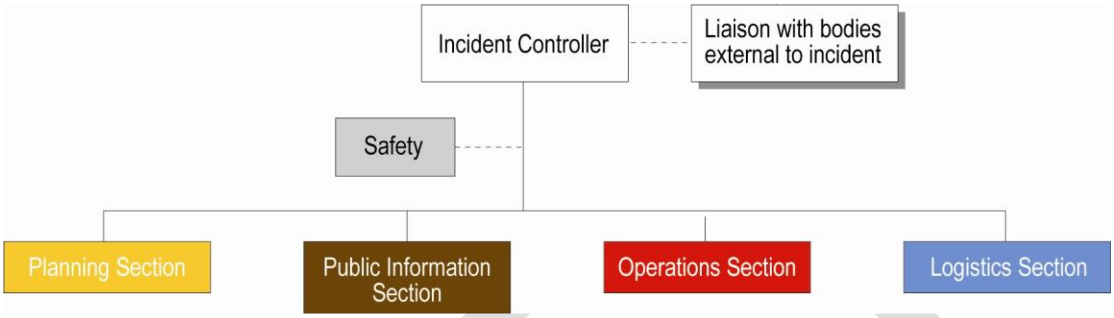


Figure 1 – The Incident Management Team

Management by objectives

Management by objectives is a process where the Incident Controller, in consultation with the Incident Management Team, determines the desired outcomes (or objectives) of the incident response effort.

The incident objectives are communicated through the Incident Action Plan (IAP). The IAP is the overall plan for resolving the incident. At any point in time, each incident can have only one set of objectives and one IAP. This is to ensure that all incident personnel are working towards the one set of objectives.

Span of Control

Span of control is a concept that relates to the number of groups or individuals able to be effectively supervised by one person.

The span of control for an incident response should be 5 to 7 reporting groups or individuals to each supervisor. This maintains the supervisor's ability to effectively task, monitor and evaluate the performance of subordinates.

The incident management structure

The Incident Controller determines the incident management structure according to the size and complexity of the incident. At a small incident, or during the early phases of a potentially large or complex incident, the Incident Controller may effectively manage all the functions. As the incident develops in size or complexity, the Incident Controller may allocate responsibility for managing these functions to other people.

The incident management structure might eventually expand to have separate people and teams managing the delivery of each of the planning, operations, public information and logistics functions. The structure of the planning, public information, operations and logistics sections are shown in the following diagram.

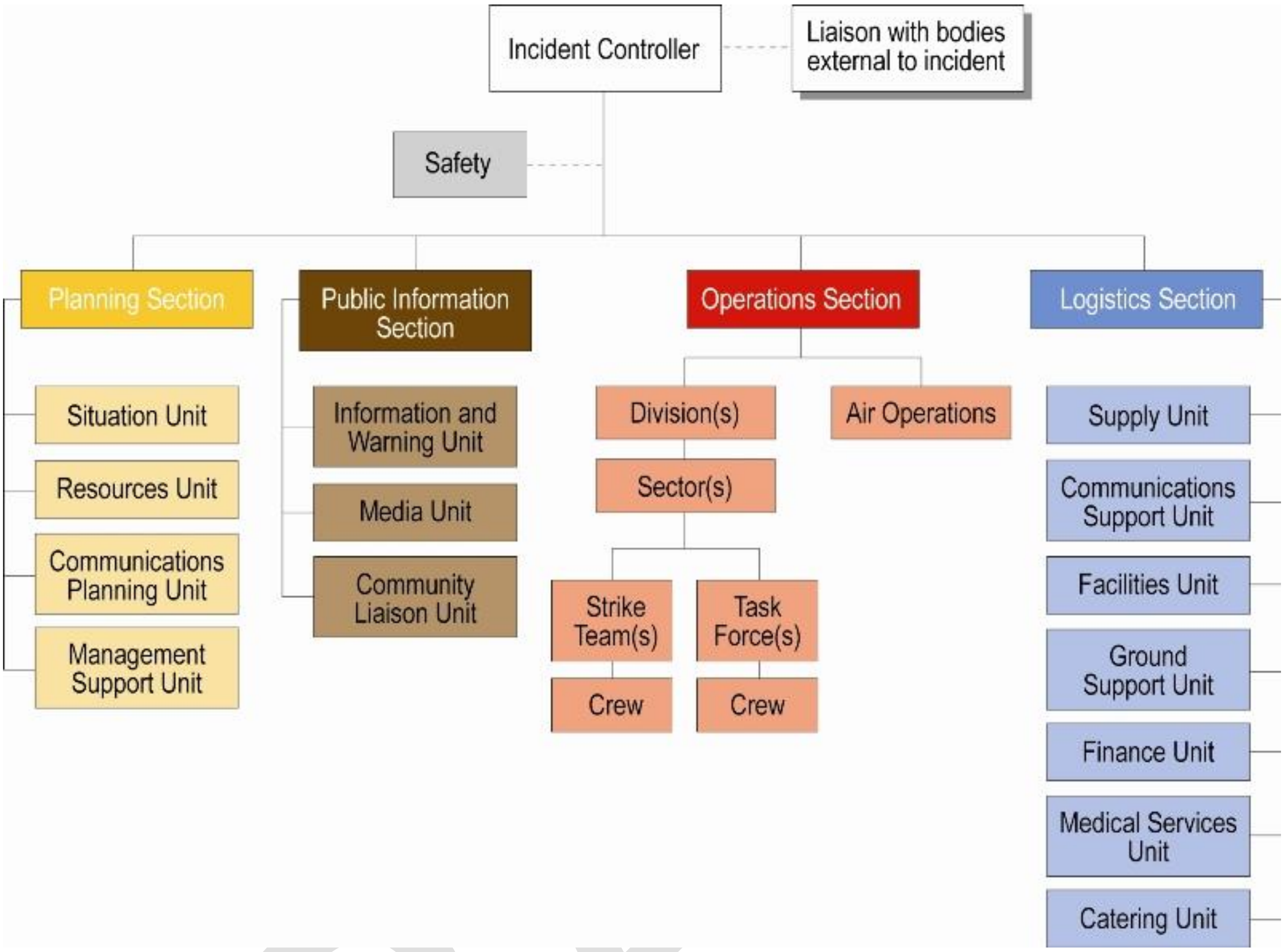


Figure 2 – The AIIMS structure

Note how the Operations Section is divided into divisions and sectors. Divisions are only used in large or complex incidents.

The Planning Section

The planning function provides support for control of the incident through:

- Collection and evaluation of information on the current and forecast situation
- Preparation and dissemination of the Incident Action Plan (IAP)
- Collection and maintenance of the information about resources allocated to the incident.

The incident Controller may allocate responsibility for the planning function to a Planning Officer.

The complexity of an incident may require the Planning Section to be divided into units and specialist resources dedicated to particular tasks or functions such as:

- Situation Unit - monitors and predicts the incident's behaviour and prepares alternative strategies;
- Resources Unit – gathers, maintains and presents information on incident resources;
- Communications Planning Unit – prepares the Communications Plan (e.g. the radio channel, phone number for each part of the AIIMS structure); and

- Management Support Unit – provides administrative services and operates communications equipment within the Incident Control Centre.

Technical specialists may also provide advice in their particular area of expertise.

The Situation Unit

The Situation Unit is engaged in the collection, processing and organising of situation information. The Unit summarises this information, develops projections and forecasts of possible future events and prepares maps and intelligence information for use at the incident. The Unit also prepares a range of alternative strategies and identifies their associated risks and likely outcomes.

The components of the Situation Unit are:

- Incident prediction/options Analysis;
- Mapping;
- Collecting, processing and organising situation information; and
- Weather services.

The mapping function

Mapping information, with relevant supporting documentation, is an important tool for summarising and describing the incident situation. Maps are used to record and communicate intelligence, strategies and tactics, for briefings and are also a valuable record of the incident activities.

The mapping function could be performed by a single officer or a by a Mapping Team.

Depending upon requirements, the tasks performed by the mapping function may include:

- Production of maps for the Incident Action Plan and for operational briefings;
- Production of public information maps;
- Production of maps to help the Planning Section, Situation Unit (e.g. current and projected incident situation) and other units; and
- Creation of incident data from GPS, field observation, imagery and other sources.

The Mapping Team

During a large incident the Mapping Team comprises:

- The Mapping Team Leader;
- Mapping Team Members; and
- Mapping Team Assistants.

Mapping Team Leader

The Mapping Team Leader:

- Works within the Situation Unit to identify the required products the Mapping Team is required to produce;
- Establishes team goals and identifies the tasks required to achieve team goals;
- Establishes and allocates team member tasks; and

- Manages team performance in order to deliver products to the required standard and timeframe.

Mapping Team Member

The Mapping Team Member:

- Works under limited supervision as a member of the Mapping Team;
- Supervises Mapping Team Assistants as required;
- Collects basic spatial data (e.g. downloads a GPS device);
- Interprets image data information;
- Applies geographic information systems (GIS) software in order to produce the required mapping products.

Mapping Team Assistant

The Mapping Team Assistant:

- Works under the direct supervision of a Mapping Team Member; and
- Interprets and creates simple digital maps using basic cartographic skills.

Deployment to an incident

On deployment to an incident, the Mapping Team will usually be advised of type of incident they are being sent to (e.g. fire or flood etc.).

On arrival at the Incident Control Centre, the Situation Unit Leader or the Mapping Team Leader should brief the Mapping Team.

The briefing should include the types and specification of maps that are required and their intended recipients e.g. incident management personnel, Departmental Heads, Ministers, the community etc., and the priority and timing of their production.

Information flow for the Mapping Team

The Mapping Team Leader reports to and receives the objectives for the shift from the Situation Unit Leader. This is to ensure the Mapping Team activities contribute to the overall objectives of the Planning Section and Situation Unit.

Sometimes requests are directed to the Mapping Team from other people mid-shift. Where these requests conflict with current agreed team objectives, the Mapping Team should refer these requests to the Situation Unit Leader who may need to review the Mapping Team objectives.

Workspace requirement

The Mapping Team needs to be located:

- Where there is access to the agency's corporate GIS reference data e.g. topographic data;
- Where there is a reliable power source and backup power source;
- With computers with:
  - access to the agency's electronic filing system;
  - the agency's GIS software package loaded;
  - maximum power/memory to be able to cope with the demands of map production;

  - big screens for ease of map production;

- Close to the Situation Unit, to whom the Mapping Team reports and will need to interact regularly; and
- Close to printers and plotters; and
- Close to all other Mapping Team members.

The information technology demands of the Mapping Team suggest that the Mapping Team should be located in a pre-designated fixed location Incident Control Centre.

However, sometimes this is not possible with Mapping Team members deployed to mobile locations with laptop computers. In these circumstances, Mapping Team members should ascertain their needs will be met prior to arrival.

Summary

- AIIMS is based on three key principles:
  - Functional management;
  - Management by objectives; and
  - Span of control.
- The Incident Controller is appointed by the Control Agency and manages all activities related to the incident.
- The Incident Controller is supported by the Planning Officer, the Operations Officer, the Public Information Officer and the Logistics Officer. The people performing these functions are the Incident Management Team or IMT.
- The planning function provides support for control of the incident through:
  - Collection and evaluation of information on the current and forecast situation;
  - Preparation and dissemination of the Incident Action Plan (IAP); and
  - Collection and maintenance of the information about resources that are allocated to the incident.
- The Situation Unit is engaged in the collection of situation information and the development of incident control options.
- The Mapping Team is a component of the Situation Unit. The Mapping Team is responsible for producing mapping information, with relevant supporting documentation in order to summarise and describe the incident situation.
- During a large incident the Mapping Team comprises:
  - The Mapping Team Leader – who is responsible for obtaining work instructions and managing the Mapping Team to ensure that the products are delivered.
  - Mapping Team Members – who work independently to collect and interpret incident and image data, and then apply GIS software to produce mapping products.
  - Mapping Team Assistants – who work under supervision and produce basic mapping products.
- Requests for Mapping Team work should come through the Situation Unit Leader.

Self assessment questions

1. Identify the composition of the Incident Management Team or IMT.

2. Which role is responsible for the production of the Incident Action Plan?
3. Explain the role of the Situation Unit.
4. Explain the role of the Mapping Team.
5. Identify each of the key roles in the Mapping Team and their function.
6. How does the Mapping Team normally receive requests for mapping products?

Section

2

Working in the Mapping Team

Section

2

Working in the Mapping Team

This topic covers the underpinning knowledge regarding working in a team environment, such as when working as a member of the Mapping Team during emergencies.

Team work

A workgroup develops into a 'team' when the common purpose of the team is understood by all team members and each member plays their assigned role to the best of their ability to achieve this purpose.

People in a team depend on each other and share their skills and experience to achieve outcomes that they could not achieve as individuals. The combined capability of the team is the key benefit for both individual team members and the organisation.

The best performing teams have an on-going commitment to becoming even better. These teams work in a collaborative climate characterised by openness, trust and shared respect. Members are willing to listen and approach problem-solving as a challenge to be overcome. There is a collective 'buzz' and acceptance of team responsibility for success or failure. Team members feel able to express their views and ideas freely and openly and have high expectations and standards of excellence.

High performance teams

The characteristics which typically apply to teams which are successful are:

Size	The size and membership of the team must be appropriate to the task and enable the group to work together comfortably as a unit.
Supportive leadership	A supportive leader who has high personal performance standards.
Challenge	A goal that requires the collective effort and multiple skills of the team.
Shared values	Team objectives and values are understood and accepted by all team members. Team member behaviour is governed by shared team values and attitudes.
Results focus	A focus on results and commitment to objectives and measurable targets for achieving these results.
Team and individual accountability	Acceptance of both, team and individual accountability for performance.
Right mix of skills	Team members with the right mix of skills required to complete the task.
Role clarity	Clear roles and responsibilities for team members and team structures and procedures which are linked to team objectives and resources.
Sufficient resources	Resources available for completing team tasks efficiently.
Autonomy	The team has the authority to decide how they will work and how resources will be allocated.
Open communication	There is open communication and information sharing between team members. Issues, difficulties and obstacles to performance are confronted and dealt with openly.
Teambuilding	Efforts are made to develop and maintain a team climate.
Respect	Team members treat each other with respect and trust; support and value each other; and relate well to others outside the team.
Recognition	Formal or informal processes are in place for recognition and reward of individual contributions as well as team successes.
Decision-making	Procedures are in place for effective decision-making focused on team objectives.
Team learning	• Processes are in place to assist teamwork, including grievance procedures, conflict resolution and performance feedback. • Time is taken to reflect on progress and learn from outcomes of team activity and team operations and targets are regularly reviewed. • Individual and team development needs are met.

Activities

1. Consider the most effective work group you have been involved with and identify the main factors that made this group effective.
2. Consider the least effective work group you have been involved with and identify the main factors that caused this group to be ineffective.
3. Would you define either of the groups you have described above as a team? Explain why or why not.

Team 'players'

People contribute to teams in different ways because of their different skills, personalities and preferred ways of working. These differences are essential in a team but they can cause conflict. It is important that you accept and work with these differences to maximise the potential of each team member and benefit the team overall.

Each person in a team must be valued for their contribution to the attainment of team goals. Some personalities are attracted to 'big picture' roles while others are attracted to roles emphasising 'detail'. Both types of roles are equally important.

No personality type is better or worse than another and each behavioural style contributes differently to the team. This is very desirable as a team comprised entirely of people operating and behaving in the same way will lack the variety of skills usually needed in a high performing team.

Each team member has a responsibility towards the task, the team and the individual.

Key responsibilities of team members are to:

- Communicate with team leaders and other members;
- Co-operate with team leaders and other members;
- Contribute skills and experience towards achieving team tasks; and
- Share the work, and assist and support other members.

Good team players are capable people who know how to fit in with others to bring the team success. Team players:

- Share good ideas;
- Find ways to help people in their team;
- Recognise good results; and
- Ask for help when they need it to get a job done.

Individual differences

A summary of the preferred ways of working you can typically expect to see in a team are summarised below. Knowing and understanding these individual preferences will help you to value individual diversity in a team.

TRAITS	People with these traits:
Vision	• look for creative, new ways to achieve goals • can often see the bigger picture of the task • bring new ideas to the team • like solving new problems • are flexible in their approach and attitudes.
Detail	• are organised and realistic • like an established way of doing things • are patient with routine details and are good at precise work • will complete tasks set • are down to earth in their approach.
Task oriented	• focus on achieving objectives • are relatively unemotional and uninterested in feelings • like to get things settled and concluded • plan work and follow the plan • are results focused.
People oriented	• maintain team spirit and enhance the general well being of others • make sure everyone has a say • value harmony and not allow decisions to be influenced by their own or other people's likes/dislikes.

Receiving instructions

During the management of emergencies there is usually no time available for work to be repeated or for team members to take extra time to complete tasks. Tasks usually have to be completed on time and to a quality standard.

This means each team member must be clear about the work to be done and the required outcomes. Each team member is responsible for checking they understand exactly what is required and must be able to answer the following questions:

- What will the outcome/product look like? What quality criteria must be met?
- Are there standards with which the product /outcome must comply?
- What techniques/processes/procedures should be used to produce the desired outcome?
- Are there other people who should be involved in the work?
- What are the planned start and end dates/times?
- Are there any constraints to be observed, e.g. people to be involved, rules to be followed?
- How often should progress be reported, and in what form?
- Who is the contact person for problems?
- How will the quality of the product be checked?

- Does the work need to be checked at a number of points along the way? Who will be doing the checking?
- Who should be informed when the work is finished?
- Where is the finished product stored?

Reporting

Regular reporting to the team and the team leader on the progress of work is an essential part of being an effective team member. Regular reporting is important because it provides feedback on how the plan of work is progressing.

The work plan will be altered according to progress, including whether or not timeframes are being met. Resource issues that are emerging can also be addressed.

Reporting to the team provides additional opportunity for the involvement of all members. Team members may have useful experience in the task which they can share, other pertinent information or have a different way of looking at the problem.

Reporting is also a forum for seeking assistance if required. The team can provide assistance and share responsibility. It is important to note that only functioning teams are emotionally able to do this. If there is no trust or tolerance in the group, assistance and feedback may not be accepted.

Points to be considered when reporting to the team leader and/or team include:

- Progress made towards achieving the work objectives;
- Identification of information that may affect the work of another team member;
- Future resource requirements;
- Future timeframes and timelines; and
- Any predicted problems in completing work and subsequently the team objective.

Reporting should be succinct and relevant. Ultimately the team and the team leader are only interested in results and issues which may have implications for the team's work overall.

Policies and procedures

Team members must always work within the bounds set by the policies and procedures of the agency.

Policies and procedures ensure that the agency complies with its legal obligations in areas such as equal employment opportunity (EEO), anti-discrimination and occupational health and safety.

Policies and procedures reflect an agency's's intention to treat employees fairly, taking into account their individual needs. Policies and procedures also contribute to effective teamwork by setting out procedures, performance standards and the agency's quality standards.

They cover workplace matters such as:

- Legislation relevant to the agency or the emergency being managed;
- Recruitment and selection;
- Induction;
- Occupational health and safety;
- Employment conditions, equal opportunity, anti-discrimination and cultural diversity;
- Termination of employment;

- Operational procedures;
- Operational performance standards; and
- Training and development

Sometimes, during emergency work, issues arise that appear to breach the agency's policy or procedures. These should be referred to the supervisor who should know the appropriate agency process to follow in such circumstances.

Workplace health and safety

Employee responsibilities

In New Zealand and Australia there are laws and regulations which set out mandatory minimum workplace health and safety requirements. These are designed to protect employees and to provide a safe environment to work.

In New Zealand there is the Health and Safety in Employment Act 1992 which is governed by Occupational Safety and Health Services.

In Australia each state and territory has its own legislation which is enforced by their respective authorities:

- NSW Workcover Authority;
- Victorian Workcover Authority;
- Worksafe Western Australia;
- South Australian Workcover Authority;
- Queensland Division of Workplace Health and Safety;
- Workplace Standards Tasmania;
- Northern Territory Work Health Authority; and
- ACT Workcover.

Legislation provides for joint participant of employers and employees in ensuring safe working conditions.

Office hazards

A whole range of possible heath and safety hazards are present in the office environment. A hazard is anything with the potential to cause harm. You should do the following if there is a hazard:

- Say NO to working in unsafe conditions;
- Report unsafe or hazardous conditions to your supervisor straight away;
- Warn others at risk about the danger – where it is and how it happened; and
- Always ask yourself before starting a new job – can I get hurt doing this job? It you answer YES or MAYBE, talk to your supervisor right away.

Office hazards can include:

- Inappropriate furniture;
- Inadequate or incorrect lighting;
- Poor temperature and humidity control;
- Noise factors;

- Electrical hazards; and
- Chemical hazards.

Ergonomic computer workstation set-up comprises a 'neutral position' as follows:

- Gaze down slightly;
- Neck slightly bent;
- Shoulders relaxed;
- Elbows 90 degrees or greater;
- Wrists straight;
- Fingers gently curved;
- Hips at 90 degrees or greater; and
- Feet flat on the floor.

If you are regularly using a laptop computer the screen should be raised to the correct height, as detailed above, and a standard keyboard utilized in place of the laptop keyboard.

Risk factors when computing are:

- Sitting in a non-neutral posture;
- Sitting for long periods of time without moving large muscle groups;
- Overuse of the small muscles of the hand through repetitive movement;
- Using more force than necessary to input; and
- Contact stress, wrists 'planted' on the edge of the keyboard or desk.

Fire hazards are present at all worksites. You must acquaint yourself with the Fire Safety drill appropriate to your workplace immediately on commencement at that site.

Chemical hazards in an office include the toners associated with laser printers and photocopiers. These toners can cause serious irritations and inflammation of the lungs and mucous membranes. Tips to avoid this are:

- Avoid inhalation and physical contact with toners;
- Wear rubber gloves to add toner to copiers or printers. Wash your hands and face when you have finished;
- Keep the area around the copier or printer well ventilated and install an extractor fan if necessary; and
- Ensure these chemicals are labelled and stored according to directions.

If you are TIRED or STRESSED you are more likely to have an accident. To prevent this:

- Adequate rest periods and breaks should be taken during the day;
- Boring and repetitive tasks may lead to carelessness. Vary the tasks of workers;
- Ask the team leader to introduce job rotation if possible; and
- Poor health can lead to an increase in accidents and a decline in productivity. Address health problems as early as possible before the problem becomes worse.

Fatigue

Incident management is generally considered to be a fatigue-inducing activity. Incident management may require working at any time of the day or night, working under demanding time pressures and working in poor environmental conditions. The key consequences of fatigue can include:

- Increased errors;
- Decreased attention span;
- Impaired perception and awareness;
- Impaired thinking and problem solving;
- Decreased motivation;
- Irritability; and
- Restlessness.

Your agency should have a policy regarding working and resting arrangements during emergencies to prevent the consequences of fatigue.

Injuries and prevention

If you are injured:

- Inform your on-site supervisor. You will need to complete an accident report form. Do NOT leave the site before notifying your supervisor – leaving the site without notification may result in the rejection of a Compensation Claim.
- Seek medical assistance if required. Within an IMT, First Aid is obtained through the Medical Services officer in the Logistics Section or other designated First Aider. If you need to attend a doctor, he/she must give you a medical certificate which will state what your injury is and whether you need time off work.

The main causes of office-based injuries and their prevention strategies are:

- Manual handling – if the load if too heavy for you, get help right away; and
- Office overuse injuries – perform office exercises regularly.

Summary

- A team is a small number of people with complementary skills who are committed to a common purpose and an approach for which they hold themselves mutually accountable.
- A workgroup develops into a 'team' when the common purpose of the team is understood by all team members and each member plays their assigned role to the best of their ability to achieve this purpose.
- Team players:
  - Share good ideas;
  - Find ways to help people in their team;
  - Recognise good results; and
  - Ask for help when they need it to get a job done.
- Team members must be prepared to request and accept assistance from other team members.
- Key responsibilities of team members are to:
  - Communicate with team leaders and other members;
  - Co-operate with team leaders and other members;
  - Contribute skills and experience towards achieving team tasks; and
  - Share in the work and assist and support other members.

- Each team member must be clear about the work to be done, the required outcomes and is responsible for checking they understand exactly what is required
- Points to be considered when reporting to the team leader and/or team include:
  - Progress made towards achieving the work objectives;
  - Identification of information that may affect the work of another team member;
  - Future resource requirements; and
  - Future timeframes and timelines.
  - Any predicted problems in completing work and subsequently the team objective.
- Team members must always work within the bounds set by the policies and procedures of the agency. These ensure the agency complies with its legal obligations in areas such as equal employment opportunity (EEO), anti-discrimination and OHS.
- You should do the following if there is a hazard:
  - Say NO to working in unsafe conditions;
  - Report unsafe or hazardous conditions to your supervisor straight away;
  - Warn others at risk about the danger – where it is and how it happened; and
  - Always ask yourself before starting a new job – can I get hurt doing this job? If you answer YES or MAYBE, talk to your supervisor right away.

Self assessment questions

1. What characteristics define a well-performing team?
2. What makes a good 'team player'?
3. Identify the key responsibilities of team members.
4. Identify some of the points that should be covered when reporting progress to the team leader.
5. Why is it important to work within the agency's policy and procedure framework?
6. What should you do if you notice a hazard in your workplace?

Section

3

Leading the Mapping Team

Section
3

Leading the Mapping Team

This topic covers underpinning knowledge relating to leading a small group of people within the Mapping Team during emergency work and managing their performance.

Managing the mapping function

In a large incident, the Mapping Team will work under the direction of a Mapping Team Leader and may include Mapping Team Members and Assistants. The Mapping Team Members may be asked to supervise Assistants.

At a smaller or less complex incident, there may only be a small number of people working in the Mapping Team and the Mapping Team Member may be required to act as the team leader.

If supervising others, the Mapping Team Member may be responsible for:

- Establishing the team objectives;
- Allocating tasks to the others in the team; and
- Managing the performance of team members.

Additionally, the Mapping Team Members may be responsible for the workspace, including ensuring it is properly established and the systems, hardware, plotters etc are maintained.

Establishing team objectives

The Mapping Team Leader reports to and receives the objectives for the shift from the Situation Unit Leader in AIIMS. This is to ensure the Mapping Team activities contribute to the overall objectives of the Planning Section and Situation Unit.

Where there has been a previous shift working at the incident, the Mapping Team Leader and individual team members usually participate in a ‘handover briefing’ (refer to later section on Shift Handover and AAR) where they will be handed a set of handover notes from the previous team. Team objectives in the handover notes will need to be confirmed with the Situation Unit Leader and any tasking confirmed through the team planning process.

Sometimes requests are directed to the Mapping Team from other people mid-shift. Where these requests conflict with current agreed team objectives, the Mapping Team Leader should be refer these back to the Situation Unit Leader who may need to review the Mapping Team objectives.

The Mapping Team leader can plan team tasks once team objectives have been agreed.

Allocating tasks

The Mapping Team Leader usually plans the team tasks - often in conjunction with the team members. Even if a set of 'handover notes' was received with a plan formulated from the previous team, the planning process model is a useful tool for evaluating the existing plan and allocating tasks.

Ideally all members of a team should be involved in all steps of this process. Reaching agreement as a team during the planning process helps team members to be committed and motivated to produce the required outcomes.

Possible steps for planning are to:

- Identify the team objectives;
- Identify issues, factors and information that affect the situation;
- Identify resources available;
- Develop options for achieving objective/s;
- Determine a plan of action;
- Allocate tasks; and
- Set up feedback processes.

Tasks and activities need to be assigned to team members based on their skills and experience and what is needed to complete the work.

In assigning tasks, the following aspects need to be considered:

- Previous experience - have team members done similar work before?
- Personal interests - are team members interested in working on this task or project?
- Personal characteristics - are team members likely to work well together as a team?
- Availability - are the allocated team members available when required?

Performance management

Monitoring

During emergency work, it is critical that the Mapping Team meets it objectives on time.

A late map is useless and may even hinder efforts to control the incident.

After work has commenced, the Mapping Team Leader and the team members ensure plans are followed and work is being completed as scheduled. Unforeseen issues and changes may result in the need for re-planning. Occasionally there may be a need to undertake a major review of how the work will proceed.

The team leader must be aware at all times of how work is progressing, be alert to possible problems and should respond to warning signs such as:

- Tasks taking longer than estimated.
- Mapping standards not being met.
- Team members having an optimistic rather than a realistic view of progress.
- Team members not working as a harmonious team. and

- Informal communication being more powerful / prevalent than formal communication.

Sometimes problems may arise as a result of team members not having the required skills to do the job. Re-planning may involve changing the roles and responsibilities of team members so that roles are better suited to the skills and knowledge of individuals assigned to tasks.

At other times there will be a need to further develop the skills of team members. This may involve training for team members either on or off the job.

Planning and managing time is essential for the successful completion of tasks by a team member.

Regular reporting on work is essential. Team members need to give information about the progress of work and any other relevant information to the team leader and other team members.

Giving and receiving feedback

Receiving and providing feedback on performance plays an integral role in developing honesty and trust within teams. Positive feedback motivates the team and constructive feedback can refocus an individual or team and ensure that there is no bad feeling.

As a team member, you may find that you receive or provide feedback on:

- The progress of work;
- The behaviour of team members and its impact on the work of the team; and
- Ideas generated in the team or by individual team members.

Receiving feedback

Team members should be aware of how their behaviour appears to others. A person's self image may be different from the image others see. Being aware of these differences enables a person to act appropriately in teamwork situations. Team members should be prepared to receive feedback when this is viewed as helping the performance of the individual and the team.

The effectiveness of giving and receiving feedback relies on having open discussion about issues raised and on reaching agreement about actions to be taken in the light of feedback given. When receiving feedback from a team leader or team member, you should:

- Keep an open mind and suspend judgment;
- Listen and repeat or paraphrase what you have heard and confirm that you understand what is being said; and
- Focus upon behaviours and facts rather than any emotions or subjective opinions being expressed.

Giving feedback

Providing appropriate feedback may include: acknowledging initiative, aptitude, ideas, performance and providing constructive criticism. Techniques for providing feedback in a useful and productive way are summarised below.

Focus on specific behaviours

Feedback should be specific rather than general. Avoid vague statements such as '*You have a poor attitude*' or '*I'm impressed with the job you did*'. These statements don't give enough information. You need to explain why you are being critical or complimentary.

Keep it impersonal

Any feedback and negative feedback in particular, should be descriptive rather than judgmental or evaluative. No matter how upset you are, keep the feedback job-related and never criticise someone personally because of an inappropriate action.

Focus on objectives

If you have to say something negative, make sure it is directed toward the task objectives. If you are merely 'venting' your feelings, such feedback undermines your credibility and lessens the impact and influence of future feedback. An example of venting rather than providing useful feedback is:

'The team just isn't pulling together, the work is still coming in and we aren't getting anything done. Something's got to give'.

Time it well

Feedback is most meaningful when it is timely. Unnecessary delay in providing feedback lessens the likelihood that the feedback will be effective in bringing about desired behaviour change. However, if you have insufficient information, if you are angry or if you are otherwise emotionally upset, it is wise to delay giving feedback until you are better prepared. Feedback should be given with appropriate regard to protecting the confidentiality and privacy of individuals and you should never criticise someone in public.

Ensure understanding

Feedback should be specific so that the person to whom it is directed, clearly and fully understands the issue. They should verify and describe their understanding of the information received.

Make feedback useful

There is little value in reminding a person of a shortcoming over which he or she has no control. Indicate specifically what can be done to improve the situation. This offers guidance to people who understand the problem but don't know how to resolve it.

Tailor the feedback to fit the person

Consider past performance and potential when you are deciding on the frequency, amount and content of performance feedback required.

Summary

- The Mapping Team Leader is responsible for managing and maintain the Mapping Team work environment for example, maintaining systems, hardware, plotters etc.
- The Mapping Team Leader obtains the team objectives from the Situation Unit Leader.
- Possible steps for planning are:
  - Identify the team objectives.
  - Identify issues, factors and information that affect the situation;

  - Identify resources available;
  - Develop options for achieving objective/s;
  - Determine a plan of action;
  - Allocate tasks; and
  - Set up feedback processes.
- The effectiveness of giving and receiving feedback relies on open discussion of issues raised and on reaching agreement about actions to be taken.
- When receiving feedback from a team leader or colleague you should:
  - Keep an open mind and suspend judgment;
  - Listen and repeat or paraphrase what you have heard thereby confirming you understand what is being said; and
  - Focus upon the behaviours and facts rather than any emotions or subjective opinions being expressed.
- When providing feedback:
  - Focus on specific behaviours;
  - Keep it impersonal;
  - Focus on objectives;
  - Time it well;
  - Ensure understanding;
  - Make feedback useful; and
  - Tailor the feedback to fit the person.
- Planning and managing time is essential for the successful completion of tasks by a team member.
- Regular reporting on work is essential. Team members need to give information about the progress of work and any other relevant information to the team leader and other team members.

Self assessment questions

1. What routine tasks is the Mapping Team Leader responsible for?
2. How does the Mapping Team set its objectives?
3. Identify the steps in planning team tasks.
4. What are some of the things you should keep in mind when <u>receiving</u> feedback?
5. What are some of the things you should keep in mind when <u>giving</u> feedback?
6. Why is it essential that Mapping Team objectives are met?

Section

4

Shift handover

Section 4

Shift handover

A smooth handover between the outgoing and incoming Mapping Team at shift changeover is essential to ensure the continuity of mapping services to incident management. A smooth handover requires:

- Incident Logs to be maintained throughout the shift;
- Maps produced during the current shift to be properly stored;
- Handover Notes to be prepared;
- Maps produced during the shift to be printed;
- The incoming shift to be briefed; and
- An After-Action-Review (AAR) to be conducted.

Shift information

Incident logs (e.g. diary)

The Mapping Team should keep a record of their activities for the shift.

Some agencies will keep one logbook for the whole Team, while others will require each individual to keep a log. If there is one logbook for the whole Team then the individuals may consider keeping a private diary.

Incident logs relate to positions, rather than individuals, with the outgoing Mapping Team handing over the incident log to the incoming person.

Incident logs must not be taken home although a copy of the log for a particular shift can be made and retained as a personal record. This is a good idea if the incident is likley to have legal consequences.

There may be differences between agencies regarding the type and format of incident logs. Some agencies prefer a logbook, others prefer electronic logs while some refer to the record as a diary)

In general, incident logs must include:

- The title of the position (e.g. Mapping Team Member);
- The date and time of shift changeover; and
- The name of the person filling the position for a particular shift.

Logs must be maintained for significant events including:

- The time when image data was received;
- The time when data was archived;
- The time and details of requests received (e.g. the type of map, number of maps, the time the map is due etc); and
- The time and details of information sent out.

Maps produced during the shift

At the end of each shift, the Mapping Team should print out a hard copy of each map produced during the shift and file it according to your agency's requirements.

Maps should also be stored and archived digitally according to your agency's requirements. This means scanning of hand-drawn maps or maps with comment.

This will ensure that there is a continuous record of the incident maps and will assist in the case of a post-incident inquiry.

Shift handover

Handover notes

Your agency will have a protocol for preparing handover notes. The Mapping Team Leader, and perhaps Mapping Team members will need to prepare a set of Handover Notes to give to the person replacing them in the next shift.

Handover Notes should include:

- A list of completed tasks, including:
  - A list of maps (including custom maps) that have been produced;
  - Who they have been given to; and
  - A file path for where they have been saved.
- A list of outstanding tasks, including:
  - Uncompleted tasks with deadlines;
  - Map distribution still to happen; and
  - Information needed for briefings etc.
- Issues – either long or short term.
  If you think the next shift will be impacted by an item (no matter how big or small) then include the information. It is better to have too much information than not enough.
- Other, including:
  - General reminders;
  - Generic on-going notes for future shifts; and
  - Roster updates.

Again, a copy of the Handover Notes should be stored so that they can be traced and referred to at a later date.

Handover briefings

Arriving and departing personnel should register with the Resources Unit at the time of arrival or departure.

Handover briefings are usually conducted in the following way:

- A general group briefing (often provided by the Situation Unit Leader or more senior person) outlining:
  - Incident objectives;
  - Incident control strategies;
  - Safety issues associated with controlling the incident;
  - Section structure and reporting relationships; and
  - Unit priorities and tasks.
- A more specific one-on-one briefing given by each outgoing Mapping Team member to the incoming Mapping Team member covering:
  - Exchange of Handover Notes and Incident Log;
  - The work required to be done by the incoming shift;
  - Key outstanding tasks and timelines;
  - Filing system used for both electronic and hard copy data. Files may need to be by shift and data type e.g. map files and document files. If Management Support personnel are used to assist in filing then this should be mentioned;
  - Equipment maintenance requirement e.g. printer/copier cleaning, ink cartridge replacement, paper stocks etc.;
  - Alternative power supplies; and
  - Key issue and/or solutions.

  The one-on-one discussion should allow for the incoming Team Member to ask questions and obtain clarification on issues.

After Action Review

At the end of the shift the Team Leaders should conduct an After Action Review (AAR) that lasts no more than 15 minutes with their unit personnel.

The AAR is the primary tool for incorporating the action's or day's events into the learning cycle. By identifying and addressing the issues as soon as possible after an event, they should be dealt with while the details are still fresh in everyone's minds.

Your agency may have a specific process that they wish to be followed in an AAR. If not, you could ask the team the following questions:

- What was planned? What were the goals and objectives?
- What really happened? Discover the events of the day through the team members' eyes. Collectively, the team probably knows what happened, but each individual may not.
- Why did it happen? Find the root causes behind identified performance successes and failures. It is important to remember, the AAR focuses on the WHAT not WHO.
- What can we do better next time? Once you have identified the root causes, develop remedies that concentrate on improvement strategies.

End on a positive note.

The following are a few key points for AAR facilitators

- Explain the process and establish the rules for the behaviour of participants – about outcomes, “what” not “who”, allow people their opportunity to speak, no interruptions, etc.
- Where appropriate, introduce all personnel present indicating the role they played during the incident.
- Provide a summary of what happened in the lead up to and during the incident. This should include an assessment of what was achieved.
- Participants should be given the opportunity to clarify any points or correct factual errors.
- Make sure everyone participates, as everyone can and should speak up if they have an observation, insight, or question that may help identify improvements.
- The AAR process focuses on WHAT happened, not WHO did what. For example:
  - Who: Brian didn’t put the paper in the printer?
  - What: The paper wasn’t replaced in the printer and so time was lost and the maps were late as a result.
- Reinforce it is OK to disagree. Differing points of view and conflicts need to be addressed and no-one, regardless of rank or position, has all the answers. Disagreement is not disrespect if done tactfully. However don’t allow this to bog down the process unnecessarily.
- Tact and civility are required. If a participant still has comments or issues that are inappropriate for the group AAR, then a one-on-one discussion should be conducted. Personal attacks are forbidden.
- Go through the event in a logical sequence. This makes it easier to compare performance against task and intent.
- The facilitator enters the discussion only when necessary: a good AAR has discussions from many individuals.
- End on a positive note. Try to leave the participants motivated for the next operation or event.
- Ask each participant to identify the key issue they will take away from their involvement.
- When closing the debrief resolve who will collate the findings and distribute them to the participants.

Summary

- A smooth handover includes:
  - Maintenance of Incident Logs throughout the shift;
  - Confirmation and storage of maps produced during the current shift;
  - Preparation of Handover Notes;
  - Printing of maps produced during the shift;
  - Briefing of the incoming shift; and
  - Conducting an After-Action-Review of the outgoing shift’s activities.
- In general, incident logs must include details of significant events including:

  - The time when image data was received;
  - The time when data was archived; and
  - The time and details of requests received.
- Handover Notes should include:
  - A list of completed tasks, including:
    - a list of maps (including custom maps) that have been produced;
    - who they have been given to; and
    - a file path for where they have been saved.
  - A list of outstanding tasks, including:
    - uncompleted tasks with deadlines;
    - map distribution still to happen; and
    - information needed for briefings etc.
  - Issues – either long or short term.
- Handover briefings are usually conducted with:
  - A general group briefing (often provided by the Situation Unit Leader or more senior person); and
  - A one-on-one briefing given by each outgoing Mapping Team member to the incoming Mapping Team member.
- The one-on-one handover briefing covers:
  - Exchange of Handover Notes and Incident Log;
  - The work required to be done by the incoming shift;
  - Key outstanding tasks and timelines;
  - Filing system used for both electronic and hard copy data;
  - Equipment maintenance requirement;
  - Alternative power supplies; and
  - Key issue and/or solutions.
- The After-Action-Review (AAR) could include discussion of:
  - What was planned;
  - What really happened;
  - Why it happened – remembering that the AAR focuses on the WHAT not WHO; and
  - What can be improved for next time.

Self assessment questions

1. Why does there need to be a structured handover between shifts?
2. Identify the activities that must occur for there to be a smooth handover between shifts.
3. Identify the important details that Incident Logs for the Mapping Team should include.
4. What are the usual components of a handover briefing?
5. What information should a one-on-one handover briefing between Mapping Team members include?
6. Identify the process usually followed in an After-Action-Review (AAR).

Section

5

Spatial reference systems

Section

5

Spatial reference systems

This unit explains spatial reference systems. This information is underpinning knowledge for the remainder of the Mapping Team Member training.

Further information can be obtained through the Fundamentals of Mapping http://www.icsm.gov.au/mapping/index.html and Geodetic Datums http://www.ga.gov.au/earth-monitoring/geodesy/geodetic-datums.html

Geo-referencing

All the elements on a map have a specific geographic location on or near the earth's surface.

'Geo-referencing' is accurately describing a geographic location. This is a critical skill for both mapping and GIS.

Figure 3:- Geo-referencing (ESRI)

Datum

Datum is a set of reference points on the earth's surface against which position measurements are made.

Horizontal datum is used to describe a point on the earth's surface. Vertical datum is used to measure elevations or depths.

The Geocentric Datum of Australia, 1994 (GDA94) has been adopted for use throughout Australia. GDA94 datum replaces the AGD66 and AGD84 datum throughout Australia.

A datum often has an associated model of the shape of the earth to define a coordinate system.

Coordinate systems

There are two main types of coordinate systems:

- Geographic coordinates(for example, latitude and longitude – usually expressed in degrees or decimals)
- Projected coordinates (for example, a grid that represents the earth on a flat surface such as a page - usually expressed in metres).

The projected coordinate systems associated with GDA94 are:

- Map Grid of Australia 1994 (MGA94) is the standard projection for large scale maps; and
- Lambert (VG94) or Albers is the standard projection for small scale maps.

World Geodetic System 1984 (WGS84) is a worldwide reference system used by GPS. It is very similar to GDA94 (but not the same). This explains why GPS data may need to be converted to GDA94 prior to being able to be used in a GIS.

Data from different sources may need to be converted to the one datum and coordinate system in order for it to be merged within a GIS.

Geographic coordinate systems - latitude and longitude

One example of a geographic coordinate system is latitude and longitude.

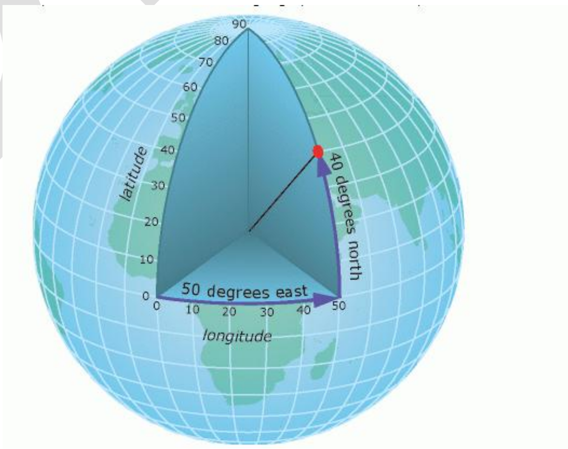


Figure 4: Latitude and longitude (ESRI)

Latitude angles are measured in a north-south direction. The equator is at an angle of 0°. The northern hemisphere has positive measures of latitude and the southern hemisphere has negative measures of latitude.

Longitude measures angles in an east-west direction. Longitude measures are traditionally based on the Prime Meridian, which is an imaginary line running from the North Pole through Greenwich, England to the South Pole. This angle is Longitude 0°. West of the Prime Meridian has negative Longitude and east has positive Longitude.

The closer you get to the Poles (i.e. the larger the latitude value), the distance between meridians gets closer and closer. This means that one degree of longitude actually represents a smaller distance the closer to the Poles you are. For example, at the latitude of Darwin (about 12°S), one degree of longitude is about 106km, but at Hobart (about 43°S), one degree of longitude is only 79km.

To precisely locate points on the earth's surface, degrees longitude and latitude have been divided into minutes (') and seconds ("). There are 60 minutes in each degree. For example, Canberra is approximately -35° 18' Latitude, 149° 08' Longitude.

Projected coordinate systems

Since the earth is spherical, a challenge is how to represent the real world using a flat or planar coordinate system. The process of flattening the earth is called projection, hence the term map projection.

Projected coordinate systems are any coordinate systems designed for a flat surface, such as a printed map or a computer screen. There is an infinite number of possible map projections.

All map projections representing the earth's surface as a flat map create distortions in some aspect of distance, area, shape or direction. Users cope with these limitations by using map projections that fit their intended uses, geographic location and extent.

GIS software can transform between coordinate systems.

Conical projection

This is mainly used for small scale maps of the whole state, across several zones.

This projection is based on the concept of the 'piece of paper' being rolled into a cone shape and touching the Earth on a circular line. Most commonly, the tip of the cone is positioned over a Pole and the line where the cone touches the earth is a line of latitude; but this is not essential. The line of latitude where the cone touches the Earth is called a Standard Parallel.

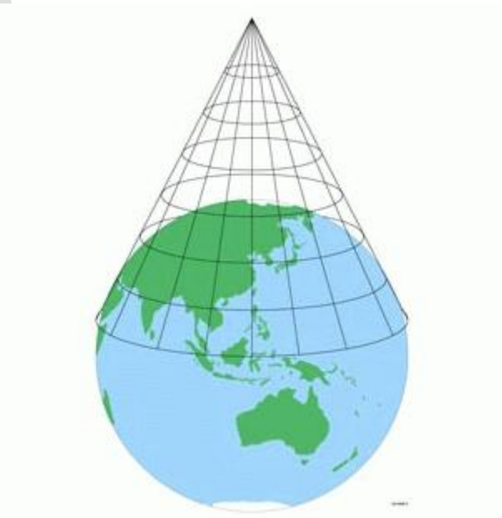


Figure 5: Conical projection (ICSM)

Examples of conical projections are:

Albers projection is a conic, equal area map projection that uses two standard parallels. A conic projection distorts scale and distance except along standard parallels. Areas are proportional and directions are true in limited areas.

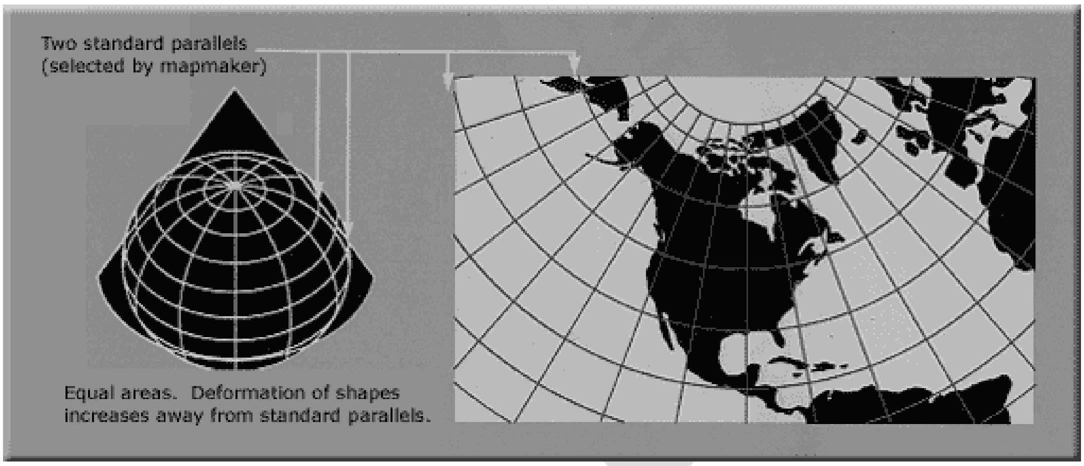


Figure 6: Albers Equal Area (USGS)

Lamberts Conformal Conic projection is similar to the Albers conic equal area projection except that Lambert conformal conic portrays shape more accurately than area.

Area and shape are distorted away from standard parallels. Directions are true in limited areas.

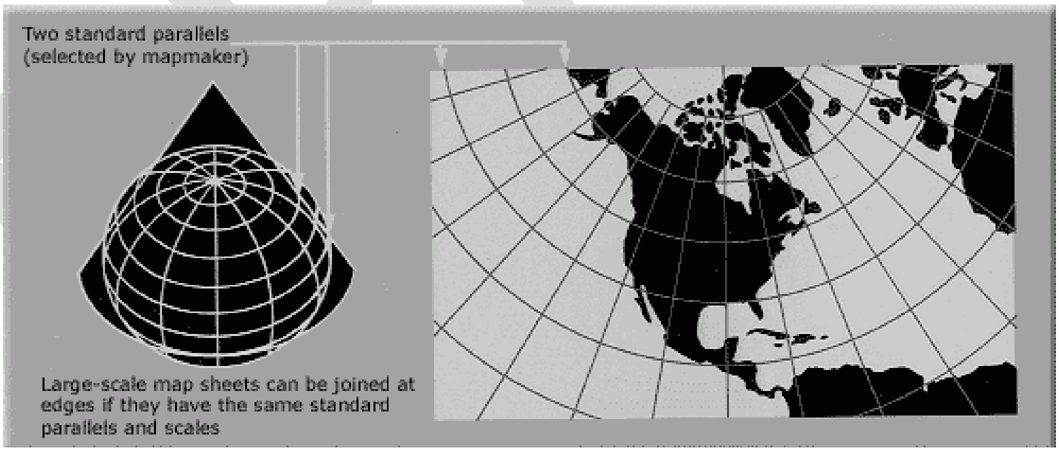


Figure 7: Lamberts Conformal Conic (USGS)

NSW uses Lamberts Conformal Conic projection with a standard parallel at 147 degrees.

Lambert (VG94) or Albers is the standard for small scale maps.

Cylindrical

This is mainly used for large scale maps wholly within a zone.

This projection is based on the concept of the 'piece of paper' being rolled into a cylinder and touching the Earth on a circular line. The cylinder is usually positioned over the Equator, but this is not essential.

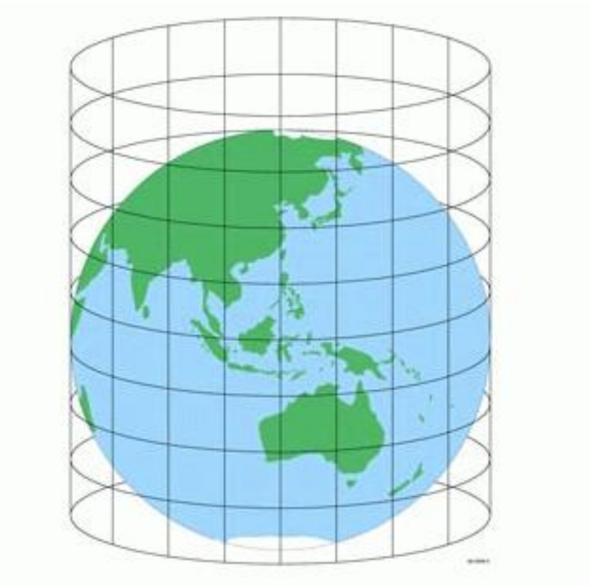


Figure 8: Cylindrical projection (ICSM)

This simple cylindrical projection is unsuitable for many mapping purposes as land mass shapes become greatly distorted quite quickly when moving away from the Equator

Universal Transverse Mercator (UTM)

To overcome this problem, the transverse form of this projection is used, where the cylinder is tangential along a meridian of longitude, creating a series of tangential (or central) Meridians rather than parallels of latitude in defined Zones around the Earth's circumference. This then leads to sixty zones each of 6 degrees in longitude for the Universal Transverse Mercator system.

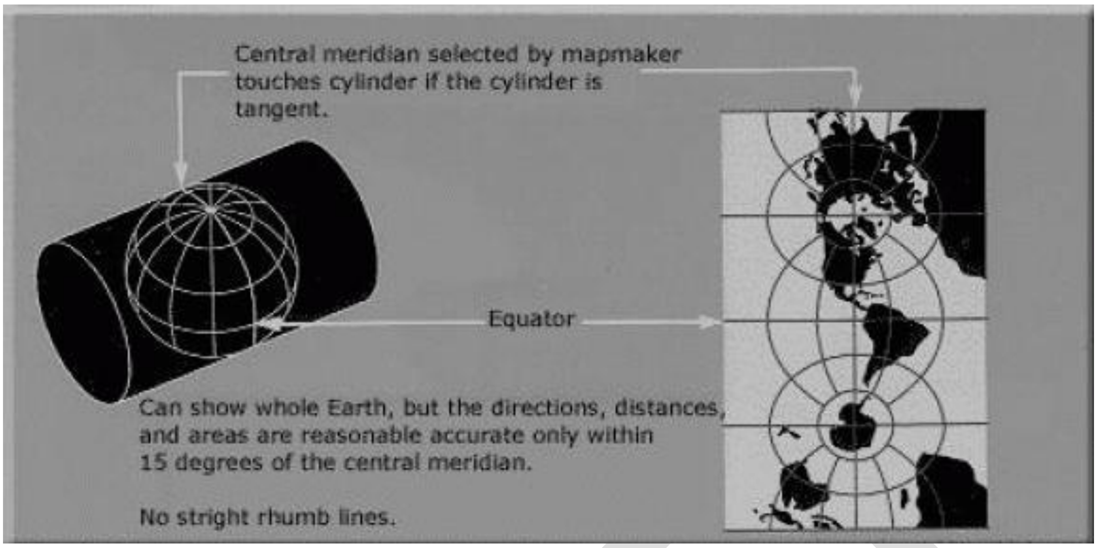


Figure 9: Universe Transverse Mercator (USGS)

Scale

Map scale is the mathematical relationship between the size of the map and the size of the piece of earth it is describing.

All maps have a scale, which may be simple (for single scale maps) or complex (for multi-scale maps). Modern maps have the advantage of using advanced earth measuring techniques and map projections, which results in more accurate mapping, with a reliably consistent scale applied across the face of the map.

This is based on a 'flat earth concept' – i.e. that there are no hills or valleys. As such it is a horizontal scale which makes no allowance for slope.

Methods of expressing scale

Representative fraction (RF)

This method expresses the distance on the map as a fraction of the corresponding distance on the ground. If the scale is 1:100,000, every distance on the map is 1/100,000 of the distance on the ground, e.g. 1 cm on the map represents 100,000 cm (or 1 km) on the ground.

Common scales for topographic maps are 1:250,000, 1:100,000, 1:50,000 and 1:25,000. A large-scale map shows more detail than a small-scale map. A 1:25 000 map is a larger scale map than a 1:100,000 map, because 1/25,000 is a larger fraction than 1/100 000.

Linear scale (or scale bar)

A linear scale is drawn to assist in the measurement of distance, and on modern maps shows distances in kilometres and metres. Scale bars are created with logical units of measure e.g. 0.5 km, 1km, 2km, 5km, 10km etc to provide a product which is logical to use to measure distance.

Effect of scale

As the scale of a map changes from a smaller number to a larger number (e.g. from 1:100 to 1:100,000) the area of the Earth's surface which can be shown increases, but the amount of detail which can be shown decreases.

Smaller scale maps have less detail and cover a bigger area. Larger scale maps have more detail and cover less area.

There is no rule as to which scales are described as small, medium or large – it all depends on your point of view.

The scale of a map, together with the size of the page, determines how much information can be shown on it. When selecting a map scale for an emergency response situation, the two main points to consider are the:

- Amount of detail required to support response activities;
- Size of the area involved in an incident; and
- Available page size.

Topographic mapping series are designed to be used at a specific scale for legibility e.g. 1:50,000. It is important that the Mapping Team use topographic maps at the relevant designed scales.

Figures 10 and 1 show an example of how the amount of detail changes with the changing scale.

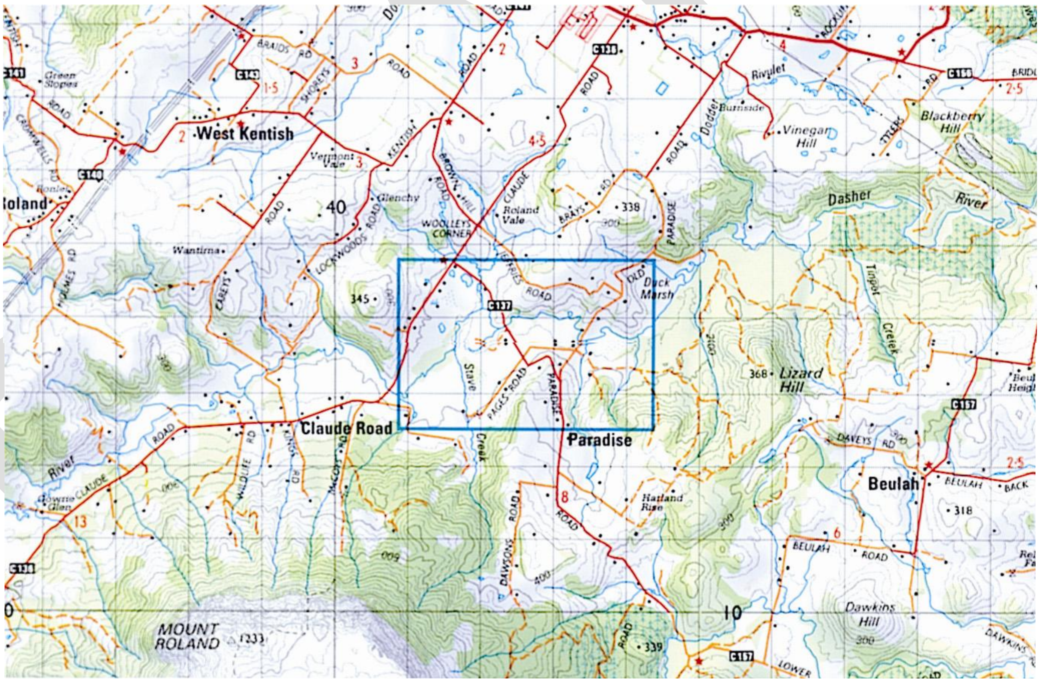


Figure 10: Effect of scale at 1:100 000

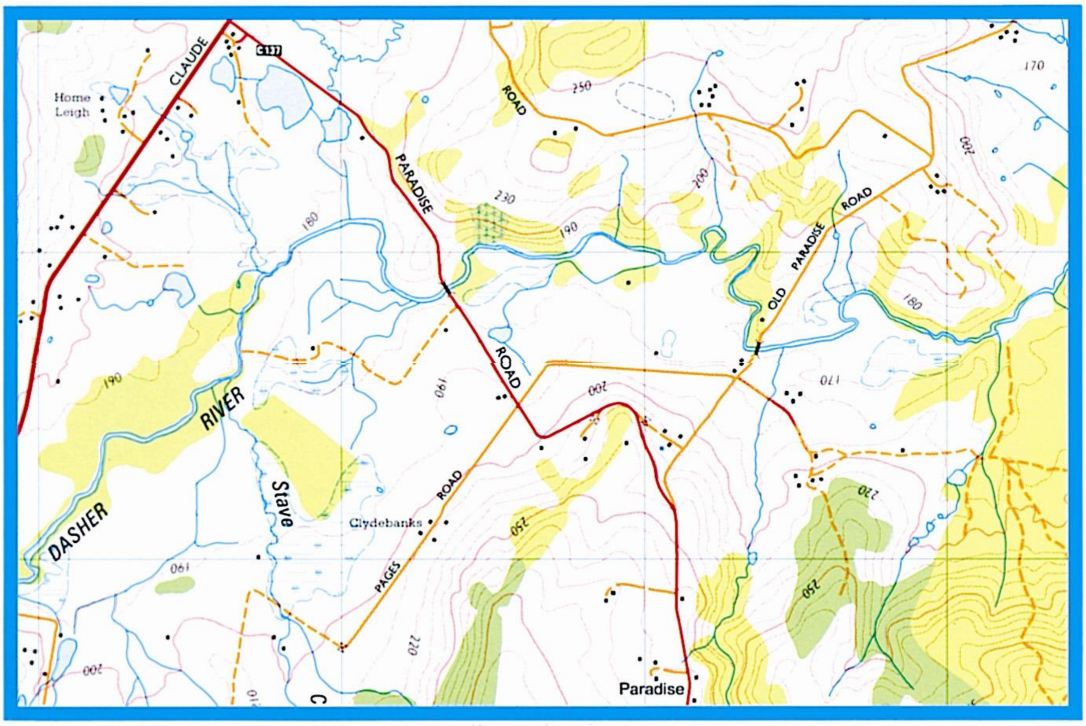


Figure 11: Effects of scale at 1:25 000

Use of a scale bar or linear scale is the easiest way to measure ground distance.

Summary

- Datum is a set of reference points on the earth's surface against which position measurements are made.
- Horizontal datum is used to describe a point on the earth's surface. Vertical datum is used to measure elevations or depths
- The Geocentric Datum of Australia, 1994 (GDA94) has been adopted for use throughout Australia. GDA94 datum replaces the AGD66 and AGD84 datum throughout Australia.
- A datum often has an associated model of the shape of the earth to define a coordinate system.
- There are two main types of coordinate systems:
  - Geographic coordinates(for example, latitude and longitude – usually expressed in degrees or decimals)
  - Projected coordinates (for example, a grid that represents the earth on a flat surface such as a page - usually expressed in metres).
- The projected coordinate systems associated with GDA94 are:
  - Map Grid of Australia 1994 (MGA94), which is the standard for large scale maps; and
  - Lambert (VG94) or Albers, which is the standard for small scale maps.
- World Geodetic System 1984 (WGS84) is a worldwide reference system used by GPS. It is very similar to GDA94 (but not the same). This explains why GPS data may need to be converted to GDA94 prior to being able to be used in a GIS.
- Data from different sources may need to be converted to the one datum and projection system in order for it to be merged within a GIS.

Self assessment questions

1. What is a datum?
2. Identify the two main types of coordinate system.
3. Which datum and map projection has been accepted Australia-wide?
4. Which datum is used by GPS?
5. Why do you often need to convert data from one datum and projection to another in a GIS?

Section

6

Collecting spatial data

Section

6

Collecting spatial data

This topic provides underpinning knowledge relating to the collection and storage of spatial data for use in emergency management. Practical instruction and exercises regarding the collection of basic spatial data will be provided by your agency.

The topic covers, at a basic level:

- Spatial and non-spatial data;
- Vector and raster data formats;
- Metadata; and
- Data collection.

The topic does not cover the collection of information in the field that, during emergencies, is normally undertaken by Ground or Air Observers or through reports received from operational personnel.

Spatial data

During emergencies, information about the current incident and its effects is collected and represented in a range of maps for use by incident managers (refer to Section on Mapping Products for more detail about these).

The incident information collected will often have a strong geographic component – in other words, it is tied to a 'place'.

'Features' are natural and manmade features such as cities, rivers, roads, states, vegetation, mountain ranges etc that can be shown on a map. This is 'spatial' or geographic data.

An ‘attribute’ is information about the feature, for example the depth of the lake or height of the mountain. This is ‘non-spatial’ or ‘aspatial’ data.

Maps comprise layers of this data as shown in the following diagram.

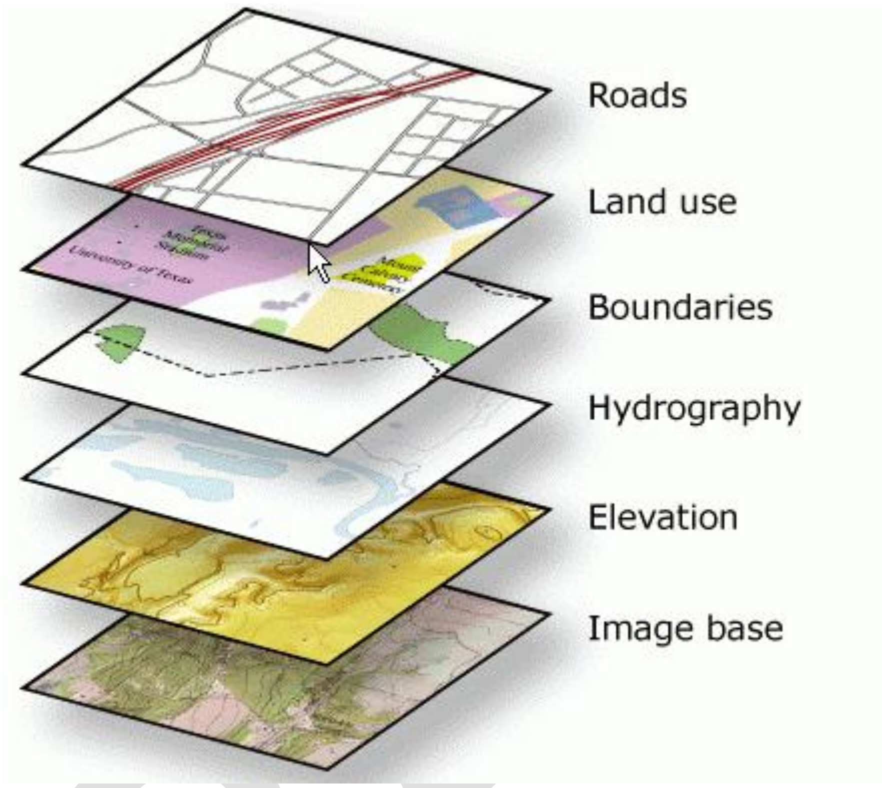


Figure 12 Map layers (ESRI)

Vector and raster data

There are two types of spatial data – vector data and raster data.

Vector data

Vector data is data that represents geographical features on maps through different shapes (points, lines or polygons) on maps as follows:

- Points – these represent small features or locations such as address locations, GPS coordinates, or mountain peaks.
- Lines – these represent the shape and location of geographic objects too narrow to depict as areas (such as streams). Lines also represent features that have length but no area such as contour lines and administrative boundaries.
- Polygons – these are enclosed areas that represent the shape and location of homogeneous features such as states, local government areas, parcels, soil types, and land-use zones. Fire or flood perimeters can be represented as polygons.

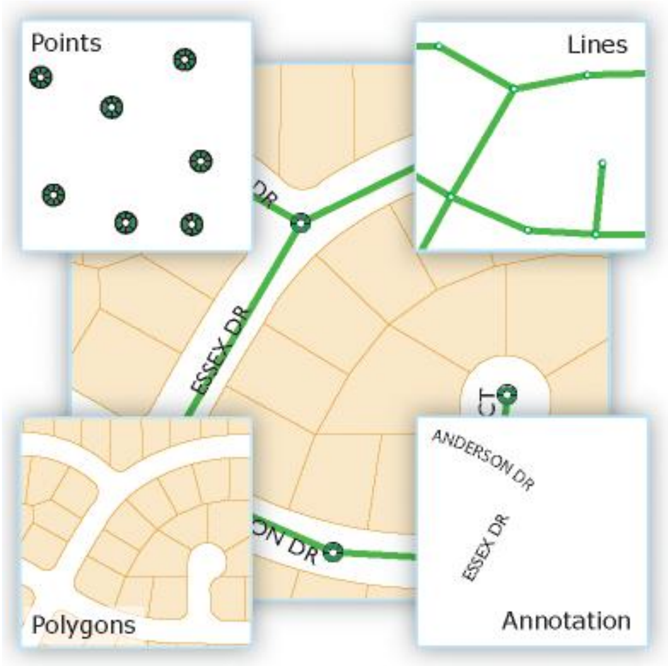


Figure 12: Source – Wiki GIS.

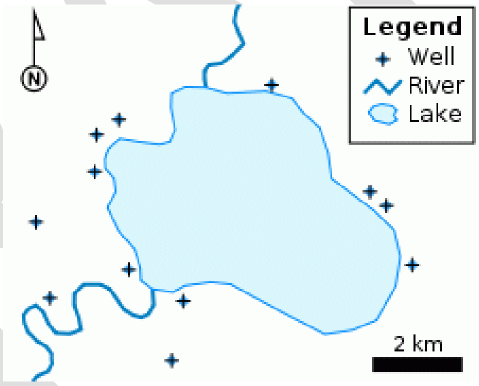


Figure 13: A simple vector map showing points for wells, lines for rivers, and a polygon for the lake (Wikimedia Commons)

'Topology' is a set of rules about how these points, lines and polygons relate to each other. For example, adjacent features such as two countries, will share a common edge.

Vector data may be stored in a relational database management system (RDBMS) which is a collection of two-dimensional tables that store sets of data (see diagram below), or in a file based system, like an ESRI Shape file.

All data inside the GIS is treated as a table.

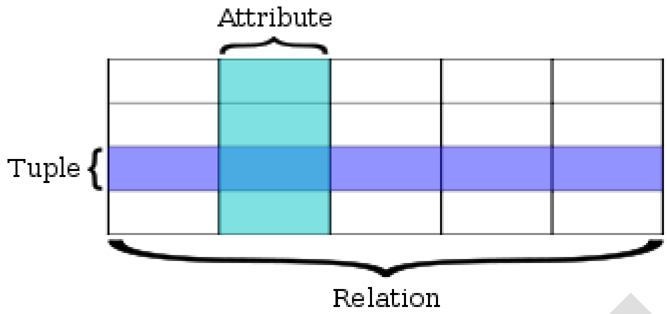


Figure 14: Vector data (source – Wikipedia)

A single record (e.g. spatial data regarding a feature) is stored as a row, also known as a tuple, while attributes of the data (i.e. the non-spatial data) are listed in columns, or fields, in the table.

For example, a database that lists the lake may contain information on the depth of the lake, water quality and pollution level. This information can be used to make a map depict a particular attribute of the dataset. For example, lakes could be coloured according to the level of pollution.

The characteristics of the data (in the column) relate one record to another. Each column has a unique name and the content within it must be of the same type.

A key is an entity in a table that distinguishes one row of data from another. The key may be a single column, or it may consist of a group of columns that uniquely identifies a record.

Tables can be queried to answer questions about the data (feature and attribute queries). For example, how many wells are within one kilometre of the lake? Each GIS storage system approaches the process of solving a query slightly differently but the fundamental concepts are the same.

In an ESRI based system, each layer of vector data is transferred using a Shape file. Shape files spatially describe geometries: points, lines, and polygons. These, for example, could represent water wells, rivers, and lakes, respectively. Each item may also have attributes that describe the items, such as the name or temperature.

Raster data

Raster data (also known as grid data) is used to represent surfaces and consists of rows and columns of cells, with each cell storing a single value. Raster data can also be images (raster images) with each pixel (or cell) containing a colour value.

1	1	1	1	1	1	1	3	3	3
1	1	1	1	1	1	1	3	3	3
1	1	1	1	1	1	3	3	3	3
1	1	1	2	2	2	2	3	3	3
1	1	1	2	2	2	2	3	3	3
1	1	1	2	2	2	2	3	3	3
1	1	1	1	2	2	2	3	3	3
1	1	1	1	1	1	3	3	3	3
1	1	1	1	1	1	1	3	3	3
1	1	1	1	1	1	1	1	3	3

Figure 15 Raster data

Raster data is viewable via a monitor, paper, or other display medium. Raster images are stored in image files with varying formats (see next chapter).

A bitmap or pixmap is pixel data storage structure used by the majority of raster graphics file formats. Pixel data can also include data about the attributes of the feature and 'feature and attribute queries' can be made regarding this data.

Raster graphics are resolution dependent - they cannot be made larger without loss of quality. This is in contrast with vector graphics, which can easily be made larger.

Raster data is stored in various formats including TIFF, ECW and JPEG formats when stored as an image.

Metadata

A metadata record is information regarding the basic characteristics of the data.

Examples of metadata are:

- How the data was created;
- Purpose of the data;
- Time and date of creation;
- Creator or author of data;
- When the data was placed on the computer; and
- Standards used.

For example, a digital image may include metadata that describes how large the picture is, the colour depth, the image resolution, when the image was created, and other data.

Metadata can be divided into 3 categories:

- **Administrative metadata,** which is established by the owner of the data for their own administrative purposes. Your agency will have a format for metadata for spatial datasets and this should conform to the Australian standards for geospatial datasets (see below).
- **Structural metadata,** which is used to describe the structure of computer systems, for example:
  - All Microsoft documents contain metadata about the author, time of production etc.;
  - Digital image files contain their own metadata through tagging - the process of automatically adding metadata to various media such as photographs, video, websites, or RSS feeds; and
  - Each relational database system has its own internal metadata system (identifying tables, columns etc).
- **Descriptive metadata**, which is expressed as words in a language. Descriptive metadata helps humans find things.

There is an Australian standard for the metadata describing geospatial datasets (AS/NZS ISO 19115). It is based on the International Metadata Standard ISO 19115.

The current 'standard' used by Australian Government agencies is the ANZLIC Metadata Profile (version 1.1; August 2007). This is managed by ANZLIC — the Spatial Information Council, the peak intergovernmental organisation providing leadership in the collection, management and use of spatial information in Australia and New Zealand. This profile is an implementation profile based upon the standards AS/NZS ISO 18115 and ISO/TS 19139. There are metadata entry tools available.

See http://www.osdm.gov.au/Metadata/ANZLIC+Metadata+Profile/default.aspx

Collection of spatial data

The Situation Unit is responsible for the collection of data relating to an incident.

The Situation Unit will require the Mapping Team to convert the data into products within a particular timeframe so may consult with the Mapping Team regarding the data to be collected.

The key risk is that the data will not be collected and processed in time for it to be useful.

The Situation Unit will need to plan ahead to ensure the correct data is collected e.g:

- The data must be collected from the correct place;
- The data must provide information that is useful;
- The data must be in a format that is able to be used; and
- The data must arrive in time to be downloaded, processed and converted into information products which are still current and useful at the time of their release.

As such, the Situation Unit will need to prepare a data collection plan that takes into account:

- Who will be collecting the data;
- The method to be used to collect the data (i.e. so the required information is collected);
- Any limitations of the data collection method (e.g. the limitations of the technology used);
- The time required for travel to and from the incident scene;
- The time required to collect the data;
- Allowance for other things the person collecting the data will need to do on return from data collection (drinks, attend other debriefs etc) prior to downloading;
- The time required to download the data and convert it into the correct format (if required);
- The time it will take to produce the information product; and
- The time the information product is required.

The time all adds up – so some pre-planning is required!

Spatial (and non-spatial) data can be collected using several techniques, primarily:

- Updates from Operations personnel;
- Information provided by Ground or Air Observers;
- Images sourced from remote sensing; and
- Information from other sources e.g. the Bureau of Meteorology, asset and infrastructure information.

Updates from the Operations Section

An Incident Control Centre usually displays an Incident Overview Map on a wall. This map usually displays the whole incident.

When the Operations Officer and Division/Sector Commanders return from the incident scene they usually update this map with hand-drawn additions. Updates from other sources can also be added.

The map is a 'running' record of the incident development and the information can later be digitized by the Mapping Team.

Increasingly emergency management agencies are eliminating the need for manual updates on the Incident Overview Map – and moving to technologies where data can be loaded digitally and directly into the GIS database.

Ground and Air Observers

The Situation Unit is responsible for identifying the need for, establishing and tasking Ground and Air Observers.

These can use a variety of data collection methods including:

- Marked-up street atlas or topographic map;
- Global Position System (GPS);
- Coordinate Geometry (COGO) (used in some states) ;
- Imagery (e.g. photography or remote sensory data);
- Video; and
- Manual data collection.

Your agency can confirm the key methods it uses to collect spatial data during emergencies

There can be serious occupational health and safety risks involved in sending people onto the incident ground. Before Ground Observers are mobilized:

- The Operations Officer should agree to and acknowledge their presence at the incident scene;
- Appropriate safety procedures should be put in place (agency and incident specific); and
- A method should be established for keeping track of the location of these personnel at all times.

On their return, the Ground and Air Observers should report back to the Situation Unit and the Mapping Team and transfer the data as arranged.

Data collected through aerial reconnaissance may also be able to be conveyed back to the Situation Unit by:

- Email transmission via the mobile phone network (e.g. shapefiles can be distributed by phone);
- Verbal radio transmission of grid references;
- Landing at a nearby aerodrome and handing the images to a person who will then transport the files back to the Incident Control Centre; or
- Dropping prints or computer disks at a pre-arranged location.

Remote sensing

Remotely sensed data plays an important role in data collection and is collected by sensors attached to a platform. Sensors include cameras, digital scanners and LIDAR (a narrow laser beam which can be used to map physical features with very high resolution), while platforms usually consist of aircraft and satellites.

Satellite data of the entire Australian continent is available via the sensors known as MODIS on Terra (morning pass) and Aqua (afternoon pass). The MODIS Land Rapid Response system has been developed to provide rapid access to MODIS data globally.

http://rapidfire.sci.gsfc.nasa.gov/

Data from other agencies

Your agency may have an arrangement for datasets to be obtained from agencies such as the Bureau of Meteorology and infrastructure agencies. For example, information on critical infrastructure and key assets requiring protection may be obtained from telecommunications and utility companies.

Summary

- Geographic data is 'spatial' data.
- 'Features' are natural and manmade features such as cities, rivers, roads, states, vegetation, mountain ranges etc that can be shown on a map.
- An 'attribute' is information about the feature, for example the depth of the lake or height of the mountain. This is 'non-spatial' or 'aspatial' data.
- Maps comprise layers of spatial data.
- There are two types of spatial data – vector data and raster data.
- Vector data is data that represents geographical features on maps through different shapes (points, lines or polygons).
- Vector data may be stored in a relational database management system (RDBMS) which is a collection of two-dimensional tables that store sets of data (see diagram below), or in a file based system, like an ESRI Shape file. However, from inside the GIS, the data is still treated the same, i.e. as a table.
- Raster data (also known as grid data) is used to represent surfaces and consists of rows and columns of cells, with each cell storing a single value.
- Raster data can also be images (raster images) with each pixel (or cell) containing a colour value.
- A metadata record is information regarding the basic characteristics of the data.
- There is an Australian standard for the metadata describing geospatial datasets (AS/NZS ISO 19115). It is based on the International Metadata Standard ISO 19115.
- The collection of incident data is the responsibility of the Situation Unit.
- Spatial (and non-spatial) data can be collected using several techniques, primarily:
  - Updates from Operations personnel;
  - Information provided by Ground or Air Observers; and
  - Images sourced from remote sensing.
- Ground and Air Observers can use a variety of data collection methods including:
  - Marked-up topographic map or street directory;
  - Global Position System (GPS);
  - Coordinate Geometry (COGO) (used in some states) ;
  - Imagery;
  - Video; and
  - Manual data collection.
- Remotely sensed data is collected by sensors attached to a platform. Sensors include cameras, digital scanners and LIDAR (a narrow laser beam which can be used to map physical features with very high resolution), while platforms usually consist of aircraft and satellites.

Self assessment questions

1. What is ‘spatial’ data?
2. What are ‘features’ and ‘attributes’?
3. How does spatial data relate to maps?
4. What are the two types of spatial data?
5. Explain vector data (in simple language).
6. How is vector data stored?
7. Explain raster data in simple language.
8. What is ‘metadata’?
9. Identify a range of techniques used to collect spatial data.

Section

7

Geographic Information Systems

Section

7

Geographic Information Systems

This topic covers underpinning knowledge relating to Geographic Information Systems (GIS).

- The principles of a GIS;
- Geo-processing;
- Querying data; and
- Problem solving.

There are many different GIS in use by emergency management agencies in Australia and New Zealand. You agency will have its own system and you will need to learn how to operate that system.

However, regardless of the system being used by your agency, there is a generic body of information common to all GIS.

Overview of GIS

GIS is a computer-based data collection, storage, analysis and presentation tool that combines individual layers of spatially referenced information into easily understood maps.

GIS can perform complicated analytical functions and then present the results visually as maps, tables or graphs, allowing decision-makers to virtually see the issues before them and then select the best course of action.

GIS uses layers to overlay different types of information. Each layer represents a category of feature, such as roads or forest cover.

A GIS makes it possible to link, or integrate, information that is difficult to associate through any other means, as shown in the following diagram.

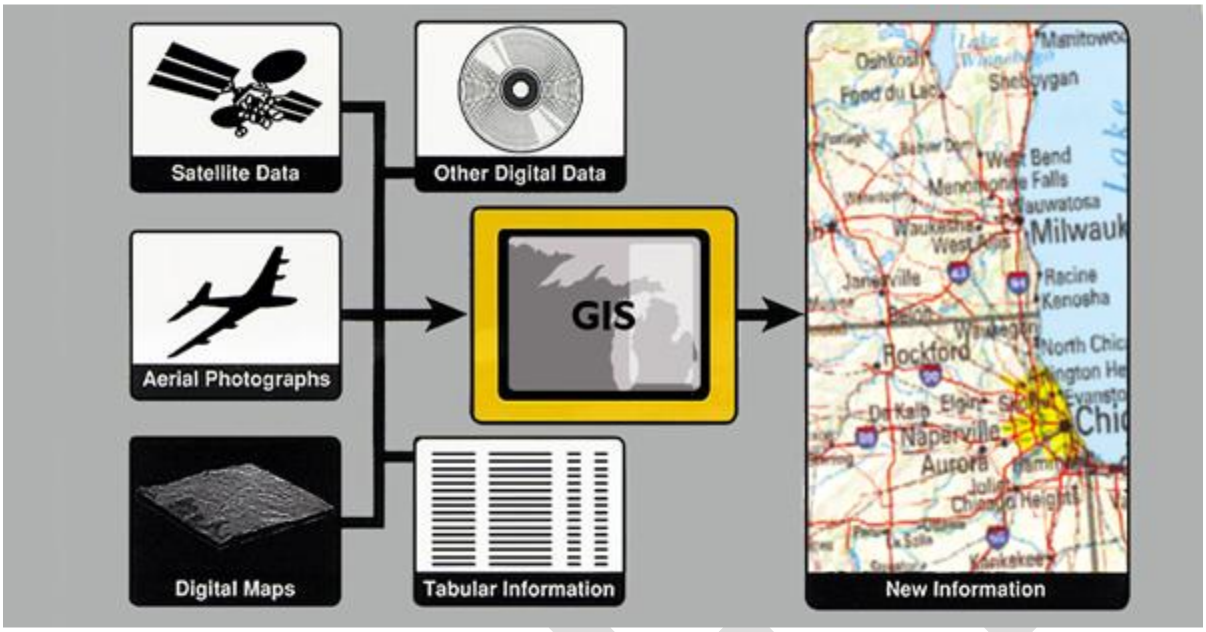


Figure 16: Context of GIS

Map information in a GIS must be manipulated so that it registers, or fits, with information gathered from other maps.

Before the digital data can be analysed, it may have to undergo other manipulations – conversion to a standard datum and set of projection coordinates, for example.

Geo-processing

Geo-processing is a GIS operation for manipulating spatial data.

A typical geo-processing operation takes an input dataset, performs an operation on that dataset, and returns the result of the operation as an output dataset, as per the following diagram.

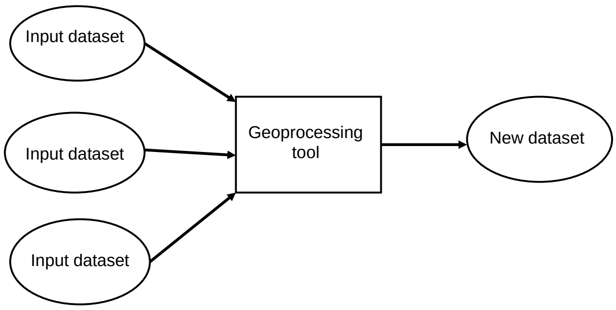


Figure 17: Context of geo-processing

Common GIS analysis functions that are geo-processed include:

Buffer

In GIS, a buffer is a zone drawn around any point, line or polygon map feature encompassing all the area within a specified distance of the feature.

Buffers are used to identify places at risk of impact from a specific point, line, or polygon feature.

"Negative buffers" may also be used for polygons to specify a distance inward from the boundaries of the area feature.

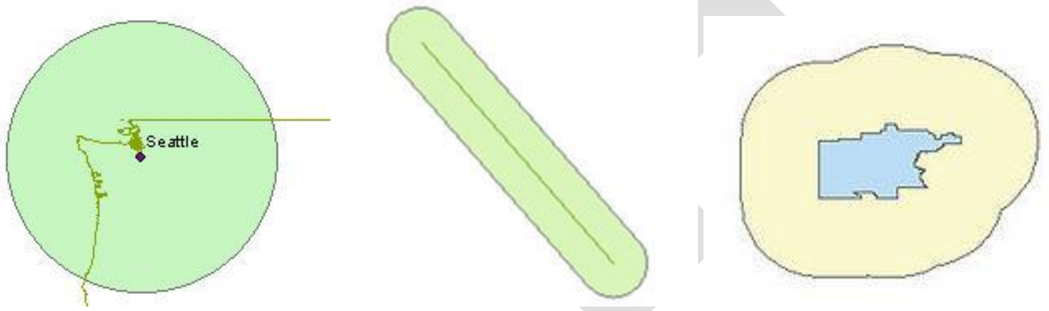


Figure 18: A buffer drawn around a point, line and polygon on a map.

An example of the use of buffers in emergency management could be to identify the area likely to be impacted by a fire or a chemical spill.

A buffer operation can be done using raster or vector data.

Clip

In GIS, to clip is to overlay a polygon on one or more features and extract from the feature/s only the data relating to that feature from within the area outlined by the clip polygon.

Clipping creates a study area or specific area of interest.

This becomes advantageous when an analyst only needs to work with a certain focus area; he/she can discard the unnecessary spatial information with no loss to his/her core data.

A clip operation can be done using raster or vector data.

An example of using the clip tool would be analyzing traffic patterns at a college campus. An analyst does not need road data outside of the college campus, so he/she may clip the road data to the college campus boundary.

Dissolve

In GIS, **dissolve** is an aggregation process in which a new map feature is created by merging adjacent polygons, lines, or regions that have a common value for a specified attribute.

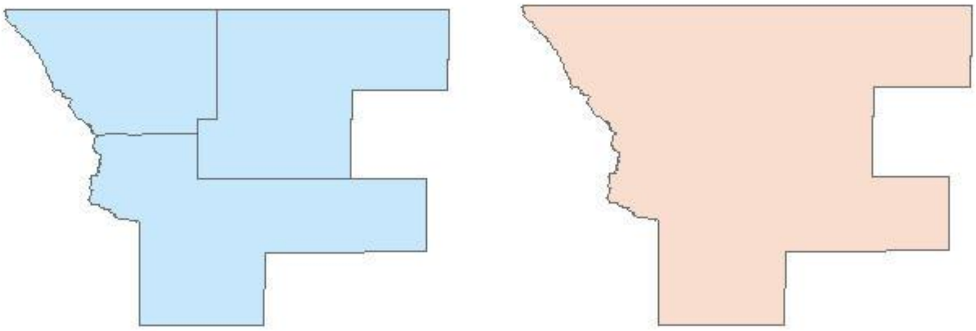


Figure 19: Polygons before and after the dissolve operation.

Intersect

In GIS, intersect is where the GIS computes the intersection of more than one input feature (i.e. map layers). The features that are common to all map layers become the intersect output.

Input features can include any combination of point, line, and polygon features.

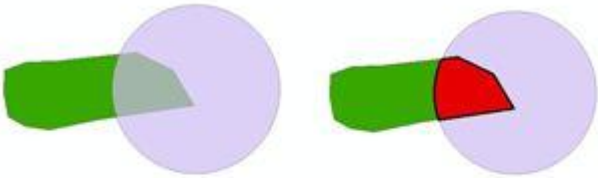


Figure 20: Concept of intersect function

When two polygons intersect, a third polygon is produced that only covers the area where the two polygons overlap.

An example of the use of the intersect tool would be to identify a threatened species likely to be impacted by an emergency.

Merge

In GIS, merge is a process in which input features from multiple input sources (of the same data type) are combined into a single new feature class. The input data sources may be point, line, or polygon feature classes or tables.

Union

In GIS, a union is an analytical process in which the features from two or more map layers are combined into a single, composite layer.

Union can only be used with polygon features as it takes two polygon features and combines both the spatial polygon and the associated attribute data into a single, composite layer.

This allows for analysis of the information from two datasets in the one layer.

Overlay

An overlay creates composite maps by combining different data sets relating to the same map base.

Raster and vector models differ significantly in the way overlay operations are implemented. Overlay is usually more efficient in raster-based systems. However, hybrids of both raster and vector overlays exist.

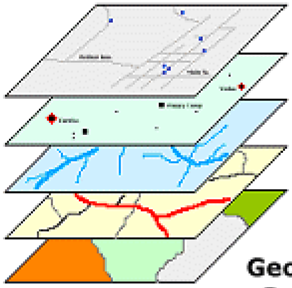


Figure 21: GIS Thematic layers in GIS

Querying data

Many GIS have custom functions to allow the spatial data to be manipulated and queried, for example to find all the residents of an area within an exposure zone for a potential environmental hazard.

Queries are used to create a selection set of to filter data.

SQL (Structured Query Language) is a query language designed for managing data in relational database management systems and retrieves data based on specific criteria.

Almost all modern Relational Database Management Systems like MS SQL Server, Microsoft Access, MSDE, Oracle, DB2, Sybase, MySQL, Postgres and Informix use SQL as standard database language.

The function names for queries differ for different GIS. You will need to find out how to query data on the GIS used by your agency.

Overlay analysis

Overlay analysis is a common method for querying spatial data.

Overlay analysis uses map layers in a GIS to discover relationships across the layers.

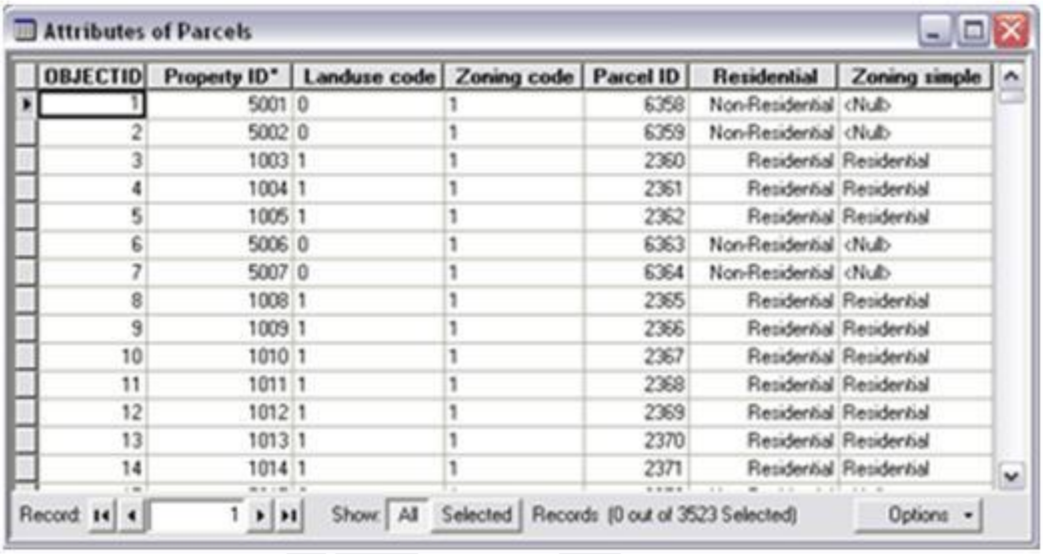
Overlay analysis is used to investigate geographic patterns and to determine locations that meet specific criteria, which is typically defined in queries.

Feature and attribute queries

Particular feature classes can be queried with a ‘Feature Attribute Table’ being produced.

The ‘Feature Attribute Table’ is usually arranged so that each row represents a feature and each column represents one attribute.

A table can be added to a map the same way any other data is added to a map. To explore the attributes of a layer on a map, open its attribute table to select features and find features with particular attributes.



OBJECTID	Property ID*	Landuse code	Zoning code	Parcel ID	Residential	Zoning simple
1	5001	0	1	6358	Non-Residential	<Null>
2	5002	0	1	6359	Non-Residential	<Null>
3	1003	1	1	2360	Residential	Residential
4	1004	1	1	2361	Residential	Residential
5	1005	1	1	2362	Residential	Residential
6	5006	0	1	6363	Non-Residential	<Null>
7	5007	0	1	6364	Non-Residential	<Null>
8	1008	1	1	2365	Residential	Residential
9	1009	1	1	2366	Residential	Residential
10	1010	1	1	2367	Residential	Residential
11	1011	1	1	2368	Residential	Residential
12	1012	1	1	2369	Residential	Residential
13	1013	1	1	2370	Residential	Residential
14	1014	1	1	2371	Residential	Residential

Figure 22: Feature and attribute queries (source – GIS Wiki)

Univariate statistical analysis

Univariate statistical analysis is where a single feature and its attributes are queried and the results are presented in a table, bar chart or a similar form of graphical format.

Problem solving

Data editing

After being entered into a GIS, the data usually requires editing to remove errors.

Vector data must be made "topologically correct" before it can be used for some advanced analysis.

For example, in a road network, lines must connect with nodes at an intersection. Errors such as undershoots and overshoots must also be removed.

For scanned maps, blemishes on the source map may need to be removed from the resulting raster. For example, a fleck of dirt might connect two lines that should not be connected.

Datum and projection conversion

Data from different sources will need to be converted to the one datum and projection in order for it to be merged within a GIS (refer to section on Spatial Reference Systems).

Data coming in from other agencies could be in any coordinate system, and could cause an issue, as the data will simply look like it is not overlaying – or not appearing!

The first step to troubleshooting is to identify the coordinate system of the vector data in question. This is sometimes reasonably easy to spot – as the coordinates will be either in decimal degrees or in metres.

Remember, there are two main types of coordinate systems:

- Geographic coordinates(e.g. latitude and longitude); and
- Projected coordinates (e.g. a grid, usually in metres, which represent the earth on a flat surface such as a page).

With this information at hand, you should decide which vector data file/s should be re-projected to a new coordinate system. The third step is to do the actual conversion.

Summary

- GIS is a computer-based data collection, storage, analysis and presentation tool that combine previously unrelated information into easily understood maps.
- GIS can perform complicated analytical functions and then present the results visually as maps, tables or graphs, allowing decision-makers to virtually see the issues before them and then select the best course of action.
- GIS uses layers to overlay different types of information. Each layer represents a category of feature, such as roads or forest cover.
- Geo-processing is a GIS operation for manipulating spatial data.
- Typical geo-processing analysis functions are:
    - Buffer;
    - Clip;
    - Dissolve;
    - Intersect;
    - Merge; and
    - Union
- Many GIS have custom functions that allow the spatial data to be manipulated and queried. The function names for queries differ for different GIS.
- Map information in a GIS must be manipulated so that it registers, or fits, with information gathered from other maps.
- Before the digital data can be analysed, it may have to undergo other manipulations – e.g. conversion to a standard datum and projection.

Self assessment questions

1. Explain, in simple terms, the function of a GIS.
2. Explain the benefits of using GIS to answer questions with a spatial component.
3. Explain the concept of 'themed' layers in GIS.
4. What is geo-processing?
5. Identify some of the more common geo-processing functions.
6. What are some of the common causes of problems with data in GIS and how can these often be resolved?

Section

8

Interpreting image data

Section

8

Interpreting image data

This topic provides underpinning knowledge on reading and interpreting basic image data for use in emergency management. Practical instruction and exercises in reading and interpreting image data will be provided by your agency.

Image data

Image data can be either digital (satellite images, digital photographs etc) or hard copy (hard copy photographs or maps etc).

The two most common forms of image data for the Mapping function are aerial photography and raster maps.

The size of a raster image file is expressed as the number of bytes. The number of bytes increases with the number of pixels composing an image, and the colour depth of the pixels - the greater the number of rows and columns, the greater the image resolution and the larger the file. Also, each pixel of an image increases in size when its colour depth increases—an 8-bit pixel (1 byte) stores 256 colours, a 24-bit pixel (3 bytes) stores 16 million colours, the latter known as truecolour.

There are two types of image file compression: lossless and lossy.

- Lossless compression reduces file size without losing image quality.
- Lossy compression reduces file size but loses image quality.

The most common form of image file from remote sensing is ECW.

- **ECW** (Enhanced Compression Wavelet) is a proprietary wavelet compression image format optimized for aerial and satellite imagery. The lossy compression format efficiently compresses very large images with fine alternating contrast.

The two most common formats for graphic images are TIFF and JPEG.

- **JPEG** (Joint Photographic Experts Group) (or JFIF) is a compression method. JPEG compression is (in most cases) lossy compression. Nearly every digital camera can save images in the JPEG/JFIF format, which supports 8 bits per colour (red, green, blue) for a 24-bit total, producing relatively small files. JPEG files suffer degradation when repeatedly edited and saved.

  JPEG 2000 is a compression standard using a more advanced compression method compared to the standard JFIF/JPEG format. JPEG 2000 improves quality and compression ratios, but requires more computational power to process.

- **TIFF** (Tagged Image File Format) is a flexible format that normally saves 8 bits or 16 bits per colour (red, green, blue). TIFF image format is not widely supported by web browsers. TIFF remains widely accepted as a photograph file standard in the printing business.

Image interpretation

Image interpretation is the process of examining images and identifying their significance by analysing their location, extent and the features they depict.

Expertise in image interpretation is achieved over the period of time through experience.

Image Interpretation Elements

Image interpretation and analysis uses some pointers or keys to identify features. Some of the keys are - Shape, Size, Colour, Shadow, Texture, Pattern, Association, Site, Time and Resolution.

Shape: A shape of the feature helps in identifying a feature. A round or oval shape feature could be a stadium. A straight line with very few turns could be a railway track. An assimilation of various elements of recognition will help to ascertain/identify the feature. A natural water body is more likely to have irregular shape.

Size: Size of a feature in relation to the nearby feature plays an important role in successful identification of a feature.

Shadow: Shadow of a feature helps in delineating the boundary of the feature. A big object would cast a large shadow as compared to smaller ones. The shadow is also used to measure the height of an object. Shadow can also give you shape. For example, it is very difficult to identify a ferris wheel unless it is off-centre or has a good shadow.

Colour/Tone: Colour or tone of an object is the relative brightness/darkness of an object. A dark blue to black coloured huge feature could be water. If using infra-red (IR) imaging or near infra-red imaging (NIR) and there is a shade of red colour on top of the water body then it could be mangroves. Variation in the tone could be attributed to reflection, remittance, absorption or transmission of the feature.

Texture: Texture is the frequency of the tonal changes of the surface. This element is quite important in case of agriculture and forestry. A group of trees may have a specific texture and that will help to distinguish between a species of tree. A rocky mountain will have a different texture than the mountain with lots of plantation.

Pattern: Spatial arrangement of features in a particular format is pattern. A river will have number of tributaries and on the basis of arrangement of these tributaries you can identify them. A city area with well defined rectangular plots could help you to identify the sectors in the city.

Association: The relationship between different features at the area of interest is the association. A long canal/pipeline along the wide spread area of agricultural fields. If there is a water body with well defined edges then it could be a man made water body, such as a dam.

Site: A site is the presence of a feature at a particular geographical location. A large vessel or lighthouse will be associated with the sea.

Time: A temporal change in a feature over a period of time can provide a lot of information for image interpretation. The volume of water in pond, river etc can be used to analyze the water supply for a city. Temporal images of an agricultural field can be used to determine the health of the crop.

Resolution: Resolution of the image is also a key aspect in image interpretation. Sometimes an image can be seen very clearly or sometimes it's too small in relation to nearby feature.

For example, in a low-resolution image, a city boundary could be delineated but delineation of a building structure could be difficult. In high-resolution imagery identifying a building structure would be easy.

Apart from the above scale, colour balance and condition of the image (prints) can also play a role in image interpretation.

Fire example

The following is an example of the interpretation of a fire image produced by infra-red remote sensing. The image shows the apparent temperature of areas on the ground. Areas of active fire are shown in red.

Sometimes imagery from infra-red sensing can resemble a black and white aerial photograph. At other times, depending on conditions, imagery can be stretched, distorted, murky, washed out or otherwise poor in appearance and consequently difficult to interpret.

Any fire in an image will raise the temperature of that part of the image. Day time images are normally shown as hot-white and night time images as hot-black to get the best image quality. Areas of active fire will normally be shown in red. Navigation information supplied on the image gives the location of the aircraft when the image was taken.

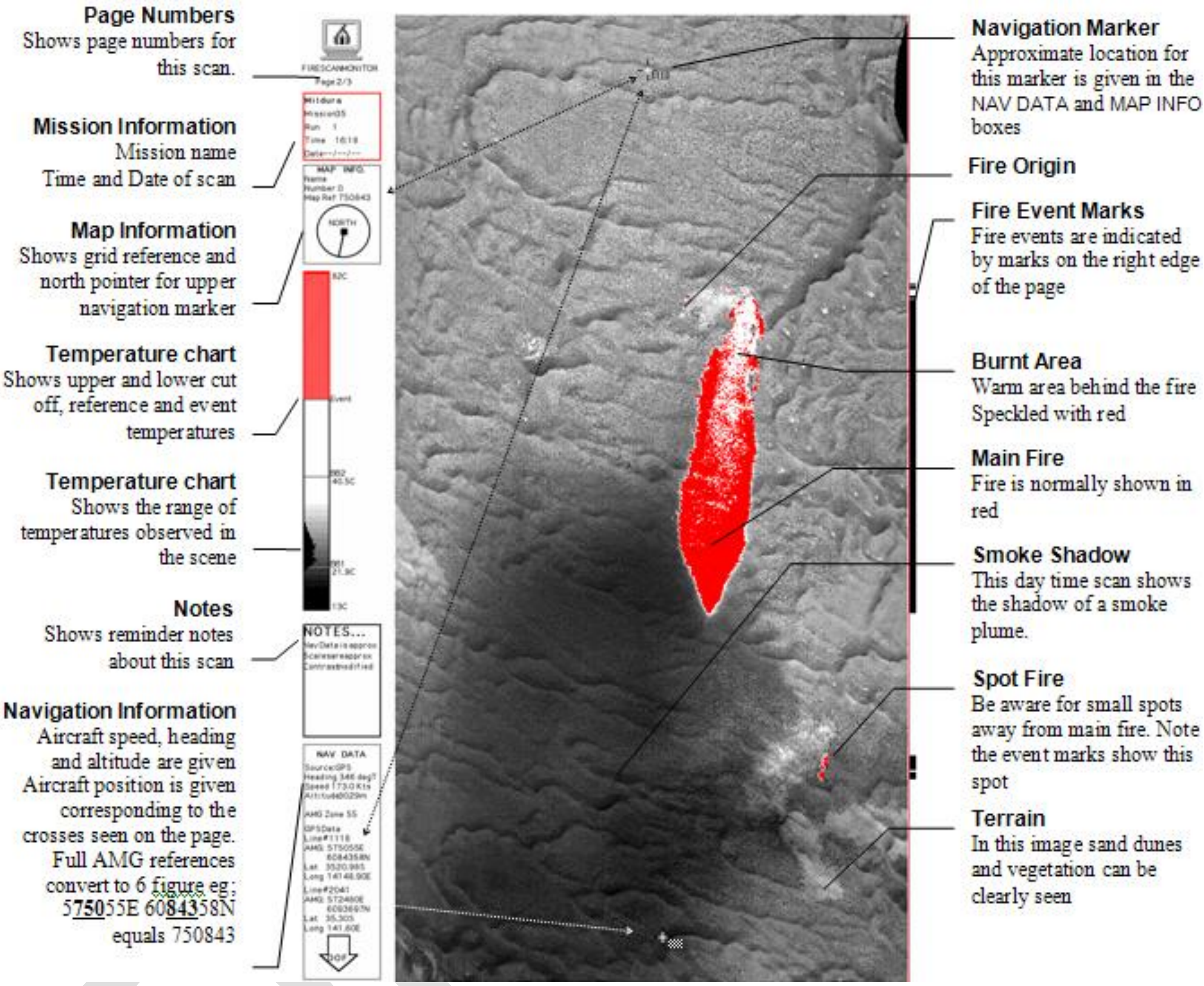


Figure 23: Infra-red image of fire (source DSE Victoria)

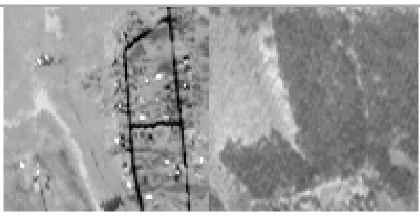
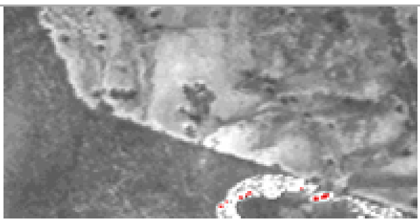
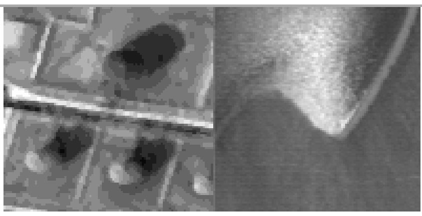
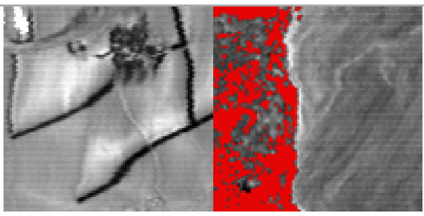
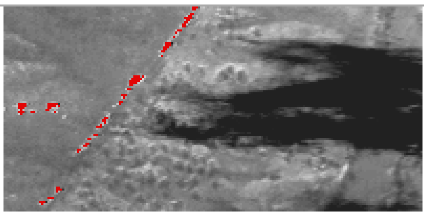
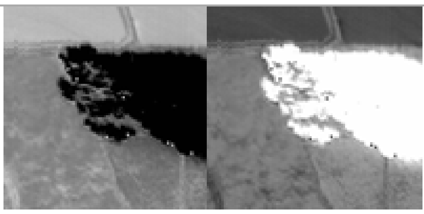
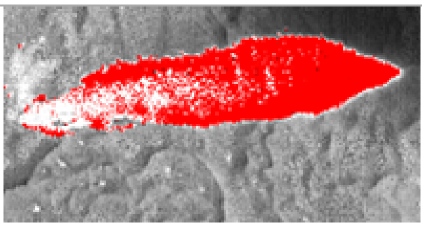
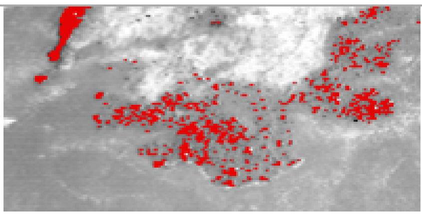
	**Roads, streams, trees and pasture** Streams and roads can be identified in Firescan images as linear features of a different temperature to the surrounding terrain. In general during the day roads will appear hotter than their surrounds. This contrast may last for much of the night as the road gives off its heat gained during the day. In general flowing streams will be cooler than their surrounds during the day and warmer at night. Standing water may be warm or cool.
	**Solar Heating** Areas of open ground and road surfaces will rise in temperature during the day, sometimes to temperatures well in excess of the daily maximum temperature. These solar heated areas can become so warm they may lead to false events and false fire indications. In the image shown fire is visible in lower right corner. A solar heated field can be seen just above fire towards centre of image.
	**Sun shadows & Reflected radiation** The more sun light incident on an object the hotter it will appear. Objects which are in shadow will therefore appear cooler. During the day tall objects on the target surface will cast thermal shadows. Heavy smoke will also cast shadows in strong sunlight. Water and metal structures may reflect sunlight. This can be the cause of false events, and so false fire indications. Reflected solar illumination is worst around midday.
	**Wind streaks & smear** Wind Streaks occur down wind from obstructions on flat terrain and typically occur as warm patterns on an image. Wind velocity is lower down wind from obstructions which reduces the cooling effect of the wind. Surface wind may produce parallel curved lines of alternating lighter and darker intensity that may extend over large portions of an image. This is called wind smear.
	**Cloud** Infra-red radiation is absorbed by water molecules. Any cloud or fog between the scanning aircraft and the ground will attenuate the infra-red radiation passing up from the ground. Heavy cloud may block out all such radiation. Clouds are usually seen in the imagery as areas of very low apparent temperature.
	**Polarity** Firescan images can be printed as either black-hot or white-hot polarity. Generally day time images will be printed white-hot as they then resemble aerial photos. Night time images on the other hand are generally printed black-hot as this suits the night infra-red conditions best. On Firescan prints the polarity is shown to the left of the image in the temperature chart.
	**Active Fire** Any flame in the field of view of the scanner will raise the apparent temperature of the portion of the image in which they fall. If flame covers an entire pixel then the apparent temperature of the pixel will be that of the flame. Small fires can be over looked as they may not raise the pixels apparent temperature by much. Active fire will tend to 'saturate' the infra-red detector. This will mean that the fire will be seen as a blob of one colour.
	**Burnt Area** Once the fire front has past, the area burnt through will still contain a number of burning areas, stumps, tree boles, fence posts, etc. Heavily timbered dry fuel will continue to smoulder for weeks while a grass or heath land may burn out in minutes. These remaining fires appear as speckles on a background that often appears washed out and low contrast. Fire burn patterns are sometimes visible in these areas.

Figure 24: Interpretation of infra-red fire image (source DSE Victoria)

Image rectification

Two different maps might show data at different scales.

A GIS must manipulate images so that they align with data gathered from other maps. The images may require datum and projection conversion (see section on Spatial Reference Systems).

Image rectification, a standard feature available with commercial GIS software packages, converts images to a standard map coordinate system. This is done by matching ground control points (GCP) in the mapping system to points in the image.

Summary

- Image data can be either digital (satellite images, digital photographs etc) or hard copy (hard copy photographs or maps etc).
- The size of a raster image file is expressed as the number of bytes.
- The three most common form of image files are TIFF, JPEG (both for graphic image files) and ECW (for remotely sensed data files).
- Image interpretation is the process of examining images and identifying their significance by analysing their location, extent and the features they depict.Image interpretation and analysis uses some pointers or keys to identify features. Some of the keys are - Shape, Size, Colour, Shadow, Texture, Pattern, Association, Site, Time and Resolution.
- Two different maps might show data at different scales. A GIS must manipulate images so that they align with data gathered from other maps.
- Image rectification, a standard feature available with commercial GIS software packages, converts images to a standard map coordinate system.

Self assessment questions

1. Give some examples of image files.
2. How is the size of a raster image file expressed?
3. What are the three most common image formats?
4. Identify some of the keys used for image interpretation?
5. How does the GIS rectify images with other data?

Section

9

Symbology

Section

9

Symbology

This topic covers the nationally agreed symbols for maps used in emergency management.

Symbology is defined in geographic information systems (GIS) as the set of conventions, rules, or encoding systems defining how geographic information is represented on a map.

Thematic symbols

Within Australia, there is a standard set of map symbols used for emergency management.

Many emergency events, especially large scale incidents, cross jurisdictional and geographic boundaries. By using standard map symbols, personnel from different agencies and jurisdictions can use the same maps without the need for additional training.

This Australasian All Hazards Symbology project was sponsored by the Intergovernmental Committee on Surveying and Mapping (ICSM) and the Australia New Zealand Land Information Council (ANZLIC), and supported by Emergency Management Spatial Information Network Australia (EMSINA). The primary aim of the project was to develop a consistent set of All Hazards Symbology and have it adopted by emergency management agencies across Australia and New Zealand.

In 2010, a standard set of symbols was developed for use by the emergency management and first responder communities at all levels of need (i.e. national, state, local and incident).

Figure 25: Symbology framework

The Generic symbols are shown on the following pages.

Your agency can provide you with the symbology related to their specific hazard type.

Note that the symbols are likely to change over time with new symbols and changes to existing ones.

Please refer to the full listing which is on the AFAC web site http://www.afac.com.au.

Summary

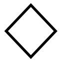
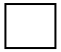
- The use of standard symbols in emergency service maps improves interoperability between agencies and increases efficiency and safety.
- In 2010, a standard set of symbols was developed for use by the emergency management and first responder communities at all levels of need (i.e. national, state, local and incident).

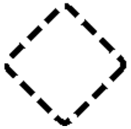
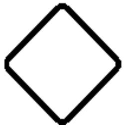
Self assessment questions

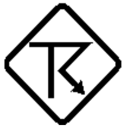
1. What are the benefits of the use of standard symbology?

General Emergency Management Symbols

Note : Existing symbol font is ICS Fire Symbols 1.1 24 point unless otherwise stated, Always use Bold and Halo

 Incident  Operations  Asset

ID	Symbol (feature)	Theme	Geometry	System Symbol	Status	Definition (Source)	Guidelines and Examples
1.1	General Incident	General	Point		**Unconfirmed**	Any unplanned event requiring emergency intervention (AIIMS).	Label with Location; Name; DTG; Use at Event/Incident to Jurisdictional levels eg. aircraft crash.
					**Confirmed**		
1.2	Air Incident	General	Point			Occurrences during the operation of an aircraft in which any person involved suffers death or serious injury or in which the aircraft receives substantial damage (EMA).	
1.3	Landslide	General	Point			A landslide is the movement of rock, debris or earth down a slope. They result from the failure of the materials which make up the hill slope and are driven by the force of gravity. Landslides are known also as landslips, slumps or slope failure (Geoscience Australia)	
1.4	Marine Incident	General	Point			Occurrences during the operation of a boat or ship in which any person involved suffers death or serious injury or in which the boat or ship receives substantial damage (modification of EMA Air Incident definition).	
1.5	Rail Incident	General	Point			Occurrences during the operation of a train in which any person involved suffers death or serious injury or in which the train receives substantial damage (modification of EMA Air Incident definition).	
1.7	Storm Surge	General	Point			The difference between the actual water level under influence of a meteorological disturbance (storm tide) and the level which would have been attained in the absence of the meteorological disturbance (i.e. astronomical tide) (WMO).	
ID	Symbol (feature)	Theme	Geometry	System Symbol	Status	Definition (Source)	Guidelines and Examples

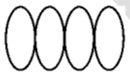
1.7	Storm Surge	General	Point			The difference between the actual water level under influence of a meteorological disturbance (storm tide) and the level which would have been attained in the absence of the meteorological disturbance (i.e. astronomical tide) (WMO).	
1.8	Thunderstorm	General	Point			Sudden electrical discharges manifested by a flash of light (lightning) and a sharp or rumbling sound (thunder) (WMO). Often accompanied by squalls and/or precipitation (Rain and/or Hail)" (BoM Weather Service Handbook 1992).	
1.9	Tropical Cyclone	General	Point			Tropical cyclones are intense low pressure systems which form over warm ocean waters at low latitudes. Tropical cyclones are associated with strong winds, torrential rain and storm surges (in coastal areas) (BoM).	
1.10	Tsunami	General	Point			A tsunami is a series of ocean waves with very long wavelengths (typically hundreds of kilometres) caused by large-scale disturbances of the ocean (BoM).	
1.11	Vehicle Incident	General	Point			Occurrences during the operation of a wheeled or tracked vehicle in which any person involved suffers death or serious injury or in which the vehicle receives substantial damage (modification of EMA Air Incident definition).	
1.12	General Assets	General	Point			Anything valued by people which includes houses, crops, forests and, in many cases, the environment (AFAC).	
					Potentially Defendable	The status of the asset is defined by the judged ability to counter the known threat of an active incident.	
					Defendable		
					Not Defendable		

ID	Symbol (feature)	Theme	Geometry	System Symbol	Status	Definition (Source)	Guidelines and Examples
1.13	HAZMAT	General	Point			Storage location of substances or materials which has been determined by an appropriate authority to be capable of posing an unreasonable risk to health, safety and property.	
1.14	Historic Site	General	Point	HS		Site of historical significance that emergency responders need to be aware of to minimise impact.	
1.15	Indigenous Site	General	Point	IS		Site of Indigenous artifacts or cultural importance that emergency responders need to be aware of to minimise impact.	
1.16	Significant Flora	General	Point	FL		Site of significant flora that emergency responders need to be aware of to minimise impact.	
1.17	Significant Fauna	General	Point	FA		Site of significant fauna that emergency responders need to be aware of to minimise impact.	
1.18	Threatened Asset	General	Point	TA		Asset identified at risk of being destroyed or significantly damaged by a hazard.	
1.19	Access point	General	Point	AP		Undefined	
1.20	Airbase	General	Point	 Or AIR		Undefined	

ID	Symbol (feature)	Theme	Geometry	System Symbol	Status	Definition (Source)	Guidelines and Examples
1.21	Animal Shelter	General	Point			Undefined	
1.22	Area of Interest	General	Polygon			The extent and location anticipated at being at risk from a particular incident or event. Syn: Area of Concern	Generic AIIMS - Acknowledge issues with wildfire burnt area. Mandatory labelling required if conflict exists.
1.23	Assembly Area	General	Point			A designated location used for the assembly of emergency-affected persons. The area may also incorporate an emergency relief centre (EMA).	
1.24	Base Camp	General	Point			A location where personnel are accommodated and fed for a period of time. A base camp usually contains catering, ablution and accommodation facilities, a water supply and a lighting system, and may include other facilities such as car parking maintenance and servicing (AIIMS).	
1.25	Control Area	General	Polygon			A declared area in which defined movement conditions apply .	Generic AIIMS - Acknowledge issues with wildfire burnt area. Mandatory labelling required if conflict exists.
1.26	Control Centre	General	Point			The location where the Incident Controller and various members of the Incident Management Team provide overall direction of response activities (AFAC).	
1.27	Control/ Operations Point	General	Point			The location from which the overall field operations are commanded by the Operations Officer (AIIMS).	
1.28	Declaration Area	General	Polygon			Undefined	
1.29	Divisional Boundary	General	Point			Division: A portion of the incident comprising of two or more sectors. The number of sectors grouped in a Division should be such as to ensure effective direction and control of operations. Divisions are generally identified by a local geographic name (AFAC).	

ID	Symbol (feature)	Theme	Geometry	System Symbol	Status	Definition (Source)	Guidelines and Examples
1.30	Divisional Command	General	Point			Location at an incident from which the Division Commander of that division operates (AIIMS).	
1.31	Drop Zone	General	Point			Target area for airtankers, helitankers, or cargo dropping (AFAC).	
1.32	Emergency Alert Warning Area	General	Polygon			Undefined	Generic AIIMS - propose solid fill as with National Standard. Transparency as required.
1.33	Evacuation/ Escape Route	General	Line			A planned route away from danger areas at a hazard (AFAC modified).	
1.34			Point		Established		
					Planned		
					Established		
					Planned		

ID	Symbol (feature)	Theme	Geometry	System Symbol	Status	Definition (Source)	Guidelines and Examples
1.36	Evacuation Centre	General	Point		Established	Centres that provide affected people with basic human needs including accommodation, food and water (EMA).	
					Planned		
1.37	Helibase	General	Point	 OR 		A location for parking, refuelling and maintenance of helicopters operating in support of an incident (AFAC).	
1.38	Helipad	General	Point			A designated location which meets specific requirements for a helicopter to take off and land.	
1.39	Location - Fire Appliance	General	Point			The location of any motor vehicles that carry firefighters and equipment (TBC).	
1.40	Location - Ambulance	General	Point			Undefined	
1.41	Location - Police vehicle	General	Point			Undefined	

ID	Symbol (feature)	Theme	Geometry	System Symbol	Status	Definition (Source)	Guidelines and Examples
1.42	Location -SES vehicle	General	Point			Undefined	
21.43	Medical	General	Point			Undefined	
1.44	Mobile Weather Station		Point			Often referred to as Portable Automatic Weather Stations (BoM).	
1.45	Refuge Area	General	Point			Areas where people may seek shelter from the danger of fire (modified EMA).	
1.46	Road Closure Traffic Control Point	General	Point		Active	Road check point or barricade to maintain compliance with movement control restrictions (AEM_Glossary).	
					Planned		
1.47	Sector Boundary	General	Line			Sector: A specific area of an incident which is under the control of a Sector Commander who is supervising a number of crews (AFAC).	
1.48	Sector Command	General	Point			Undefined	
1.49	Staging Area	General	Point			A prearranged, strategically placed area where support response personnel, vehicles and other equipment can be held in readiness for use during an emergency (EMA).	

Section

10

Mapping products

Section

10

Mapping products

This section identifies the range of mapping products routinely used in emergency management.

There are unlimited maps that could be requested, but standard maps can be produced more quickly and easily than customised maps and most agencies have standard map products they use for their specific types of incident.

Sometimes people will request a special map. Customised products can be made but the requesting person must be made aware that these will take longer to produce. Additionally, their production may hinder the production of other maps.

Where there are a lot of maps being requested, the Mapping Team leader will need to clarify priorities for map production with the Situation Unit Leader,

ALL maps should be checked and approved by the Situation Unit Leader before release.

Planning maps

Planning maps include:

- Incident Overview Map;
- Situation Map; and
- Strategic Map.

Incident Overview Map

Incident Control Centres usually display an Incident Overview Map (sometimes called Operations Map or Operations Overview Map) on a wall. This map shows the whole incident on the one map and updates can be added – making the map a 'running' record of incident development.

When the Operations Officer and Division and Sector Commanders return from the incident they usually update this map. Updates from all other sources can also be added as they become available. Traditionally these updates were hard copy but increasingly digital technology is being used – with the information being transferred directly into the GIS.

This map could be used for

- The Planning Officer and IMT to develop strategy and tactics;

- General reference by all IMT staff;
- Briefings;
- Operations personnel (who would use a smaller version of the same map in the IAP – see Incident Action Plan maps below).

An example of this type of map follows:

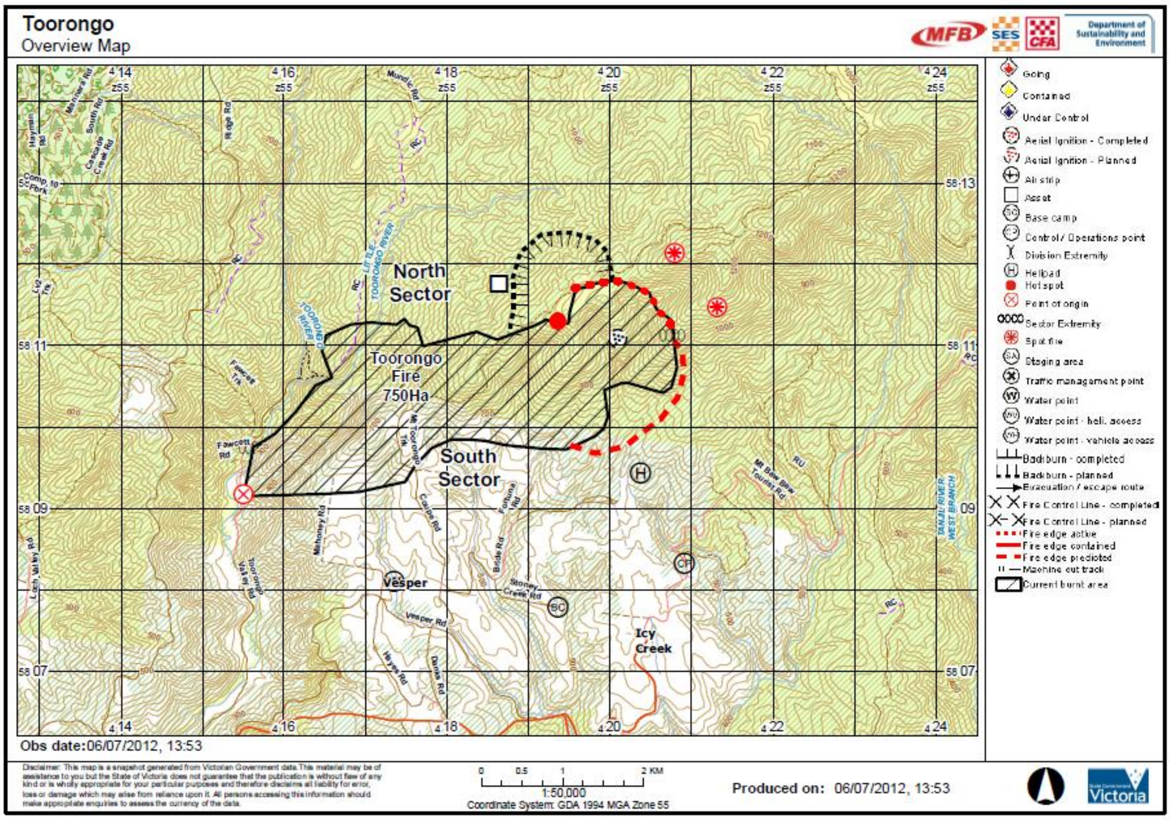


Figure 26: Incident Overview Map (source Department of Sustainability and Environment, Victoria)

The map should display all the relevant data required for incident control and could include:

- Known/estimated incident perimeter;
- Declared areas such restricted areas, control areas and quarantine areas;
- Problem areas;
- Division/sector boundaries;
- Incident facilities e.g. Incident Control Centre, Operations Point, Division/Sector Command Points, Staging Areas, Base Camp, airstrip, helibase etc.;
- Control line (if appropriate, e.g. for fire and flood) both proposed and constructed;
- Affected and unaffected areas (e.g. areas within the perimeter that are/are not burnt or flooded);
- Water points;

- Houses and other buildings;
- Hazards;
- Infrastructure (e.g. powerlines, pipelines etc);
- Rare and endangered flora and fauna etc;
- Specific types of asset related to the type of incident;
- Sealed/unsealed roads;
- Major/minor hydrography (streams/dams);
- Vehicle control points;
- Road closures; and
- Refuge points

Information on the base map must be clearly visible, readable and not obstructed by labelling or other text information put on the map.

Sector and Division labels should be placed at a reasonable distance away from the incident boundary.

Specifications for this map are:

- Scale is dependent on the size of the incident and the available data for the area. For example, in settled areas, the data could be sufficiently detailed for the map to be 1:25,000 or up to 1:100,000 or smaller. Large incidents or large unsettled or remote areas may only have sufficient data for a 1:100,000, 1:250,000 or 1:1,000,000 data. Incidents that cross state boundaries may have different scale data for each state.

  Individual sector maps may need to be developed if the incident becomes too large to fit on one page.
- The size should be A1 or larger.
- AO sizes with a clear overlay are required for the Operations Point and Incident Control centre and may be needed where briefings take place at staging Areas. Smaller sizes of the same map (e.g. A3) may be adequate for the individuals above as long as the scale is correct and useful and the maps are readable.
- Layers should be base topographic map data; incident control data; land tenure data and may include aerial photography and other images.

This map will need to be updated in preparation for briefings and handover for the next shift.

Situation Map

The Situation Map usually looks about one day ahead and is used to assist with planning a course of action to combat the incident. It is used by the Situation Unit to display the current and projected incident situation for planning purposes.

Situation maps could include:

- A summary of the current situation (e.g.. current incident perimeter);
- Likely future incident scenario (e.g.. projected incident perimeter);
- The key threats posed by the incident;
- The current incident control arrangements, such as Divisions and Sectors and the location of key incident facilities such as the Incident Control Centre, Operations Point, Staging Area etc.

As an example, a Situation map for a biosecurity incident could include

- Infected premises;
- Change in infected premises over time period; and
- Change in other premises.

Strategic Map

Strategic maps (may be called a range of other names) are similar to Situation Maps but project over a longer timeframe.

Possible features of the strategic maps could be:

- **Timeframe** – the situation projected could range from several days to several weeks or months, depending upon the type of incident.
- **Scenarios –** the map could present a range of possible scenarios.
- **Values at risk** – the map could present the range of values at risk including communities, assets, and environmental features at risk from the incident.

The purpose of the Strategic Map is to assist with longer term planning (i.e. not for the immediate shift). The map will help identify the likely scenarios, the possible future situation and the likely threats from the incident.

Strategic maps will also be of interest from a 'whole-of-government' perspective and should help inform policy and planning for all agencies.

Maps for the Incident Action Plan

The Operations Section requires maps in the Incident Action Plan (IAP). These maps include:

- Incident Overview Map (same map as for the Planning Section but only smaller); and
- Division and/or sector Maps.

IAPs and their associated maps are generally updated for each work shift (although for some incident types, the plan and maps may remain the same for several days).

The information on IAP maps is critical for the safety of the operations personnel and the effectiveness of the incident operations.

Therefore the information must be clearly visible, readable and not obstructed by labelling or other text information.

Maps for use during nightshift should be easily readable in poor light.

Operational details such as division and sector boundaries need to be authorised by either the Situation Unit Leader, Planning Officer or the Operations Officer.

Incident Overview Map

The IAP usually contains a copy of the Incident Overview Map. This is usually the same map as developed for the Planning Section but printed on a smaller piece of paper suitable for carrying out to the field (usually A4).

This map contains the main features of the incident and its relationship to towns, major roads and access. This map gives incident respondents some context to the location of the incident and with access to the incident. It also includes division and sector boundaries.

Division/Sector Map

An individual map is usually provided for each Division and Sector and this is usually at a larger scale than the incident overview map, with more detail, enabling Division and Sector Commanders to clearly see the essential detail of the area they are managing.

Scale: 1:25,000 or to 1:50,000. Note that the scale of the map should be appropriate to the scale of the data on which the map is based.

Size: A4 or A3

Layers: Base topographic map data; incident control data; land tenure data

These maps need to contain all the relevant data required for managing the Sector or Division including:

- Incident location and access;
- Direction of incident travel (e.g. an arrow showing the direction of spread of the incident, if it is spreading);
- Known/estimated incident perimeter;
- Problem areas (e.g. hotspots for fires);
- Division/Sector boundaries;
- Incident facilities e.g. Incident Control Centre, Operations Point, Division/Sector Command Points, Staging Areas, Base Camp, airstrip, helibase etc.;
- Refuge points
- Location of key assets requiring protection etc.;
- Control line (if appropriate, e.g. for fire)- both proposed and constructed;
- Affected and unaffected areas (e.g. areas within the perimeter that are/are not burnt or flooded);

- Water point;
- Houses and other buildings;
- Hazards;
- Infrastructure (e.g. powerlines, pipelines etc);
- Rare and endangered flora and fauna etc.;
- Specific types of asset related to the type of incident (such as water-related assets and dams);
- Sealed/unsealed roads;
- Major/minor hydrography;
- Vehicle control point; and
- Road closure.

Public Information Map

These maps are for communicating information to both internal and external groups such as the community, the media, senior emergency management personnel, government and stakeholder agencies and they are often used for public briefings.

These maps are usually general in nature and do not contain a lot of technical detail. They usually cover:

- An incident overview;
- The direction in which the incident is likely to expand (e.g. for a flood or a fire);
- Major roads;
- Closed roads;
- Rivers and lakes;
- Towns; and
- Local references and major features e.g. mine sites etc.

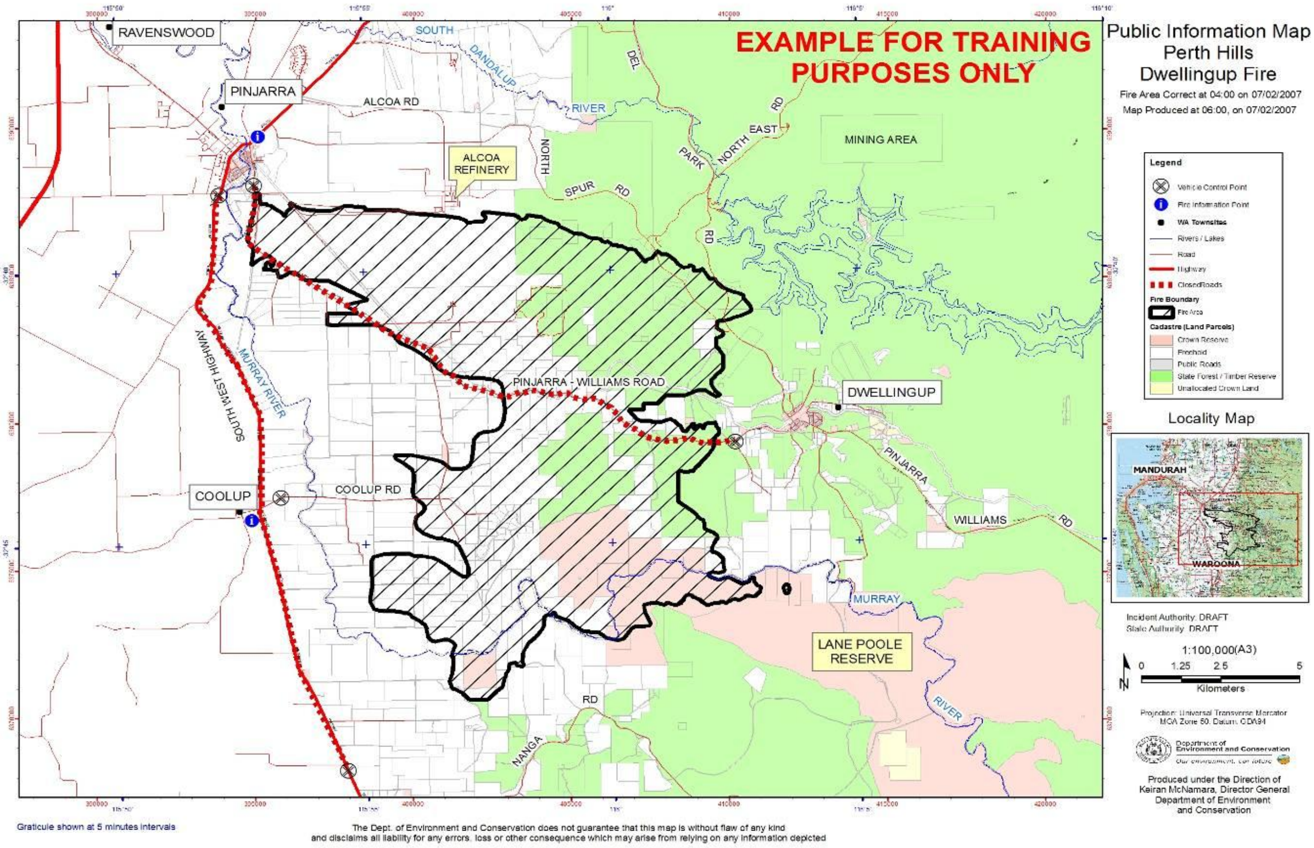


Figure 27: Public Information Map (source Department of Environment and Conservation, WA)

Agency-specific maps

Individual agencies will have their own maps in addition to those listed above. These include:

Preparedness map

Some agencies prepare a map which shows the location of resources, for example Incident Management Teams, in advance of an incident, for example on a day of forecast extreme fire weather or extreme rainfall.

Loss map

This displays the location of assets that have been damaged or destroyed during the course of the incident.

Recovery map

This shows the locations of rehabilitation or recovery actions required once the incident has concluded and could include the location of roads requiring grading, unsafe trees, damaged fences etc.

Communications map

This shows the location of radio repeaters.

Activity

Identify the standard maps used by your agency, the purpose of each map and who will use it.

Mapping standards

All maps produced for emergency management should include:

- Agency logo and disclaimer;
- Incident name and map type (e.g. Blue Rock incident – Incident Overview Map);
- When prepared (time, date and shift);
- The time and date when the information was collected;
- North arrow;
- Scale (including a bar scale);
- Grid lines;
- Legend; and
- Essential features.

Quality assurance and authorisation

Most agencies place considerable emphasis on the authorisation of data and mapping products to ensure incorrect data is not put on maps and that the maps are checked and authorised prior to release.

The Mapping Team Leader is responsible for ensuring that datasets and maps are properly authorised before they are finalised, copied and distributed.

Maps are often considered as a definitive record of the incident and are requested during Royal Commissions and coronial inquiries etc. It is critical the correct information is used and the maps are fit for purpose and will withstand organisational and/or public scrutiny.

Operational details such as division and sector boundaries will need to be authorised by either the Situation Unit leader, Planning Officer or the Operations Officer.

Timeliness

If a map takes too long to produce then it may not be useful anymore.

It is therefore important for the Mapping Team to clarify the time constraints for map production when the request is first received.

The use of standard agency mapping products will greatly assist the Mapping Team to produce maps on time as there are usually simple templates for the production of these maps.

Scale

A map needs to have the level of accuracy and currency required by the users of the map. Larger scale maps are good for tactical decision making (i.e. can be more easily used by ground personnel) and it is easier to measure distances and areas using them.

Use a bar scale (rather than a representative fraction, such as 1:25,000) as most operations personal do not carry rulers and the map scale may change with the copying process.

Maps which are not to scale need to have 'not to scale' written on the map

As previously explained, scale is dependent on the size of the incident, the available data for the area and the size of the page on which the map is to be printed.

Sensitive information

Maps, like other documents, contain information that may be either general (readily available to the public) or sensitive and which should only be available for managers or people with specific roles at the incident.

These days, open communication with the community is more commonplace. However it is still important to be careful about some types of information they may be misinterpreted, restricted for a specific purpose or too traumatic if released.

Types of sensitive information may include:

- Locations of rare or restricted flora, fauna or habitats;
- Locations of cultural heritage sites;
- Military information - e.g. the defence forces may not want the locations of their facilities known during combat of incidents on land controlled by them;
- Extent or location of the incident before it is timely to release it e.g. the extent of a landslide before it is established there are victims;
- Infected or infested premises (biosecurity); and/or
- Privacy-related data etc.

Graticules

The gridlines pattern on a map is called a graticule. Your GIS will give you a choice of the projection used for the graticule. Public Information maps will not need a graticule. However, maps for use in the field should include a graticule as grid lines make it much easier for distances to be judged.

Amount of information

The amount of data or information shown on a map influences the user’s ability to find and use particular information they are interested in.

Maps that contain too much information may be cluttered and difficult to read and important information on the map may be missed altogether. Maps with a small scale representing steep terrain may be cluttered by contour lines. Too many labels or notations may also clutter the map.

Conversely, where there is insufficient information, the map may not be useful for its purpose. Again, decision-making and safety of personnel may be compromised by too little or too much information.

Paper size

A map should be of size suitable for its purpose but this needs to be balanced against the information it is required to show.

For example, a map designed for the wall of the Incident Control Centre can be bigger than a map to be used in a vehicle by a Sector Commander. Similarly, a map to be used by the media in a newspaper will need to be quite small..

A map may also need to be of a size that allows for growth of an incident. A change in scale or a series of adjoining maps will need to be considered if an incident is growing so that its map covers more than one page.

How the map is to be sent to another destination may influence the size of the map. If it is to be faxed then it will need to be either A4 or A3 paper size. A map larger than A4 or A3 will have to be mailed or hand delivery in a tube container.

Number of copies

The number of copies of a map depends upon who needs the map. The ability to make multiple copies may also influence how many copies can be made e.g. the availability of a colour printer or photocopier and the speed at which copies can be made.

The delivery of the copies to personnel also has to be considered. If multiple copies of the same map have to be available in a number of locations by a particular time then this may be a significant constraint and alternative methods of map transfer may need to be considered.

Finally…..

Always do final check of your maps to make sure:

- The title is correct;
- The incident name is correct;
- The time and date are correct for both the collection of information and the production of the map;
- The legend explains all details on the map;
- The scale bar is correct (check against the graticule [grid lines]);
- The graticule is correct; and
- The map has been approved by the Situation Unit Leader.

Always destroy maps that are incorrect.

Remember, perfect cartography is not as important as getting the incident data onto a map and out to Planning and Operations.

Summary

- Most agencies have a standard list of map products they use for the specific types of incidents they manage.
- Customised products can be made but the requesting person must be made aware that these will take longer to produce.
- An Incident Overview Map displays the whole incident and updates are added as information comes into the Incident Control Centre (ICC). This map is a ‘running’ record of the incident development.
- Situation Maps display the current incident situation and the projected incident situation.
- The Incident Action Plan (IAP) contains maps for operations personnel to use in the field. The information on these maps is critical for both the safety of the operations personnel and the effectiveness of the incident operations. These include:
    - Incident Overview Map - contains the main features of the incident and its relationship to towns, major roads and access. This is a smaller copy of the Incident Overview Map displayed in the ICC.
    - Division/Sector Maps - with more detail, enabling Division and Sector Commanders to clearly identify the essential detail of the map for the area they are managing.
- Public Information Maps are usually general in nature and are used to disseminate information to both internal and external groups such as for the community, the media, senior emergency management personnel, and government and stakeholder agencies.
- Other agency-specific maps include:
    - Preparedness maps displaying the location of resources, for example Incident Management Teams in advance of an incident;
    - Loss maps displaying the location of assets that have been damaged or destroyed during the course of the incident;
    - Recovery maps displaying the locations of recovery actions required once the incident has passed; and
    - Communications map showing the location of radio repeaters.
- All maps produced for emergency management should include:
    - Agency logo;
    - Title and incident identifier;
    - When prepared (time, date and shift);
    - Who prepared the map;
    - North arrow;
    - Grid lines;
    - Scale;
    - Legend; and
    - Essential features.
- If a map takes too long to be produced then it will not be useful anymore. Perfect cartography is not as important as getting the incident data onto a map and out to Planning and Operations.

- The use of standard agency mapping products will greatly assist the Mapping Team to produce maps on time as there are usually simple templates for the production of these maps.
- Maps need to have the level of accuracy and currency required by their users.
- Small scale maps are good for overviews and strategic decision making.
- Larger scale maps are good for tactical decision making (i.e. can be more easily used by ground personnel) and can be used for accurately measuring distances and areas.
- Types of sensitive information included on maps that should have a restricted audience are:
  - Locations of rare or restricted flora, fauna or habitats;
  - Cultural heritage sites;
  - Military information;
  - Extent or location of the incident before its timely release;
  - Infected or infested premises (biosecurity); and
  - Privacy–related data etc.
- The map should be of a size that suits the needs of its user e.g. a wall map should be large whereas a map that will be used in the car should be smaller.

Self assessment questions

1. Explain why agencies use standard maps in preference to customised maps.
2. Explain the purpose of the Incident Overview Map usually displayed in the Incident Control Centre.
3. What information is displayed on a Situation Map?
4. Identify the maps usually contained in the Incident Action Plan (IAP)?
5. What are the maps in the IAP used for?
6. Identify at least four different audiences for Public Information Maps.
7. Identify the features all maps produced for emergency management should include.
8. Why is timeliness important when producing maps during emergencies?
9. Do all maps have to be very detailed ? Explain your answer.
10. Give some examples of when small scale maps could be useful.
11. Give some examples of when large scale maps could be useful.
12. Give some examples of sensitive information on maps that should have a restricted audience.
13. What size should a map be?

Section

11

Self Assessment Answers

Self assessment answers

Section 1: The Mapping Team

1. The Incident Management Team or IMT comprises the Incident Controller, Planning Officer, Operations Officer, Public Information Officer and Logistics Officer.
2. The Planning Officer is responsible for the production of the Incident Action Plan.
3. The Situation Unit is responsible for the collection of situation information and the development of incident control options.
4. The Mapping Team is responsible for producing mapping information, with relevant supporting documentation in order to summarise and describe the incident situation.
5. The key roles in the Mapping Team are:
    - The Mapping Team Leader - responsible for obtaining work instructions and managing the Mapping Team to ensure that the products are delivered.
    - Mapping Team Members – work independently to collect and interpret incident and image data, and then apply GIS software to produce mapping products.
    - Mapping Team Assistants – work under supervision and produce basic mapping products.
6. The Mapping Team normally receives requests for mapping products through the Situation Unit Leader.

Section 2: Working in the Mapping Team

1. A well-performing team has a common purpose that is understood by all team members and on which each member plays their assigned role to the best of their ability to achieve this purpose.
2. A good 'team player':
    - Shares good ideas;
    - Finds ways to help people in their team;
    - Recognises good results; and
    - Asks for help when they need it to get a job done.
3. The key responsibilities of team members are to:
    - Communicate with team leaders and other members;
    - Co-operate with team leaders and other members;
    - Contribute skills and experience towards achieving team tasks; and
    - Share in the work and assist and support other members.
4. Some of the points that should be covered when reporting progress to the team leader are:
    - Progress made towards achieving the work objectives;
    - Identification of information that may affect the work of another team member;
    - Future resource requirements;
    - Future timeframes and timelines; and

- Any predicted problems in completing work and subsequently the team objective.

5. It is important to work within the agency's policy and procedure framework because these ensure the agency complies with its legal obligations in areas such as equal employment opportunity (EEO), anti-discrimination and OHS.
6. If you notice a hazard in your workplace you should:
   - Say NO to working in unsafe conditions;
   - Report unsafe or hazardous conditions to your supervisor straight away;
   - Warn others at risk about the danger – where it is and how it happened;
   - Always ask yourself before starting a new job – can I get hurt doing this job? It you answer YES or MAYBE, talk to your supervisor right away.

Section 3: Leading the Mapping Team

1. The Mapping Team Leader is responsible for managing and maintain the Mapping Team work environment for example, maintaining systems, hardware, plotters etc.
2. The Mapping Team Leader obtains the team objectives for the work shift from the Situation Unit Leader.
3. Possible steps for planning the allocation of team tasks are:
   - Identify the team objectives;
   - Identify issues, factors and information that affect the situation;
   - Identify resources available;
   - Develop options for achieving objective/s;
   - Determine a plan of action; and
   - Allocate tasks.
4. Some of the things you should keep in mind when receiving feedback are:
   - Keep an open mind and suspend judgment;
   - Listen and repeat or paraphrase what you have heard thereby confirming you understand what is being said; and
   - Focus upon the behaviours and facts rather than any emotions or subjective opinions being expressed.
5. Some of the things you should keep in mind when giving feedback are:
   - Focus on specific behaviours;
   - Keep it impersonal;
   - Focus on objectives; and
   - Time it well.
6. It essential that Mapping Team objectives are met as the rest of the Incident Management Team is often dependent upon the map products to achieve their objectives and the control of the incident.

Section 4: Shift handovers

1. A smooth handover between the outgoing and incoming Mapping Team shifts is essential to ensure the continuity of mapping services to incident management.
2. A smooth handover usually includes:
   - Maintenance of Incident Logs throughout the shift;
   - Confirmation and storage of maps produced during the current shift;
   - Preparation of Handover Notes;
   - Printing of maps produced during the shift;
   - Briefing of the incoming shift; and
   - Conducting an After-Action-Review of the outgoing shift's activities.
3. In general, incident logs must include details of significant events including:
   - The time when image data was received;
   - The time when data was archived;
   - The time and details of requests received; and
   - The time and details of information sent out.
4. Handover briefings are usually conducted with:
   - A general group briefing; and
   - A one-on-one briefing given by each outgoing Mapping Team member to the incoming Mapping Team member.

2\. The one-on-one handover briefing covers:
   - Exchange of Handover Notes and Incident Log;
   - The work required to be done by the incoming shift;
   - Key outstanding tasks and timelines;
   - Filing system used for both electronic and hard copy data;
   - Equipment maintenance requirement;
   - Alternative power supplies; and
   - Key issue and/or solutions.

6\. The After-Action-Review (AAR) could included discussion of:
   - What was planned;
   - What really happened;
   - Why it happened – remembering that the AAR focuses on the WHAT not WHO; and
   - What can be improved for next time.

Section 5: Spatial reference systems

1. Datum is a set of reference points on the earth's surface against which position measurements are made. Horizontal datum is used to describe a point on the earth's surface. Vertical datum is used to measure elevations or depths.
2. The two main types of coordinate systems are:

- Geographic coordinates(for example, latitude and longitude – usually expressed in degrees or decimals); and
- Projected coordinates (for example, a grid that represents the earth on a flat surface such as a page - usually expressed in metres).A projection is a mathematical means of transferring information from a model of the Earth, which represents a three-dimensional curved surface, to a map grid— a paper map or a computer screen.

3. The Geocentric Datum of Australia, 1994 (GDA94) has been adopted for use throughout Australia. GDA94 datum replaces the AGD66 and AGD84 datum throughout Australia. The Map Grid of Australia 1994 (MGA94) is the standard projection for large scale maps. Lambert (VG94) or Albers is the standard projection for small scale maps.
4. World Geodetic System 1984 (WGS84) is a worldwide reference system used by GPS. It is very similar to GDA94 (but not the same). This explains why GPS data may need to be converted to GDA94 prior to being able to be used in a GIS.
5. Data from different sources needs to be converted to the one datum and projection in order for it to be merged within a GIS. The GIS can do this.

Section 6: Collecting spatial data

1. Geographic data is ‘spatial’ data.
2. ‘Features’ are natural and manmade features such as cities, rivers, roads, states, vegetation, mountain ranges etc that can be shown on a map. An ‘attribute’ is information about the feature, for example the depth of the lake or height of the mountain. This is ‘non-spatial’ or ‘aspatial’ data.
3. Maps comprise layers of specific features.
4. There are two types of spatial data – vector data and raster data.
5. Vector data is data that represents geographical features on maps through different shapes (points, lines or polygons).
6. Vector data may be stored in a relational database management system (RDBMS) which is a collection of two-dimensional tables that store sets of data (see diagram below), or in a file based system, like an ESRI Shape file. However, from inside the GIS, the data is still treated the same, i.e. as a table.
7. Raster data is used to represent surfaces and consists of rows and columns of cells, with each cell storing a single value.
8. A metadata record is information regarding the basic characteristics of the data. The collection of incident data is the responsibility of the Situation Unit.
9. Spatial (and non-spatial) data can be collected using several techniques, primarily:
   - Updates from Operations personnel;
   - Information provided by Ground or Air Observers; and
   - Images sourced from remote sensing.

Section 7: Geographic Information System

1. GIS is a computer-based data collection, storage, analysis and presentation tool that combines previously unrelated information into easily understood maps.

2. GIS can perform complicated analytical functions and then present the results visually as maps, tables or graphs, allowing decision-makers to virtually see the issues before them and then select the best course of action.

3. GIS uses layers to overlay different types of information. Each theme represents a category of feature, such as roads or forest cover.

4. Geo-processing is a GIS operation for manipulating spatial data.

5. Some of the typical geo-processing functions are:

   - Buffer;
   - Clip;
   - Dissolve;
   - Intersect;
   - Merge; and
   - Union.

6. One common cause of problems with data in GIS is that the data has been collected using different datum and projections. The data may need to be converted to the one datum and projection coordinates it can be used.

Section 8: Interpreting image data

1. Image data can be either digital (satellite images, digital photographs etc) or hard copy (hard copy photographs or maps etc

2. The size of a raster image file is expressed as the number of bytes.

3. The most common image file formats are TIFF and JPEG (graphic image files) and ECW (for a remotely sensed image file).

4. Image interpretation and analysis uses some pointers or keys to identify features. Some of the keys are - Shape, Size, Colour, Shadow, Texture, Pattern, Association, Site, Time and Resolution.

5. A GIS can convert images from one datum and projection to another. This is usually a standard feature on GIS.

Section 9: Symbology

1. The use of standard symbology for emergency service maps improves interoperability between agencies and increases efficiency and safety.

Section 10: Mapping products

3. Agencies prefer to prepare standard maps in preference to customised maps as they are much quicker and easier to produce. Customised maps can be produced but the person requesting the map needs to be advised that the map will take longer to produce. Production of customised maps could mean that the Mapping Team gets behind in its work and the Mapping Team Leader may need to reset priorities.

4. The Incident Overview Map displays the whole incident and hand-drawn updates can be added when people return from the incident. This map is a ‘running’ record of the incident development. A smaller version of this map is included in the Incident Action Plan (IAP).

5. Situation Maps usually display the current incident situation and the projected incident situation.
6. The maps Incident Action Plan (IAP) usually contains:
    - Incident Overview Map - contains the main features of the incident and its relationship to towns, major roads and access.
    - Division/Sector Maps - with more detail, enabling Division and Sector Commanders to clearly identify the essential detail of the map for the area they are managing.
5. The maps in the IAP are used operations personnel at the incident. The information on these maps is critical for both their safety and the effectiveness of the incident operations.
6. Public Information Maps are usually general in nature and are used to disseminate information to both internal and external groups such as for the community, the media, senior emergency management personnel, and government and stakeholder agencies.
7. All maps produced for emergency management should include:
    - Agency logo;
    - Title and incident identifier;
    - When prepared (time, date and shift);
    - Who prepared the map;
    - North arrow;
    - Grid lines;
    - Scale;
    - Legend; and
    - Essential features.
8. Timeliness is important when producing maps during emergencies because if the map is late then it maybe of no use to the incident managers and could even hinder the process of controlling the incident.
9. Maps need to have the level of accuracy and currency required by their users.
10. Small scale maps are good for overviews and strategic decision making.
11. Larger scale maps are good for tactical decision making (i.e. can be more easily used by ground personnel) and can be used for accurately measuring distances and areas.
12. Sensitive information on maps that should have a restricted audience includes:
    - Locations of rare or restricted flora, fauna or habitats;
    - Cultural heritage sites;
    - Military information;
    - Extent or location of the incident before it is timely to release it;
    - Infected or infested premises (biosecurity); and
    - Privacy–related data such as ownership etc.
13. The map should be of a size that suits the needs of its user e.g. a wall map should be large whereas a map that will be used in the car should be smaller.