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# Marine Incident Geospatial Support Guideline 2018

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**Document**

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# GLOSSARY

| | |
|---|---|
| ACP | Area Contingency Plan |
| ACTESA | Australian Capital Territory Emergency Services Agency |
| AIIMS | Australasian Inter-service Incident Management System |
| AIS | Automatic Identification System |
| AMSA | Australian Maritime Safety Authority |
| API | Application Programming Interface |
| COP | Common Operating Picture |
| COTS | Commercial off-the-shelf |
| CP | Contingency Plan |
| DEPI | Department of Environment and Primary Industries |
| EDS | Environmental Data Server |
| EMSINA | Emergency Management Spatial Information Network Australia |
| ESI | Environmental Sensitivity Index |
| ESRI | Environmental Systems Research Institute |
| GIO | Geographic Information Officer |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| HTML | Hyper Text Mark-up Language |
| IAP | Incident Action Plan |
| IC | Incident Controller |
| ICC | Incident Control Centre |
| ICP | Incident Command Post |
| ICS | Incident Command System |
| IMT | Incident Management Team |
| KSAT | Kongsberg Satellite Services |
| MAPS | Mapping and Planning Support |
| MIGS | Marine Incident Geospatial Support |
| MODIS | Moderate Resolution Imaging Spectro-radiometer |
| MOU | Memorandum of Understanding |
| NIMS | National Incident Management System |
| NOAA | National Oceanic and Atmospheric Administration |
| OSRA | Oil Spill Response Atlas |
| PIO | Public Information Officer |
| RPS-APASA | Asia-Pacific Applied Science and Associates |
| SCAT | Shoreline Cleanup and Assessment Technique |
| SGML | Standard Generalised Markup Language |
| SOG | Standard Operating Guideline |
| SOP | Standard Operating Procedure |
| SRT | State Response Team |
| SLAR | Side-Looking Airborne Radar |
| SSAR | Satellite Synthetic Aperture Radar |
| TRK | Training Resource Kit |
| WGS84 | World Geodetic System 1984 |

# 1. DOCUMENT BACKGROUND

Geospatial capability is fundamental to emergency management, which is almost always about location(s). In dealing with maritime emergency response, control agencies need to identify their own geospatial needs, including how to coordinate geospatial emergency response efforts. All phases of emergency management (Prevention, Preparedness, Response and Recovery) involve collecting, analysing and disseminating of geospatial data/information in a timely and logical manner. Each phase will use existing information, prediction, and field observations (monitoring) to enhance situational awareness and decision-making.

This Guideline provides an outline of a consistent approach for marine oil spill emergency response using Geographic Information Systems (GIS) and technical professionals, embedded within an Incident Command System (ICS) structure.

The *Marine Incident Geospatial Support (MIGS) Guideline* have been developed by the National Plan Marine Incident Geospatial Support Working Group, under AMSA guidance. It is mostly based on and adapted from the National Alliance for Public Safety GIS (NAPSG) Foundation's *"Geospatial Standard Operating Guidance for Multi-Agency Coordination Centres - Supplement for Coastal Oil Spills"*, and also references other documents listed in Appendix 16.

## 1.1. Intended Audience

The Guideline defines a nationally consistent approach for local, State and Commonwealth marine incident response Geographic Information Systems (GIS) coordinators to develop and implement their own processes and products. The result should improve processes for the organisation, collection, management and delivery of geospatial data, intelligence and products into the Incident Control Centre (ICC). Each jurisdiction can have its own guidance and plan for its GIS personnel to use when supporting a maritime emergency incident. This will allow other emergency management professionals to better understand the spatial information management issues and business needs of a maritime response.

This document will evolve as more and more local agencies adopt GIS operating procedures for emergency management and provide critique and commentary to the MIGS Working Group.

# 2. INTRODUCTION

## 2.1. Purpose

A nationally consistent guideline on geospatial capability will help jurisdictions build their own, through mutually agreed standards, where possible, and within their own jurisdictional systems. The information and references provided can act as:

- An initial assessment of capability gaps and areas for improvement.
- A template to help jurisdictions prepare checklists to use during an incident.

This *Marine Incident Geospatial Support Guideline* will provide guidance and key information to help jurisdictions understand and develop their own response GIS capability. It provides structured guidance on the management of GIS data, resources, personnel, and outputs within the IMT.

This Guideline focusses predominantly on the preparedness and response phase requirements, as this is where planning and preparation is going to be most effective.

Managing expectations and standardising processes about creating, preparing, coordinating, and disseminating GIS services and products can make incident response much more effective. This will assist in answering the common questions asked during a maritime incident (casualty or pollution).

These questions all have a location component, and can be summarised based on NOAA's five basic questions to help guide a response (NOAA, 2018):

- What happened, where and how?
- Where is it now and where will it go?
- What could get hit when and where?
- What could get hurt when and where?
- How can we best help when and where?

## 2.2. Guideline Objectives

To adequately address GIS needs and practices during an incident response, the Guideline needs to be accessible to local and state GIS professionals, whether or not they have an oil spill response background. They need to be able to understand what is required of them and how they can more efficiently become productive members of the emergency management/first responder team.

Topics to be covered will include:

- Technology-independent Standard Operating Guideline (SOG) templates for marine incidents, focusing on State and Commonwealth Government needs.
- Contextual information on spill response, to provide the necessary health and safety, and environmental and operational information to perform their job well and safely.
- Work continuity to allow processes to continue uninterrupted and to be completed on an established schedule, especially during incident transition periods
- Data collection, data management and mapping protocols.
- Data/map dissemination/sharing (via web applications) protocols.
- Key GIS resources, supplies and tools for the ICC and GIS personnel.
- Quality control of processes and products
- Data and map sharing practices outside the IMT and ICC, including with external contacts.
- Data management, curation, communication and retention expectations.

## 2.3. What will this look like?

To be 'fit for purpose', the Working Group will ensure that the Guideline benefit from:

- **Design** – it has been through a good and thorough design process, and peer- reviewed by geospatial specialists experienced in maritime emergencies, and beyond.
- **Completeness** – it has all the bits it needs or is able to point to external references.
- **Validation** – it works! The guideline has been tried and tested.

The Guideline is in two parts:

1. The main content provides a resource for technicians and decisions makers to understand the importance of and to identify the requirements for a good geospatial support capability during all phases of an incident.

2. Appendices provide technical guidance about planning and delivering such a system, including examples.

The *Capability and Readiness Assessment Tool* (CARAT) (NAPSG, 2018) developed by the NAPSG Foundation uses the concept of "crawl, walk, and run" stages to determine the level within which a certain capability would be at and is a useful tool to help an agency determine where gaps and weaknesses exist and need attention:

- **Crawl** – basic capability, and just getting started. Need to understand what to do next and how to develop further. E.g. using paper base maps to mark-up situational awareness information.
- **Walk** – moderate and limited capability (e.g. web map updated by a GIS specialist supporting an incident based on information gathered at the IMT and from the field).
- **Run –** advanced and smart capability, using analysis tools to provide value added information (e.g. makes use of direct field data feeds to instantly update the web-based Common Operating Picture (COP) and derive additional intelligence).

# 3. HOW WILL GIS BE USED?

A GIS is an information system that lets us visualise, query, analyse and interpret data collected from various sources. Much more than a map, a GIS is interactive and can provide a mechanism to centralise and visually display all data relevant to an oil spill within a geographic context.

GIS products are built with thematic layers of data, each of which can be stored in an individual file. When displayed together, after some analysis and interpretation, these can reveal underlying intelligence and relationships distinct from each of the individual layers, often through the power of the GIS software. For example this data can be overlaid together on a map to show which sensitive species habitats will be affected by an oil spill, current weather conditions that will influence the movement of the oil, the best locations to deploy the booms, as well as the location of those first responders who will be involved in the containment (NAPSG, 2013). In addition, it can calculate and anticipate potential areas of impact so that emergency managers can better understand the inherent risk, formulate a response and foresee recovery needs. This information can then be displayed in maps, charts, graphs, or reports, and disseminated in several way including the web.

GIS provides situational awareness that enhances incident-level decision making. During a marine incident, GIS can answer many questions graphically, including:

- Where is the oil spill?
- Where and when will the oil impact the shoreline?
- How can the coastline be protected?
- What are the potential environmental impacts?
- What will be the economic impacts (NAPSG, 2013)?
- If a vessel has lost power, where could the vessel drift towards? Where could it potentially impact?
- Where a vessel has lost containers, where are these like to have drifted or sunk, and what resources could they affect?

# 4. KEYS TO EFFECTIVE USE OF GIS

Emergency managers and first responders need to understand that the most important key elements to a successful and effective response are integration, training, communication, cooperation, and understanding (NAPSG, 2013)

## 4.1. Communication

Good communication and efficiency is key to achieving goals quickly during marine response. Besides communication with the responding team directly involved in the response, there may be several different local and state agencies/organisations involved, and depending on the size of the incident this may involve any number of them. Jurisdictions should consider how their GIS Team will communicate with the various interest groups, and this will be dictated mainly by jurisdictional requirements or policies. As per NAPSG (2013), communication opportunities that GIS professionals could be involved with may include:

1. **Local or State GIS Emergency Responders** – must ensure you go through the command and control structure. The lead Commonwealth agency or responsible party could be providing additional resources and support, but you can also contact your State GIS Coordinator to request additional resources. A listing of State Coordinators should be made available.

2. **GIS coordination calls and distribution lists** – Determine how to get on relevant State or Commonwealth Government GIS coordination calls and/or distribution lists. Many states have active distribution lists even when there is not a current incident. Also, during an event, there are typically coordination calls that occur between groups that are working on the incident. It is important for a representative from the GIS group to be involved in these calls. To learn about these groups/calls it is suggested that you contact your State GIS Coordinator or State Geographic Information Officer's (GIO) office (refer to 1 above).

3. **Special Interest Groups** – there are many special interest groups that will want to be involved during an incident. Consider who will respond to GIS-based questions special interest groups submit. This will most likely be through the Public Information Officer (PIO). GIS staff should direct all requests to that individual, and should never send out information directly. Having one point of contact or knowing who within the response group will be responding to special interest groups will ensure good, consistent communication.

4. **The Public** – during a large-scale event, the public will also be looking for information. Press releases and news-based information should be handled through the PIO in the IMT. However, the GIS team should explore creating a web-based application to disseminate information to the public if approved by the incident's Public Information Section.

## 4.2. Emergency Managers and Responders

NAPSG (2013) suggests that some of the key elements emergency managers and first responders need to be aware of on how the of the use of GIS will be most effective during an event are:

1. Secure suitably qualified GIS staff prior to an oil spill incident.
2. Provide appropriate bandwidth, Internet connectivity, servers, printers/plotters, software, standardised platform, supplies and IT staff support.
3. Meet with your GIS team prior to any oil spill incident to understand what GIS can provide to assist your emergency management needs and the timing required to obtain that product.
4. Integrate the use of GIS into the standard operating procedures/emergency management workflow.
5. Provide regular communication with the GIS team on emergency management and first responder needs, expectations and product delivery timetables. Ensure that GIS staff are in constant contact with the data management group.
6. Provide the GIS professionals with a clearly defined organisational chart so that they can understand the structure of the organisation and who to go to get things done.
7. Provide your GIS team with regular training on GIS software/tools as well as integrating the use of GIS into emergency management drills/scenarios.
8. Provide a space/room in the ICC for the GIS team to work together/collaborate. This will help to streamline workflow and foster better communication.
9. Designate a GIS liaison to work with the emergency managers and first responders to meet their needs and suggest support that can assist them in resolving their issues.
10. Understand that GIS can be used for more than just planning, and can extend to logistics and operations.
11. Enable proper coordination with State and Commonwealth Governments when appropriate.

12. GIS staff can benefit from basic oil spill training (e.g. science of spills, SCAT, online oil and chemical spill response training). It is recommended they have a working understanding of spill trajectory modelling and Adios3 oil weathering charts.

# 5. THE GIS TEAM IN THE IMT

The ICS command structure under the Australasian Inter-service Incident Management System (AIIMS) (See Appendix 1) is set up to provide a common incident management system that provides a framework for first responders both in the ICC and in the field to work collaboratively and effectively.

During an incident, under the AIIMS structure, the GIS team will often be placed within the Mapping Unit, in the Intelligence Section, either as its own unit or as part of a Situation Unit:

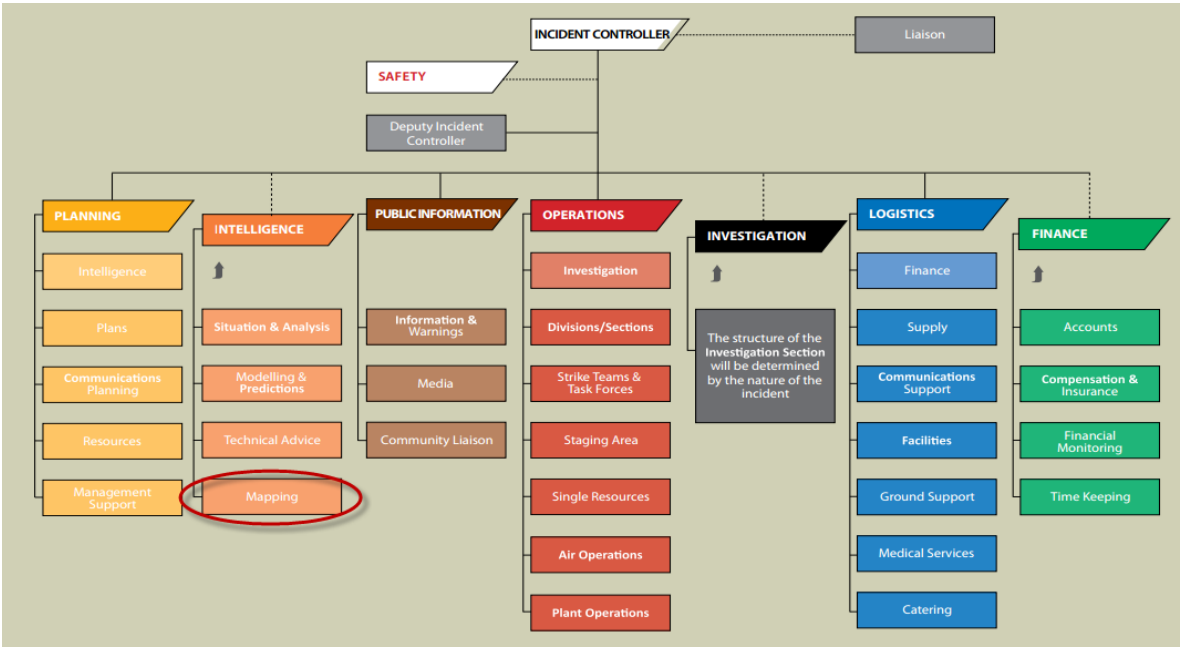



**Figure 1 - The Mapping Unit within the Intelligence Section of the Incident Command System**
*[Source: AIIMS 4, 2013]*

GIS professionals working in the IMT need to familiarise themselves with the IMT organisation chart during the event so that they understand what the reporting lines are and also where to source information from. Refer to *Section 7.5.3 AIIMS Training*. This will ensure that the information is flowing through the correct line of command. Here is where a list with pre-determined contact list and shift preference can be used to reference to during the response.

# 6. PREVENTION

Prevention includes activities designed to avoid or prevent an incident from occurring in the first place and to reduce impacts resulting from those that do occur.

Geospatial assets can inform mitigation planning in important ways, perhaps most importantly the opportunity to visualise and measure the effects of alternative mitigation plans. These can include:

- Development of risk assessment data based on sensitivities and vulnerabilities, and
- Predictive stochastic models to predict probability of oil event impacts over a period of time

# 7. PREPAREDNESS

Preparedness is a crucial component to a successful emergency response (NAPSG, 2013). It involves ongoing activities to prepare for a major incident and shorten the time required for the subsequent response phase. During this phase, plans are developed to address response and recovery requirements, and to train/exercise GIS responders to prepare for a real event.

For geospatial requirements, this phase has the following objectives:

- Identify data requirements
- Develop data structure and base data sets such as:
  - Infrastructure
  - Hazards and risks
  - Oil containment and recovery equipment locations
  - Shoreline segments and types
  - Habitat and biological assets
- Determine common data standards for dissemination and storage
- Compile and update metadata
- Coordinate cross-agency data sharing and sourcing
- Develop Memorandum of Understanding (MoU) with external agencies
- Identify available GIS resources and support, both internal and external – personnel and equipment
- Develop templates for maps, documentation, folder structures, etc. (See Section *7.2 Mapping Protocols*)
- Develop databases for specific recovery and response activities
- Develop web applications for data collection, analysis, and delivery
- Develop imagery user requirements including a plan for requesting acquisitions
- Develop standard map symbology for the data
- Develop probability models of resource impact
- Establish risk models
- Develop and maintain shoreline and field data collection tools

## 7.1. Planning Documents

These documents assist with the response to a marine incident by providing information about an area being effected by a spill. They are often used pre-event to create a response plan, or post-event to determine where to focus restoration or clean-up (NAPSG, 2013). These will often contain valuable data and information that the GIS Team will need to consult and need be aware of.

### 7.1.1 Emergency Management Policies

Appendix 1 outlines some examples of emergency management policies that GIS personnel should become familiar with and understand. Each jurisdiction would also have their own in addition to these.

### 7.1.2 Contingency Plans

Contingency Plans are established by the State and Territory Marine Pollution Control Agencies to help respond effectively to a significant future oil spill incident within their jurisdiction. These can be prepared at a National, State or local level. It may include plans and processes for preparing and responding to an oil spill, as well as for containment and recovery of the oil. It is important to note that each jurisdiction has a State Contingency Plan which the GIS team should have read and incorporated into their templates and data requirements pre-event, as they may contain specific response requirements for the area.

### 7.1.3 Resources at risk mapping

These are maps that compile information for coastal shoreline sensitivity, biological resources, and human resources (NAPSG, 2013). The information is used to create pre-event clean-up strategies to help emergency managers and first responders to prepare to take action during an oil spill. It is important to note that each state has one or more Environmental Sensitivity Index (ESI) atlases and associated GIS data which the GIS team should have read, understood, and incorporated into their templates and data requirements pre-event. More information about ESIs can be found here.

Shoreline sensitivity to spilled oil is classified based upon:

- Relative exposure to wave and tidal energy
- Biological productivity and sensitivity
- Substrate type (grain, size, mobility, and penetration)
- Shoreline slope
- Ease of cleanup
- Ease of restoration

This relative ranking scale based upon overall sensitivity to spilled oils has a range from 1 to 10, with 10 being the most sensitive. There can be additional subdivisions within this general scale such as A, B, C, etc. to help further refine shoreline types. A typical ESI map legend will generally look like the following:

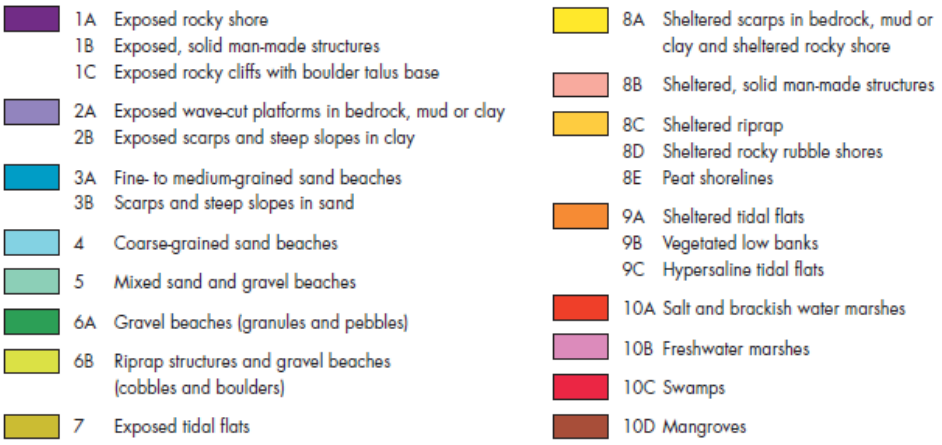



**Figure 2 - Colour code of Environmental Sensitivity Index**
**[Source: *IPIECA, 2015*]**

### 7.1.4 Site specific plans

These are site-specific strategies used as guideline for emergency managers and first responders for the initial response to an oil spill and whose goal is to ensure the response to a spill is fast and effective. Preparing site specific plans prior to an incident reduces the time needed to make decisions during a spill, by providing essential information about the site, including maps, the equipment needed, access details and other relevant information (NAPSG, 2013).

Each plan map serves as an oil spill responder's quick reference guide to the resources at risk which are prioritised based on their sensitivity to oil and a protection strategy to be used during an emergency response. Weather, tides, currents and storms, as well as the availability of resources, all play a role in the final strategy agreed upon within these plans.

## 7.2. Mapping Protocols

Mapping protocols and standards ensure consistency by maintaining a uniform look and feel, and to facilitate interpretability and ease of use. GIS staff should follow the guidelines listed below when creating map products in support of an emergency event (NAPSG, 2013).

### 7.2.1 Common Operating Picture (COP)

A COP consists of a central GIS-based platform, usually web-based, that provides a single source of data and information for situational awareness, coordination, communication and data archival to support emergency management, response personnel and other stakeholders involved in or affected by an incident. Individual agencies may already have an established COP in use. This may be a system specific for maritime incidents or can be as part of a jurisdictional all-hazards system.

The most powerful thing about a COP is the ability to push content out to many different target applications. The information stored in it can be viewed and queried on a computer, a mobile device application, or a web-based viewer. This allows emergency managers and first responders to be completely mobile and take their response efforts out of the command centre, and creates an environment that all responders involved can use (NAPSG, 2013).

For a COP to function effectively, it must provide operational information in near-real-time (IPIECA, 2015). It is important for GIS personnel to be already familiar with the COP being used, including its functionality, access, and related policy.

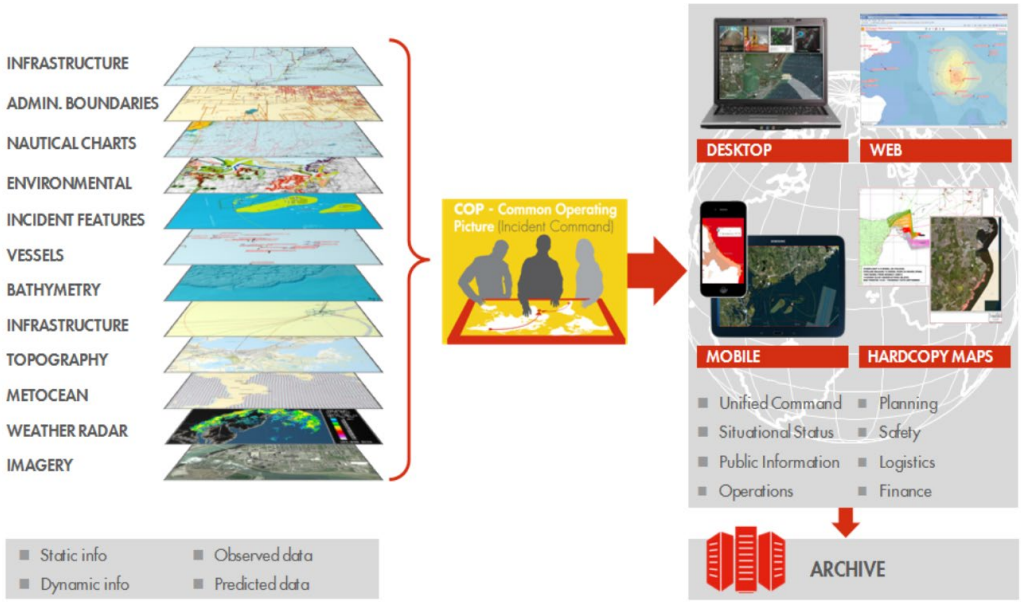



**Figure 3 – Common Operating Picture, highlighting geospatial information**
**[Source: *IPIECA, 2015*]**

In a growing number of cases, online mapping viewers are being made available to the public to communicate the status of an event. In this case, it is recommended that the viewer and any data included be determined pre-event.

### 7.2.2 Incident Management Systems

Incident Management Systems provide a secure platform for emergency managers and first responders to share real-time critical information, decisions, and intelligence during a maritime emergency.

NEMO is an example of a web-based incident information management system used by the Australian Maritime Safety Authority (AMSA) to manage marine pollution incidents (AMSA, 2018). It is based on the Noggin OCA platform, and customised to manage and monitor all national pollution and maritime casualty incidents and provide asset management capability. Each jurisdiction may have their own system requirements for its use, or even use the State version of NEMO.

GIS personnel need to familiarise themselves with what their jurisdiction have in place, what are the user requirements, and any related use policy. Training on these systems may also need to be considered.

### 7.2.3 Online GIS servers

Cloud-based GIS servers are useful for storing and centralizing GIS data access, as well as providing secure webservice layer access. ArcGIS online is an example of a complete cloud-based mapping platform hosted by ESRI, where data and maps can be shared and made available online to the IMT. Data collected in the field can be saved to this area and instantly seen by all, including in the COP.

### 7.2.4 Consumable Web Services

Consumable Web services are GIS data layers that can be accessed over the web, allowing data, maps, tools and other GIS services to be shared to multiple devices and platforms. A benefit of using consumable services is that changes to the data and maps can be seen by everyone using the service as soon as the updates are made. Another benefit is that one dataset can be used on several different maps or web applications. This allows for data to be created once and utilised in unlimited maps or applications. It is important to note that when using consumable services the data archive will need to be maintained, and a process to do so during an incident should be established pre-event (NAPSG, 2013).

Decide whether your agency would like to disseminate geographic information in this way.

### 7.2.5 Incident Data Access

Establish protocols for collecting data and creating maps when technology is not available (i.e., no internet connection, no electricity, etc.). If field collection devices are not available, have a large-scale plotter to print paper maps for staff going out in the field. Ideally, a mobile system will be available. This allows data updates to be pushed directly to the systems for immediate consumption. If a designed technology is not available, then consider other options that allow field collection. For example, taking geo-referenced photographs with a smart phone that can be uploaded later, phone calls where data (such as the presence of oil) are called into the Incident Command Post (ICP), or paper-based forms that can be used in the field when no other technology is available (NAPSG, 2013).

It is also important to establish protocols for verifying data collected in the field. This is particularly important when that data is collected using paper forms or other non-technology-based methods. Establish these protocols early in the process to ensure consistent data is being collected for the duration of the incident, including any mitigation strategies for when digital technology or connectivity is not available. At a minimum, a standardised data collection form should be used (NAPSG, 2013).

### 7.2.6 Map Elements

All map products should contain a minimum set of cartographic elements so as to provide a reference to users on how to interpret the contents of the map and how the information in it should be treated.

The placement of information and style will vary between map types and the audience it is intended to.

Appendix 9 outlines an example of the minimum set of features that it should include.

### 7.2.7 Map Distribution Protocols

Establish a protocol for distribution and dissemination of maps, either during the incident or beforehand to ensure that information is disseminated promptly and to the correct audience.

The protocol will indicate to GIS Staff to which recipients (e.g. public, media, etc.) certain maps or GIS incident data are to be released to. The protocol should include the personnel authorised to request or instruct the release of information.

### 7.2.8 Map Symbology Guideline

Standard map symbolisation should be applied throughout the COP, including paper maps, web mapping, and mobile mapping (IPIECA, 2015). Any user should be able to immediately identify map features on different COP and map products without having to decipher the information.

The Emergency Management Spatial Information Network Australia (EMSINA) has developed a symbol set specifically for all hazards. However, complete oil spill response specific symbology is not currently included, and is in the process of being developed. AMSA is leading the development of this.

Where possible, jurisdictions should create standard symbology for existing data and guidelines for creation of new oil spill symbology. Ideally, this should be consistent with the EMSINA symbology guideline but also with consideration to any other jurisdictional symbology standards.

The current EMSINA symbol set can be accessed here, and should be pre-loaded on to response laptops.

ESI maps should utilise the standard symbology defined by jurisdictions and which are also compliant with EMSINA and their own jurisdictional all-hazards standards.

### 7.2.9 Quality Control

The quality and accuracy of geospatial data dictates the overall value and level of confidence that is placed on map products that underpin decision-making during a response. There can also be implications for litigation if decisions have been made on information or data that is of poor quality or accuracy.

It is important to establish sound Quality Control procedures that include how to handle incorrect or inaccurate data and any processes for dealing with this and data/map quality checks. Before a map is released from the GIS Unit all map elements must be updated, with special attention to time and date information, as this is critical when asked to reproduce a map or for after action reporting or for post-incident inquest purposes (NAPSG, 2013).

### 7.2.10 Map Products and Templates

Anticipate what map products will need to be created, including the product objectives, target audience, cartographic requirements, and the data layers to be included. This is preferable discussed pre-event to allow the GIS staff time to create the relevant templates, familiarise themselves with the data commonly used, and have input on various ways GIS can be used during an oil spill event (NAPSG, 2013). Map templates allow geospatial information to be presented to end users in a consistent fashion and providing select sets of information specific to different audiences and teams. They also speed up the process of getting the maps out to the IMT especially during the first response period. Map templates and elements may need to be changed or added as the incident expands and contracts (NAPSG, 2013). Examples of common mapping products produced include (NAPSG, 2013):

- boom locations and status of booming operations
- environmentally sensitive areas relative to the spill
- actual and predicted movement of the spill
- trajectory model input data – tidal heights, wind direction and speed, water temperature
- location of emergency responders and equipment in the field.

- location of any facilities in the area, the types of facilities and how much oil they contain.
- Logistical information – locations of potential staging areas, access points, etc.

These templates should already be populated with base data, map layers, incident specific information, commonly used page layouts and symbolised as per local map products and/or following standard symbology (IPIECA, 2015). They should align with the desired map products and target different audiences. Oil spill specific data that may be included in templates may include those listed in Section *7.3.5 Essential Data Layers*.

Define what the primary and optional map products will be. Primary map products communicate incident specific details as well as general environment and infrastructure information to support emergency management operations (IPIECA, 2015). Optional map products provide supplementary and specialised information for use during the response and recovery phases of the incident. Other ad-hoc map products may also be requested to meet incident specific needs.

*Appendix 8 lists some descriptive examples of some common map templates.*

## 7.3. Data Management

A Data Management Plan, for either a simple or a complex incident, should be developed to ensure standards are followed. This includes: expected data formats, data collection formats, data delivery schedule, and data repositories. Having this kind of agreement in place in the early stages of an incident is essential so that data management is done properly from the beginning and GIS staff are not having to spend their time correcting quality control or data flow issues from the start of the response (NAPSG, 2013).

The Plan will address the following (NAPSG, 2013):

- Determination of what data is available for use versus what data needs to be acquired/produced
- Sharing protocols, data delivery schedules, data expectations, data formats, information flow, roles of staff, methods and systems used, documentation/archiving
- Need for a GIS Database Administrator (DBA)

NAPSG (2013) recommends that data formats, data and map transfer protocols, and backup policies must be standardised and agreed to prior to an incident. You need to consider native data and file formats that emergency responders and other GIS responders in the field will be able to access and read.

Consider storing all data and information in a cloud service (NAPSG, 2013), to prevent any data loss due to network connectivity issues, and to ensure it is backed up and stored correctly. Alternatively, if this is not an option, store data locally at the ICC on a computer or hard drive designated to the incident, and on a scheduled backup to an online cloud server.

### 7.3.1 File and data organisation

As per the NWCG Guide (2006), consistent and clear file naming and directory structure conventions are critical for ensuring an effective transition between GIS teams, by making it easy to locate and search data or products.

A common, standardised file naming convention and directory structure is not only good practice, but should provide self-evident naming protocols that are specific not only to each individual incident but also appropriately timestamped to each incident.

#### 7.3.1.1. GIS File Directory Structure

GIS staff need to be made aware of where data and maps are to be retrieved from during an incident. This can either be from a folder location or web application.

Establish a set directory structure convention prior to an incident, to avoid many wasted hours later in the incident. A digital template of this structure should be available to copy and paste from a predetermined location, preferably from a local drive in the event that a network connection is not possible. Otherwise, consult relevant documentation on how to recreate this.

*Appendix 7 shows an example of how a directory structure could be set up.*

#### 7.3.1.2. GIS File Naming Convention

A consistent file naming and directory structure also has the advantage of serving as a type of metadata, and facilitates archival and use by the agency in control of the incident (NWCG, 2014).

File names must be complete and self-explain their purpose, when outside of the file structure. They must be concise, use clear text, and avoid ambiguous terms or acronyms. However, map documents (.mxd) and exported map products (e.g. .shp, .jpg, .pdf) should reference in the name the map type, size, and orientation, as well as a timestamp and general map type description.

*Appendix 10 outlines a suggested GIS file naming convention that can be applied. However, you will need to consider your local protocols for this component.*

### 7.3.2 Data Format Conventions

Adhere to specific data format conventions to ensure recipients are able to open, exchange or view data. These should not set standards for the use of any particular software (NAPSG, 2013).

*Appendix 11 shows an example of a data format convention.*

### 7.3.3 Data Backup Policy

To avoid duplication of effort from loss of outputs and data, have in place a sound backup strategy. Legal action and cost recovery efforts are often associated after a large protracted incident, so it is recommended that all work is saved, and there is some sort of record keeping of a time log or journal of events, people, and requests made (NAPSG, 2013).

If there isn't a backup policy already in place, establish one that will include best practice on how often backups are to be made, who will make them, and where these will be stored. You will need to check your agency's security policy in relation to use of portable devices if using these for backups.

### 7.3.4 Geodetic Datum

Each jurisdiction needs to establish the datum data will be supplied in and created.

Generally, the preferred datum is the World Geodetic System of 1984 (WGS84), which is the datum used in navigation and in Global Positioning System (GPS) devices. However, the Geocentric Datum of Australia (GDA94) is approximately equivalent (to within 10 cm), and is also acceptable. GIS Staff should endeavour, where possible, to comply with and update existing data into WGS84. However, jurisdictions can establish the preferred datum to use for the data and maps and define this in the Mapping Unit Standard Operating Procedure (SOP).

### 7.3.5 Essential Data Layers

This section provides guidance to datasets that GIS personnel will need prior to and during an incident. It should include where to obtain and how to evaluate data for the minimum essential

datasets— the base datasets (other than incident data) needed to meet the business needs of maps and analyses (NWCG, 2014).

Base and incident specific geospatial data should be sought from the relevant jurisdiction's geographic information provider, and GIS personnel need to find out what state or regional data warehouses or portals are available. Where there are strict data access and license restrictions imposed, agreements for data sharing during an incident should be established in advance.

A list of these should be documented in case GIS assistance is provided by individuals or entities not familiar with the local data. It is also a good idea to have this data available in a location or hard drive that can be shared and accessed by other responding agencies or to easily reload data in case of hardware failure.

Data used during an incident will generally fall under three categories:

#### 7.3.5.1. Baseline information

This information is sourced and prepared in advance of an incident and may not necessarily relate to a specific incident (IPIECA, 2015). It will normally exist before the occurrence of an incident, and should be gathered and updated routinely as newer information becomes available. Information of this type will include for example: risk and threat assessments, resource and environmental data, contingency plans, trained expertise and experience, topographic data, bathymetry etc.

#### 7.3.5.2. Predictive data

This is information based on baseline knowledge and delivered in real-time from established sources and systems about location, process and outcomes (e.g. weather services, fate, and trajectory modelling) (Hook et al., 2016).

#### 7.3.5.3. Field information

This includes all of the relevant information that is generated during and after a spill incident and relates uniquely to that incident. It includes real-time actions and effects, obtained using various forms of field observation, sampling, and monitoring capabilities (Hook et al., 2016).

*Appendix 12 lists the data that would fall under each of the three categories above*.

### 7.3.6 Remote Sensing imagery

If satellite or aerial imagery is expected to be used during a response, consider what type of imagery will be required, whether imagery may meet multiple requirements during the response, what the acquisition process of this imagery will be, any agreements in place with imagery providers, analysis requirements, and how and to whom the imagery will be distributed after it has been acquired.

### 7.3.7 Spill Trajectory Forecasts

Using datasets and modelling software called Oilmap, RPS creates on behalf of AMSA trajectory forecasts in the event of an oil spill. Oilmap predicts the trajectory oil might follow in a body of water, either on the surface, below the surface, or both. During an oil spill incident, emergency responders rely on these oil movement and fate predictions to assist with containment and clean-up.

Requests for models from AMSA can be done via the NEMO Portal. A login and password is required for accessing the form. If you don't have a login, you will need to contact jurisdictional marine pollution control agency.

The National Oceanic and Atmospheric Administration (NOAA) provides a similar modelling tool called *General NOAA Operational Modelling Environment (GNOME)*. This tool is free to download and use. It also has a tool designed to import the trajectory products into ArcMap.

### 7.3.8 National and Local Geospatial Products and Programs

There are many geospatial data and tools resources available at both Commonwealth and State level. Appendix 14 lists some of the main ones that are available that could be accessed and used during an emergency event.

However, each jurisdiction should investigate what they have available within their region and compile their own guideline on how to access these.

### 7.3.9 Data Dissemination Protocols

Data dissemination is a vital part of incident response, and each jurisdiction will have different data dissemination protocols (NAPSG, 2013).

For dynamic data exchanges, consider data standards such as OGC to facilitate data dissemination and information exchange. (NAPSG, 2013).

Larger data files such as imagery or national datasets can be more difficult to manage. These are often shared through the physical transfer of external hard drives and other portable media, or cloud-based systems.

Identify a common information storage system to access response information as well as for archival purposes. This system should be able to handle high volumes of multiple types of information (GIS files, documents, maps, satellite imagery, photos, etc.), and also be able to cope with high data transfer traffic. The system must be accessible by all IMT personnel and must meet appropriate software and hardware security protocols, required by both private industry and government organisations (NAPSG, 2013).

Outline a detailed plan for data flow between an ICP in the field to the ICC to State Operations Centres to Commonwealth Operations Centres (NAPSG, 2013). Emergency managers must have access to data products in a timely manner to assist in their decision-making. Consideration must be given how the different data types and formats will be disseminated and to which audience.

### 7.3.10 Information Dissemination Protocols

Use visualisation platforms as well as data transfer protocols as a way of sharing information between the GIS unit and other agencies involved in the response, in a timely and effective manner, and following the IMT chain of command. Situational awareness information for instance, can be easily shared via visualisation tools to provide decision makers with rapidly needed information to effectively manage the incident.

### 7.3.11 Public Data Sharing/Exchange Policy

Establish rules and requirements for the sharing of data, or reference existing policies, for release to the news media and the public. It is imperative that any information outside the incident is not released without prior approval.

*Appendix 13 gives an example of a GIS Media Package Policy*.

Establish:

- what datasets are to be shared on a daily basis
- who should be the recipients of the data, particularly in regards to sensitive data
- what format is the data required in
- what mechanisms are in place to distribute data – e.g. FTP site, Collaboration site

There are three types of data sharing in an incident (NWCG, 2014):

- Data uploads to an FTP site (or similar) – allows users to access current information easily; password restricted
- Incident data sharing with authorised users – e.g. via the COP, from the field
- Transfer of data at team transitions

### 7.3.12 Data archival and version control

Archive all incident data for future reference, and which must be retained for regulatory compliance and possible prosecution. Have a system in place to have the ability to quickly refer back to a previous day's GIS data view if necessary. If an ESRI ArcGIS server environment is used, it must allow for easy access to old data views and must not include overwrite old datasets (NWCG, 2014).

With the exception of sensitive data, these should be stored separate from the working GIS directory (NWCG, 2014), in the jurisdictional agency's enterprise geodatabase and under a predetermined set file structure. The process and connection properties for connecting to the SDE databases should be established and documented. It is recommended that someone monitors the database to ensure the organisation and accuracy of the data.

Consider the protocol by which data archiving and version control will be done, including version frequency (e.g. daily, twice daily, etc.).

### 7.3.13 Data Connections

Data connection path information is important to document in case automatic data connectivity fails or when new GIS teams start their shift. Data connection protocols are not easily remembered when under pressure or fatigued and so it's essential to ensure that this information be recorded somewhere, like for example, included in the *Mapping Unit SOP*.

## 7.4. Staffing resources

Identify GIS staff expectations and team structures prior to an incident, and make these known to potential GIS responders prior to them agreeing to become part of the GIS team during an incident. The environment in an ICC during an incident can be very overwhelming and frenzied, with request for information and maps coming from various staff and at various rates.

This section is to identify GIS Staffing periods and team transition requirement.

### 7.4.1 Staffing requirements

Identify and train GIS personnel prior to an incident.

Have plans in place to ensure there are sufficient staffing resources available. Requirements will be dictated by the size of incident, duration of the event, and phase (i.e. response, damage assessment, recovery).

The structure should preferably be modular and scalable and modified based on your jurisdictional needs. For instance, in a smaller incident, one person could fill multiple roles and in a large-scale incident several people could staff the same role (NAPSG, 2013). Ideally, there should be one designated mapping leader and one or more mapping officers. In a larger incident there could be more specific mapping roles required (e.g. imagery analysis).

*Appendix 5 lists examples of the possible geospatial roles and their responsibilities in an ICC.*

### 7.4.2 GIS Responder Expectations

GIS staff are essential personnel during an incident, and their availability needs to be properly managed.

Responders are also expected to work under incident conditions, which may include working long hours while keeping a high performance level and intensity. Consider that some GIS staff may not be familiar with having worked in an IMT environment before and may feel overwhelmed with the volume of requests and product turnover rate. Some may not function well in this type of environment and may not be suitable as a GIS member in an IMT. Identify a protocol or program on how this staff could be suitably trained or inducted in working in an IMT, prior to working in one, and set the expectations on what the work will entail.

### 7.4.3 GIS staff knowledge, skills and abilities

GIS staff deployed to an incident should have as a minimum, the following set of technical skills and abilities (NWCG, 2014):

- Use the standard commercial off-the-shelf (COTS) GIS software effectively
- Work with a variety of raster and vector spatial data types
- Understand GPS data collection methods and be able to download, process, and incorporate the data
- Understand the use of various projections and datums that include geographic coordinates, and be able to re-project data in multiple formats
- Answer questions requiring basic GIS analysis and geoprocessing skills, such as extent of oil, assets affected, etc.
- Troubleshoot hardware and software problems sufficient to stay operational or communicate these to IT support staff (e.g. perform basic software installs, ensure the license managers are functioning, install print drivers, or connect a plotter to a computer)
- Communicate effectively with people inside and outside the Situation Unit to:
  - explain technical issues or concerns
  - train others in basic map reading
  - exchange technical information
- Perform duties in incident conditions – i.e. working long hours, under cramped conditions, tight deadlines, basic amenities, long periods away from family and home.
- Prioritise and adjust workloads
- Have a basic understanding of the ICS structure under AIIMS
- Follow safe work practices and procedures, including managing fatigue and personal welfare.

### 7.4.4 Mapping volunteers

Additional GIS and mapping specialist resources are often available within each jurisdiction, through one of the local Emergency Services agencies. For example, the Australian Capital Territory Emergency Services Agency (ACTESA) manage the Mapping and Planning Support Group (MAPS), who provide mapping and other spatial services to an IMT that are dealing with emergencies. The main philosophy of MAPS is to provide additional personnel and support to existing mapping services. Although they mainly specialise in bushfire emergencies, they can also assist to during floods, cyclones, land search & rescue (SAR), and also oil spills.

AMSA has signed a MoU with ACTESA to formalise arrangements for the provision and deployment of MAPS volunteers to support mapping requirements during a tier 2 or 3 oil spill response managed by AMSA. This group can also be accessed from outside the ACT, and AMSA can assist in activating the group during a protracted incident.

Consider however, establishing MoU arrangements with similar jurisdictional groups.

### 7.4.5 Team Transition

This involves the handover of all mapping tasks and all relevant GIS data and media to the next GIS team shift. To ensure a smooth transition between shifts, it is essential that GIS staff accurately maintain a record or log of all requests and their priority level as well as what has been delivered and what is pending. This will also be necessary as a record of all mapping activities and requests, for when there is an inquest into the incident.

A handover document is best initiated at the beginning of the assignment, as a way to track ongoing work (NWCG, 2014). This should be included as part of the *Mapping Unit SOP* (Refer to Section *7.4.7 Mapping Unit SOP*).

### 7.4.6 Documentation

Documentation should be done throughout an incident. The Mapping Unit Log and should provide a chronological, comprehensive, and accurate record of the geospatial support activities during the incident and record any significant changes to the incident data and the products produced (NWCG, 2014). This can include:

- Track of all products requested, showing dates created, due, and delivered
- personnel transition and special assignments
- Records backup/archiving of data
- any issues or events that impact the Mapping Unit's ability to deliver products

Attachments may include a list of the types of maps produced or any special products requested during an operational period (NWCG, 2014).

### 7.4.7 Mapping Unit SOP

The *Mapping Unit SOP* (or similar) is a quick access guide that should contain all the information that an incoming GIS team needs to know to continue the work without having to contact the previous GIS team. It should remain within the Mapping Unit for the duration of the incident, and updated as required.

The SOP will also contain incident specifications, which should be created at the beginning of the incident. This document outlines the operating procedures for each incident and should be available at handover time for incoming GIS personnel.

Appendix 4 gives a suggested list of what the *Mapping Unit SOP* should contain. Establish a template for this.

### 7.4.8 Handover

Consider having a structured approach to a handover process for incoming GIS team shifts, so that information is transmitted between incoming and outgoing teams consistently. The Mapping SOP is a good starting point to use as a guide for this.

When setting up the GIS team and running through the first operational period, GIS staff must follow incident check-in procedures and complete certain tasks, which might be different to those on subsequent shifts.

*Appendix 6 provides a guide on what the initial setup, start and end shifts should cover.*

## 7.5. Training and Exercises

Training and exercises ensure emergency responders are prepared to respond to an oil spill incident, and it is an important part of implementing your agency's SOPs. For a GIS team, it will help them know what types of situations to expect, decide what GIS products are most useful and exercise overall teamwork and dynamics expected during an actual event.

### 7.5.1 Pre-Event Training

It is recommended that GIS staff, particularly those that may not work or be exposed in the emergency management field on a regular basis, actively participate and get involved in regular training and exercises with spill control agencies.

Consider development of some type of customised training package and schedule targeted at GIS staff who are not normally exposed to working in either an ICC or maritime incident scenario, and include use of software/tools and emergency management scenarios.

Staff turnover as well as changing technologies and procedures makes it particularly critical for GIS professionals to regularly maintain their skills in this field. The GIS team that will be assisting emergency managers and first responders need to be familiar with responding to incident in order to be most effective (NAPSG, 2013).

Jurisdictional oil spill response agencies should therefore include GIS personnel, both internal and external to the agency, into their exercise whenever possible so that GIS processes get put into practice as well.

### 7.5.2 Training Resource Kits (TRKs)

A set of nationally-consistent and competency-based learner and assessor resource kits for the training of mapping assistants and mapping members has been developed by EMSINA under assistance from the Department of Environment, Land, Water and Planning Victoria. They have 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.

The units of competency in this training cover required to be able to work within the team environment of the Mapping Unit in the Planning Section of AIIMS during emergencies in either of two roles:

- Mapping Assistant
- Mapping Team Member

Training content includes how to:

- Collect basic data using information technology and equipment within a spatial information handling framework
- Interpret (i.e. to identify, analyse and evaluate) image data information from various types of image data
- Apply GIS software correctly to resolve problems and use spatial and non-spatial data in an integrated manner.

Although not essential for formal training, this should be considered as another resource. Access to this training kit material can be obtained through the EMSINA web page.

### 7.5.3 AIIMS Training

When responding to an oil spill incident as a GIS professional, it is important to understand the various emergency management and incident command systems in place, know how the ICC has been set up and understand the proper chain of command.

Research how your agency's ICS is set up, including familiarising with its organisational chart. It is essential that GIS responders undertake a course in AIIMS to gain a practical understanding on where they are placed within the structure of an ICC and how they are expected to interact with other sections. This should preferably be done before any other technical training.

# 8. RESPONSE

Response activities are those that are undertaken during the course of an incident. This is when geospatial information and analysis are the most critical to incident management and tactical decision making. Geospatial activities during this phase include:

- GIS Staffing and resource requirement
- Satellite/airborne imagery acquisition, processing, analysis, distribution and interpretation
- Development of information products
- Collection and generation of geospatial data, including development of maps, reports, and other products for decision-making
- Trajectory modelling
- Data distribution and management
- Net Environmental Benefits Analysis (NEBA)

## 8.1. GIS Resource requirements

It is essential to identify resources prior to an incident (NAPSG, 2013), so that time is not wasted gathering or sourcing these. A complete checklist, as provided in Appendix 3 as example, will help identify and verify what these should be.

The resources required will be a combination of GIS-related equipment and personnel skilled in delivering GIS analysis and products during an emergency.

### 8.1.1 GIS equipment and supplies

This includes things like hardware, software, peripherals, spare supplies, and personnel supplies. Some contingencies should also be in place regarding supply of critical items. For example, if the local ICC does not have computers loaded with the required GIS software or data, instructions need to be provided on where the equipment is located or can be sourced from.

Ensure there is appropriate bandwidth, internet connectivity, servers, printers, plotters and any other equipment needed for the incident. If bandwidth is inadequate or unstable, or key equipment is unavailable, communicate these requirements to the IT staff, so that steps can be taken to meet these needs. Establish a risk avoidance and mitigation plan for what to do without the essential items or services or other key items with high probabilities of failure (NAPSG, 2013).

### 8.1.2 GIS Personnel

If you don't have adequate GIS resources needed during a response, coordinate with other State and Commonwealth Government GIS professionals where appropriate to obtain additional resources. There are several other state or local GIS volunteer mapping groups available (see Section *7.4.4 Mapping volunteers* above), including GIS staff from jurisdictional marine response agencies.

## 8.2. SOP Checklist

This is a general checklist that summarises the process for the provision of geospatial support during an event. The checklist provided in Appendix 2 is a guideline and can be customised to best suit response to emergency events.

## 8.3. GIS Outputs, Products and Presentation

Each GIS product type serves a specific purpose within the incident and to the intended audience. How these are presented is quite critical, as they need to communicate the information clearly, analytically, timely, and accurately. Simply placing data layers on a map may not be sufficient, as there may be much more to that data that meets the eye.

### 8.3.1 What products are required for an oil spill?

During the course of an incident, the GIS Team will be responsible for delivering a number of GIS outputs containing incident information in a variety of graphical scales and digital formats, when requested by the IMT. The GIS Team needs to know what products and formats are expected and include them as part of the training so they know what to expect and how these assist during an incident. They will need to identify what data is required to produce those products.

### 8.3.2 Standard products

Standardise any map products during an event as much as possible and know where the data for those products is located. Establish a procedure for processing and logging standard products as well as new product requests, and communicate that with management and likely requestors. Develop a schedule for delivery of standard products based on IMT needs.

### 8.3.3 Product timeliness

During an incident it is crucial to get information out as quickly as possible, and is not the time to focus on detailed cartographic elements such as colours, titles, etc. Products need to be delivered in a time critical manner in order for emergency managers and responders to make informed decisions quickly.. If geospatial products are not delivered in a timely manner in an emergency, important decisions may be made without them.

### 8.3.4 Product simplicity

Keep presentations, situational reports and briefings straightforward and simple. GIS staff may not be working with individuals who are familiar with the technical GIS terminology or jargon. It is most productive to focus on the subject matter being depicted instead of the technical aspects of the work.

## 8.4. GIS Considerations

Some of the critical factors that GIS professionals must consider when working with ICC staff during an event are:

### 8.4.1 Needs assessment

The importance of data during an incident needs to be discussed with the incident response team as early as possible (NAPSG, 2013). As a general rule, all available data should be taken to be used during a marine incident. These events change rapidly, and it is better to have all datasets on hand to handle any issues or requests that arise. Consult with response staff and in advance to the response.

Determine what products need to be produced, including what data layers, maps and analyses are needed. Refer to section *7.2.10 Map Products and Templates*

Indicate if there will be any analysis to be performed. This can include for instance, calculating amount of boom needed to deploy, calculating area areas potentially covered by dispersants or total observed oiled, calculating distance to sensitive resources at risk, etc.

Identify key datasets collected and utilised during an incident, such as resources at risk or impacted, protection priorities for sensitive resources, Shoreline Clean-up Assessment Technique (SCAT) assessment and deployed field team locations, etc.

### 8.4.2 GIS is more than mapping

It is the role of the GIS team in the incident command centre (ICC) to ensure that the mapping and spatial products generated are useful to the incident command staff and to demonstrate the many other ways that GIS can be used during an incident. GIS can also provide answers to questions that emergency responders may not even know to ask (NAPSG, 2013). To get the best out of any system during a response, the GIS team needs to engage in dialogue and anticipation of responder intelligence needs, and deliver improvisation and innovation, as well as those standard data transactions and products expected by the various response sections.

From all the information collected, analysis can be undertaken on the data to extract value-added information that would not otherwise be available from each data layer individually. GIS is more than mapping and can be a powerful tool to view and query data in different ways to derive other information. For example: if the GIS team has been asked to create maps showing boom and platform locations, and the emergency manager is also concerned with having teams properly deployed, the GIS team could suggest using the oil trajectory data created with modelling to show the path the oil might take, and use that analysis to send teams to the appropriate locations. GIS can be used beyond its basic function in other ways (NAPSG, 2013):

- predictive modelling
- remote sensing mashups
- equipment tracking
- temporal displays (fly-through and animation)
- spatial dataset reporting
- form generation
- rapid field reporting using mobile devices which allow data to be uploaded to the server in real-time and pushed back to the field crews
- spatial division of labour
- GeoPDF production
- georeferencing photographs

## 8.5. Metadata

Metadata is essentially information about data sets held by a custodian or organisation, either in hardcopy or digital form. It provides information about the content, purpose, quality, lineage, point of contact, and attributes of the data layer it describes. It should be created for all incident data as well as base data that has been modified. It helps others understand the purpose of the data and how to best use it.

Metadata for spatial information is required for a range of purposes including: discovery, assessment to determine fitness for use, access, use, transfer and management.

Any geospatial data created during an incident, must meet a minimum set of metadata when leaving the ICC, especially any data released to the public. This is to ensure it is accurate an authoritative.

Similarly, data without metadata should not be used for decision-making, as reliability on its source and accuracy cannot be known or guaranteed.

Metadata should be created or updated compliant with the Australian/New Zealand Profile of AS/NZS ISO 19115:2005, *Geographic Information – Metadata* (implemented using *ISO/TS 19139:2007*, *Geographic information – Metadata – XML schema*), to ensure a consistent and uniform approach to the documentation of spatial information resources. Refer to the *ANZLIC Metadata Profile Version 1.1* documentation and for information on the technical definitions and specific requirements. The *ANZLIC Metadata Profile Guideline Version 1.2* should also be consulted together with the *ANZLIC Metadata Profile Version 1.1*, to facilitate its use and adoption. Additional metadata resources can be found in this page.

If during an event it is not possible to create compliant metadata due to time constraints, establish a guideline for the minimum metadata to be captured as metadata 'lite' (NAPSG, 2013), which includes basic information such as incident name, description, source of the data, contact information, date and time created/collected and any limitations the data may have. However, it does not eliminate the need for data intended to be released beyond the ICS to have full metadata (i.e. AS/NZS ISO 19115:2005 compliant.

The metadata file is best embedded in the data file itself, but can be exported in Hyper Text Mark-up Language (HTML), Standard Generalised Markup Language (SGML) or .txt format if required. It should be named in the same convention as the data to which it refers (date/time stamp, incident name, etc.).

#### 8.5.1 Metadata Toolkit

ANZLIC has developed a basic standalone metadata entry tool for creating embedded Metadata compliant with AS/NZS ISO 19115:2005 standards.

It is not a requirement to use it, but facilitates metadata creation. The tool is available for download here.

# 9. RECOVERY

Recovery includes the activities undertaken after an incident, and is designed to return the environment to its original condition. However, not all incidents may necessarily continue through the recovery phase.

Geospatial activities in this phase mainly include use of geospatial data (both base and collected during the response phase) to direct the recovery process:

- SCAT shoreline assessments
- Shoreline clean-up maps and data collection
- Data archiving and distribution

Damage assessments focus on long-term shoreline recovery as opposed to critical response operations (NAPSG, 2016). The post-event response uses reports from field observations, localised damage reports, imagery sources, models, and subject matter expertise.

## 9.1. Information availability

The large amount of data collected during a marine incident will be relevant beyond the initial response. The GIS team and emergency managers will need to establish a timeline for how long the data will be made available, what the process will be for requesting/obtaining the data and what data will be available versus what data will need to be kept confidential (NAPSG, 2013).

## 9.2. Shoreline Clean-up and Assessment Technique (SCAT)

SCAT is a structured method for surveying oil affected shorelines. It was created by NOAA in response to the Exxon Valdez oil spill in 1989 (NAPSG, 2013). It uses standarised terminology to assess shoreline conditions, and used subsequently to support cleanup decisions. SCAT work can form a big component of the GIS work both during and after the incident. It is important for the GIS team to get an an understanding of the principles by which shoreline is assessed through SCAT. Additional information on SCAT can be found here.

SCAT data collected in the field should be preferably done via mobile devices rather than paper forms to ensure timeliness of information delivery.

# 10. SUMMARY STATEMENT

The preceding guidelines provide a baseline against which maritime emergency response agencies should strive to develop their own Geospatial Capability.

Although not all of it may be possible to achieve for some agencies, at least in the short term, it should serve as the catalyst to begin researching ways of getting there. All agencies will currently be at various stages within their current capability, and so this will help identify where gaps exist and where further work needs to be done.

# Appendix 1 – Emergency Management Policies

Various emergency management policy documents guide agencies' internal organisation when responding to oil spill incidents:

## NATIONAL PLAN FOR MARITIME ENVIRONMENTAL EMERGENCIES (NPMEE)

The National Plan for Maritime Environmental Emergencies ("National Plan") implements Australia's obligations under the *United Nations Convention on the Law of the Sea, 1982*; the *International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990*; and the *Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances, 2000* with respect to the management of maritime environmental emergencies.

It sets out national arrangements, policies and principles for managing maritime environmental emergencies.

## AUSTRALASIAN INTER-SERVICE INCIDENT MANAGEMENT SYSTEM (AIIMS)

A standardised all-hazards incident management framework that is based on management by objectives, functional management and span of control to manage large multi-agency emergencies. AIIMS was developed in the 1980s based on the United States' National Incident Management System (NIMS). This framework allows first responders from different jurisdictions and disciplines to work more effectively together in an effort to respond to all hazards emergencies, including natural disasters. AIIMS lays out the standardised structure of an ICC.

# Appendix 2 – SOP Checklist

This checklist is based on the National Research Council report *Successful Response Starts with a Map: Improving Geospatial Support for Disaster Management* published by The National Academies Press (2007) and can help response agencies assess how well they have integrated geospatial data and tools into their emergency management processes and the level of preparedness they currently have.

### INTEGRATION

- ❑ Does your incident command post (ICP) have geospatial technology available?
- ❑ Do you have a permanent workspace or office for your geospatial team?
- ❑ Have you met with the emergency managers/responders to determine their geospatial needs for oil spills?
- ❑ Have you published a list of and schedule for the delivery of standard geospatial products for oil spills based on those needs?
- ❑ Is the use of geospatial information integrated into your emergency management operations and used in emergencies?
- ❑ Do your written standard operating procedures include the use of geospatial information in your workflow and decision-making processes?
- ❑ Do you know the name of your state GIS coordinator?
- ❑ Do you have contact information for the state GIS coordinator and his or her backup?
- ❑ Have you established agreements with adjoining jurisdictions and with state and Commonwealth governments to share data and products?
- ❑ Have you established agreements with adjoining jurisdictions and with state and Commonwealth governments that determine what data and tools will be used during an emergency?
- ❑ Have you developed agreements between geospatial professional teams at the local, state, and Commonwealth levels that identify the roles that each level will play and who will produce what in order to avoid duplication of effort during a large event?
- ❑ Have you worked with the state GIS coordinator to develop an inventory with around-the-clock contact information for GIS coordinators, their emergency management counterparts, and their respective backups in each county or major municipality in your state?
- ❑ Has this information been distributed to the emergency management community and the GIS coordinators in each county or major municipality in your state?

### HUMAN RESOURCES

- ❑ Do you have a designated geospatial team that is regularly deployed during oil spill incidents?
- ❑ Have you developed an organisational structure for your team that defines the roles of team members (manager, liaison, and technical support staff)?
- ❑ Does your organisation have a geospatial team (away team) that you can deploy to incident sites to assist in emergency response?
- ❑ Does your organisation have a geospatial team established, with expertise and training in oil spills?
- ❑ Have you developed a secure web site to distribute this information to authorised users?

### TRAINING

- ❑ Is the use of geospatial data and tools included as part of your emergency training exercises?
- ❑ Are these exercises conducted on a regular schedule?
- ❑ Do your emergency response professionals understand the capabilities that geospatial data and tools offer to improve their ability to plan for and respond to oil spill incidents?
- ❑ Have you established a training program for your geospatial team in emergency management organisation concepts and operational procedures?
- ❑ Does your geospatial team train with pre-developed map templates?

- ❑ Do you conduct scenario-based training exercises that include geospatial professionals and the use of geospatial data and tools in the emergency management work cycle and decision-making process?
- ❑ Are the geospatial professional team manager and liaison included in the scenario training exercise meetings and briefings to allow them to understand better how geospatial data and tools are being used in the decision-making process?
- ❑ Are the results of these exercises posted to a secure web site so that other authorised responders not involved in the exercise can learn from them?

### Data Access

- ❑ Have you developed relationships through the Regional Response Teams (RRT's) with the data custodians and established protocols and agreements, where required, to ensure access to and use of the data you require for planning, training, and emergency response activities?
- ❑ Have you developed a methodology to ensure regular updates to those data?
- ❑ Are your geospatial data backed up on a regular basis?
- ❑ Do you have a full copy of the data?
- ❑ Do you have copies of the data securely stored in different geographic regions of your state?
- ❑ Do you have a copy of the data securely stored in a different state or geographic region of the country?
- ❑ Have you tested your methodologies for rebuilding your servers using the backed-up data within the past year?
- ❑ Have you tested the process for accessing data from data-sharing partners during simulations to ensure the viability of your methodology?
- ❑ Have you established a web-based GIS service to encourage rapid access to and delivery of event-based data?
- ❑ Have you worked with the RRT's and state GIS coordinators to:
- ❑ Develop a secure web site within each state with an inventory (with around-the-clock contact information for the data custodians) of geospatial data in each state for use in emergency management operations?
- ❑ Have you developed links to each of these state inventories and made this resource available to local, county, state, and Commonwealth agencies that would respond to a catastrophe?

### Data

- ❑ Do you have the necessary baseline data for your maps?
- ❑ Do you know what Predictive data will be required?
- ❑ Do you know what Field/collected data is required?
- ❑ Data from surrounding regions and/or states
- ❑ Has your geospatial data team determined the quality and usability of the geospatial data gathered for emergency response?
- ❑ Does the data have metadata attached to it?
- ❑ Do the metadata provide an adequate description of data quality, including accuracy and currency?

### Data Gathering

- ❑ Have you established a team to identify and gather all geospatial data needed for oil spill incidents?
- ❑ Has your geospatial data team determined the quality and usability of the geospatial data gathered?
- ❑ Have you developed an inventory of local, state, and Commonwealth data that you require for use in emergency response?
- ❑ Does this inventory include metadata documenting and describing the geospatial data?
- ❑ Does your state have contracts in place for emergency aerial imagery?
- ❑ Do you have agreements in place to acquire digital images via government or private-sector plane or helicopter, of event sites immediately after an event occurs?
- ❑ Do you have live or near-live geospatial weather data?
- ❑ Do you have the capability to track the distribution of your emergency equipment or supplies geographically?

- ❑ Have you established data gathering procedures for oil spills and tested those methodologies in training exercises?
- ❑ Do you have a geospatial web-based service application that provides rapid access to your event-related data by regional, state, or Commonwealth organisations responding to a large event?

### Data Improvement

- ❑ Has the geospatial data team identified which data require improvements and which data not currently available need development?
- ❑ Do you get updates to your data (not including imagery) on an annual basis at a minimum?
- ❑ Is the imagery for your state less than five years old?
- ❑ Do you have a system for improving geospatial data to meet your emergency response requirements?

### Information Delivery

- ❑ Has your geospatial team practiced rapid delivery of geospatial information to meet emergency management decision-making requirements?
- ❑ Has your geospatial team developed templates to improve the speed of delivery of geospatial information during an oil spill incident?
- ❑ Do you have automated geocoding capabilities that will allow your geospatial team (or nontechnical staff) to convert field data and address locations to latitude and longitude quickly?
- ❑ Are your requests for assistance during an emergency tracked in a database and tracked via a GIS application to provide visual analysis of problem patterns, etc.?
- ❑ Have your geospatial professionals developed agreements with geospatial professional teams in adjacent communities or the state, and at the Commonwealth level, to determine the data and tools to be used and shared during oil spills?
- ❑ Have your geospatial professionals developed agreements with geospatial professional teams in adjacent communities or the state, and at the Commonwealth level, on the roles that each level will play and the products that will be generated in order to avoid duplication of effort during a disaster?

### Equipment and Infrastructure

- ❑ Do you have up-to-date geospatial software and hardware available?
- ❑ Do you have electronic field data collection methods (using GPS, smart phones, tablets, etc.) available to collect field data?
- ❑ Do you have capabilities of obtaining digital photographs of incident sites and transmitting them wirelessly to the ICP?
- ❑ Does your state have geospatial equipment and data prepared for deployment near an incident site?
- ❑ Do you have the ability to push out or pull in geospatial data or web-based services across the Internet?
- ❑ Do you have backup satellite communications systems to transmit geospatial data when necessary?
- ❑ Have you developed an up-to-date inventory of geospatial hardware available for use in an emergency (and around-the-clock contact information) in your state?
- ❑ Have you developed a secure web site with this inventory and around-the-clock contact information for each state?
- ❑ Have you developed a secure, national GIS web-based application to enable data to be accessed by authorised users across the country?

# Appendix 3 – GIS Resource requirements list

The table below is an example of a GIS Resource Supply List, based and adapted on the NAPSG's *Geospatial Standard Operating Guidance for Multi-Agency Coordination Centres* (NAPSG, 2013). It lists needs and availability of resources for each agency or jurisdiction. Use this list as a guide and not as a fixed set of requirements, as these can vary.

| | REQUIRED | | Location | | |
|---|---|---|---|---|---|
| | Office | Field | Primary | Secondary | Tertiary |
| HARDWARE (Where possible, field hardware should be robust) | | | | | |
| Laptop and/or desktop with DVD writer, USB ports, and sufficient RAM | √ | √ | ☐ | ☐ | ☐ |
| License keys, dongles and codes written down | √ | √ | ☐ | ☐ | ☐ |
| Plotter &/or printer & software driver | √ | | ☐ | ☐ | ☐ |
| Printer/plotter paper and ink | √ | | ☐ | ☐ | ☐ |
| Power boards, extension leads, hubs | √ | | ☐ | ☐ | ☐ |
| Projector | √ | | ☐ | ☐ | ☐ |
| GPS Hardware | | √ | ☐ | ☐ | ☐ |
| Projection Screen | | | ☐ | ☐ | ☐ |
| Multi-Gb Flash Drive (32 Gb or more) | √ | √ | ☐ | ☐ | ☐ |
| Portable, External Hard Drive (1 Terabyte or more) | √ | √ | ☐ | ☐ | ☐ |
| Backup Laptop Battery | | √ | ☐ | ☐ | ☐ |
| Broadband Access Card Activated | √ | √ | ☐ | ☐ | ☐ |
| Cell phone with published number and TXT or SMS activated | √ | √ | ☐ | ☐ | ☐ |
| SOFTWARE | | | | | |
| GIS Software and license to machine | √ | √ | ☐ | ☐ | ☐ |
| Oil Spill specific tools | √ | √ | ☐ | ☐ | ☐ |
| Install privileges | √ | | ☐ | ☐ | ☐ |
| MS Office | √ | √ | ☐ | ☐ | ☐ |
| Adobe Reader | √ | √ | ☐ | ☐ | ☐ |
| Adobe Acrobat Full Version | | | ☐ | ☐ | ☐ |
| GPS device and GIS software support GPS analyst (e.g. ArcGIS GPS Analyst extension) | | √ | ☐ | ☐ | ☐ |
| Coordinate converter | √ | | ☐ | ☐ | ☐ |
| Metric Converter | √ | | ☐ | ☐ | ☐ |
| INFRASTRUCTURE | | | | | |
| Internet connection (WiFi, or 4G card) | √ | | ☐ | ☐ | ☐ |
| Uninterruptible power supply including battery backup and surge protection. | √ | | ☐ | ☐ | ☐ |
| DATA RESOURCES | | | | | |
| Commercially Available Imagery | √ | | ☐ | ☐ | ☐ |
| Locally Available Downloaded Data | √ | | ☐ | ☐ | ☐ |
| Spare Copies of the above | √ | | ☐ | ☐ | ☐ |
| MAP RESOURCES | | | | | |
| Department Specific Maps | | | ☐ | ☐ | ☐ |
| Wall Maps | | | ☐ | ☐ | ☐ |
| Locally Used Road Maps | √ | | ☐ | ☐ | ☐ |
| Transport Maps | | | ☐ | ☐ | ☐ |
| POI Maps/Nautical Charts | | | ☐ | ☐ | ☐ |

| GENERAL RESOURCES | | | | | |
|---|---|---|---|---|---|
| Mapping Unit SOP | √ | | ☐ | ☐ | ☐ |
| Markers (Dry Erase)/Pens/Pencils | √ | | ☐ | ☐ | ☐ |
| Compass (Magnetic not scribing type) | | | ☐ | ☐ | ☐ |
| Ruler or map scale | √ | √ | ☐ | ☐ | ☐ |
| CDs/DVDs - Writeable | √ | | ☐ | ☐ | ☐ |
| Thumb drives/portable drives | √ | | ☐ | ☐ | ☐ |
| Push Pins | √ | | ☐ | ☐ | ☐ |
| Plotter Ink Cartridges | √ | | ☐ | ☐ | ☐ |
| Plotter Paper (to include Mylar) | √ | | ☐ | ☐ | ☐ |
| SAFETY | | | | | |
| Personal Phone with Texting ability or SMS (to communicate with relatives) | √ | √ | | | |
| Personal hot drink cup | √ | √ | | | |
| A supply of your business cards (Current business cell phone on card) | √ | √ | | | |
| Snacks (e.g., energy bar, fruit) | √ | √ | | | |
| Your emergency contact list printed up and current – The emergency GIS group members, your family personal contacts. | √ | √ | | | |

# Appendix 4 – Mapping Unit SOP

The following is an example of what the SOP could include (based and adapted from the National Wildlife Coordinating Group, *GIS Standard Operating Procedures on Incidents*, June 2006):

| | Description |
|---|---|
| 1 | Daily work requirements and time schedules |
| 2 | SOPs (including handover procedures and template) |
| 3 | Incident specific information<br>○ Issues with data or software<br>○ Other unique issues<br>○ Internet connectivity issues |
| 4 | Contact Lists |
| 5 | Data<br>○ structure – folder by folder description of contents<br>○ sensitive data handling<br>○ daily data needs |
| 6 | Websites used<br>○ Info on FTP site<br>○ GIS services (e.g. Web Map Services, ArcGIS)<br>○ Servers<br>○ Other important websites |
| 7 | GIS ICC Staff Checklist |
| 8 | Map/Schematic of the Room (where are resources located) |
| 9 | GIS Software<br>○ Tips/Tricks and troubleshooting<br>○ Versions<br>○ Software added on incident |
| 10 | How to Access/Use ICC Software |
| 11 | File and naming convention guides |
| 12 | Printing<br>○ Available printers & plotters: printer drivers locations, IP address/network settings<br>○ Document settings<br>○ Networked printer addresses<br>○ Supply sources and contacts |
| 13 | Common abbreviations, conversion tables, and Glossary |
| 14 | Map Matrix – showing types of map products required |
| 15 | An image, hardcopy, and a list of each map type that has been produced on the incident |
| 16 | Detailed narrative log describing status of equipment, workload, work schedule, and other activities |
| 17 | A list of resources being used for mapping and data collection (IR, helicopter, field observers, local jurisdiction(s), other partner agencies, imagery sources) |
| 18 | The skill sets of the individual GIS team members remaining on the incident (to make better use of them with the incoming team and help with scheduling and availability) |
| 19 | Map symbology information, including the authorised use of nonstandard symbols; the outgoing team must provide this information to the incoming team during the transition briefings to facilitate consistency in the use of map symbols on an incident |

# Appendix 5 – Geospatial Roles and Responsibilities

Examples of some of the mapping roles that could be expected in an IMT (based on the NAPSG's *Geospatial Standard Operating Guidance for Multi-Agency Coordination Centres* (NAPSG, 2013).

| Position Title | Roles and/or Responsibilities |
|---|---|
| Situation Unit Leader | • Reports to the Planning Officer<br>• Directs and prioritises all tasks within the Situation Unit including the GIS functions<br>• Coordinates and prioritises incoming requests from Public Information Officers and others<br>• Requests map products from the Mapping Unit<br>• Monitors the workload of the unit in compliance with the work and rest standards<br>• Authorises distribution of data/products related to the incident<br>• Orders the necessary equipment or people to accomplish the GIS work most effectively |
| Mapping Team Leader | • Reports to the Situation Unit Leader<br>• Establishes the initial work area and ensures software, hardware and equipment is available.<br>• Coordinates and prioritises map production, remote sensing, and geospatial database efforts.<br>• Determines latest needs, suggests potential geospatial solutions, determines if standard map products are meeting needs, and lets the Mapping Team know what is happening across ICC and works with them to develop needed and potential geospatial solutions to current and anticipated issues.<br>• Conducts briefings, attends meetings, and directs overall geospatial support operations.<br>• Attends IMT briefings to get direction for responsibilities and a timeframe for which products may need to be ready.<br>• Liaises with Commonwealth, state, and local authorities establishing MOUs, partnerships, and data sharing agreements.<br>• Proactively seeks opportunities to integrate geospatial products into executive decision-making.<br>• Keeps track of which staff are available to report and which staff has been affected by the event and unable to report. |
| Mapping Officer | • Responds to Mapping Team Leader<br>• Creates GIS and mapping products as advised by Mapping Team Leader<br>• Develops, maintains, and coordinates the geospatial data used.<br>• Sets database access rights and privileges.<br>• Responsible for data backups as required.<br>• Responsible for creating and managing the file-based data storage system, updating and distributing associated documentation, answering all queries for use, and briefing teams on use of data.<br>• Initiates data sharing agreements or purchases for data as required and arranges for data updates as necessary. |
| Geospatial Analyst | • Reports to the Mapping Team Leader.<br>• Prepares recurring and ad hoc GIS products.<br>• Compiles various types of geospatial information into map and data products. |

| | |
|---|---|
| | • Analyses geospatial data from various sources to answer diverse questions and populate geospatial products.<br>• Designs and builds custom database queries as requested by task force members.<br>• Performs quality control and corrects anomalies in the data.<br>• Loads data sets under direction of Database Manager. |
| Imagery Analyst | • Responsible for the coordination of RS requirements, resources, and requests for the team.<br>• Reports to the Mapping Team Leader.<br>• Operates as task originator & collection manager for assets related to the operation.<br>• Ensure imagery- derived products are delivered in a timely manner.<br>• Processes and interprets acquired imagery.<br>• Processes imagery in native and/or other formats.<br>• Prepares image data files for use by the Geospatial Analyst Staff.<br>• Creates imagery-derived datasets and products. |

# Appendix 6 – GIS team handover considerations

Based on the NAPSG's *Geospatial Standard Operating Guidance for Multi-Agency Coordination Centres* (NAPSG, 2013).

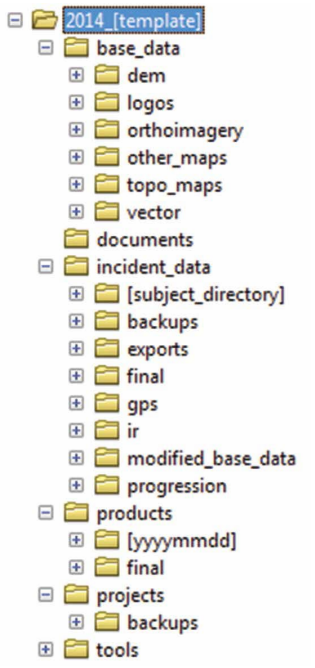
| Initial setup |
|---|
| • Brief the Situation Unit leader to establish requirements and expectations, and plan maps production timelines |
| • Establish an appropriate physical workspace |
| • Analyse the data, hardware, personnel, and supplies available |
| • Set up hardware and infrastructure, liaising with IT support |
| • Sets up the file directory structure according to the standards |
| • Inserts base data into the directory structure |
| • Establishes the coordinate system and units that will be standard for the incident data |
| • Establishes outer extent of the incident's area of interest |
| • Gathers incident data; collects hardcopy maps already in use |
| • Generates map products according to guidelines for primary map products |
| **Start of shift** |
| • Sign in on the operations centre's Staff Log. |
| • Make yourself known to the Geospatial Team Leader in the Mapping Unit. |
| • Communicate role and availability via the ICC's Incident Management System. |
| • Assess GIS needs of Incident Command and your operations centre and the needs of fellow GIS staff at other operations centres. |
| • Get debrief from the outgoing GIS team to determine products completed, map production planning timeline in progress or due in the coming shift as well as other important details |
| • As necessary or requested, provide data, map products and progress reports through relevant communication channels. |
| **End of shift** |
| • Wrap the project/map/data being working as best as possible. |
| • Debrief the end of your shift via **the appropriate communication systems and channels**. Include the name of your replacement. |
| • Brief your replacement in the following: |
| ○ What deliverables have been requested? |
| ○ What has been created, what is left to be created? |
| ○ Where are the necessary scratch files? |
| ○ What base data have been modified? |
| ○ Where are your notes? |
| ○ Provide the last Media Report. |
| ○ What next steps have been identified? |
| ○ Provide your replacement with your contact information. |
| ○ Provide your replacement with contact information for other GIS Staff that are currently staffing the event or that are due to report. |
| ○ What are the standard products and which is coming due in the next shift. |

# Appendix 7 – Directory structure template

The example directory structure convention below is based on and adapted from the *GIS Standard Operating Procedure (GSTOP) (NWCG, 2014)*.

The directory structure is set up with the date and time at the beginning of each folder and file to facilitate easy chronologic sorting to ensure that the most recent map information is at the top or bottom of a file list when sorted.

- ***<<Folder (for example, P:\ICPGIS)>>\BaseData*** - This folder contains base map data; data specific or derived from the event are NOT stored here.
    - DEMs - Digital Elevation Models
    - Logos – logos and data disclaimers
    - Raster – Hillshade, Eagle Aerial Imagery, Air Photo Imagery
    - Vector – Transportation, Admin Boundaries, Points of Interest, etc.
- ***<<Folder>>\Tools*** – This folder contains extensions, scripts, models, DMS-DD conversion macro/script, other software used during the incident
- ***<<Folder>>\Incidents***\ – This is the top tier GIS Emergency Response directory:
    - ***YYYY_IncidentName*** – This is the top tier Folder for a unique event. 4-digit year and the name of the Unique Incident (e.g. 2003_CedarFire)
        - ***YYYYMMDD*** – date/time stamped incident spatial data layers; one folder for each day of the incident
            - ***Base data*** – base data not created in the incident, not requiring daily backup
            - ***Documents*** – spreadsheets, text documents, unit logs, digital photos used on maps
            - ***Incident Data*** – All data stored in this folder are data that are specific to the incident and include a date/time stamp – DATA SHOULD NOT BE PUBLISHED TO THE WEB UNTIL THE PRODUCT IS READY FOR USE/DISSEMINATION AND APPROVED BY THE INCIDENT CONTROLLER (IC). Consideration should be given to breaking 'incident data' into sub-groups 1) DEM, 2) Raster, and 3) Vector – as incident data could be collected in these forms.
            - ***Products*** – GIS analysis and map products produced for the event on that day
            - ***Projects –*** GIS product map document files (e.g. mxd)
            - ***Tools –*** extensions, tools, or other software tools used in the incident (e.g. *easyGPS*)
            - ***External Maps*** – Daily maps produced outside the organisation




NOTE: In addition to incident related maps and data, resources such as basemap data, GIS Map templates, layer files, scripts and other tools should be accessible on another folder location.

# Appendix 8 – Map Products

This outlines each of the map products that are expected to be produced during an incident, including their objectives, data content and cartographic requirements. Adapted from the NAPSG's *Geospatial Standard Operating Guidance for Multi-Agency Coordination Centres* (NAPSG, 2013).

The following is an extended list of map products commonly produced. Most may be combined into one single map while others may not be required at all. Each jurisdiction should review their own requirements for the type of products needed.

| Map Product | Description | Objective |
|---|---|---|
| **Situation status maps**<br>*Primary maps for command meetings and general briefings. These have a very high priority and are critical to the IMT.* | | |
| **Incident Action Plan (IAP) Map** | Primary map showing overview of the current situation information, high level field assignments, execution zones, safety concerns, etc. To be used by Operations personnel for briefings and general planning meetings. Included with the daily Incident Action Plan. | Communicates geographic feature relationships and incident management objectives. It is a tool used by operations staff to display field assignments, crew instructions, and division safety concerns at the operational period briefings and breakout meetings. |
| **Briefing Map** | A simplified, high-level large-format map of the incident area and used to discuss work assignments and other details. Displayed in the briefing area and used during operational briefings. | Communicates sufficient incident detail to brief personnel on the upcoming operational period. |
| **Situation Map** | Single source of information, at-a-glance, for the incident. Includes: location, staging areas, geographic response boundaries, response sites, spill trajectory, overflight info, sensitive areas, medical facilities, safety zones, etc. | Intended for real-time vessels, weather, currents, extent of the incident, and current status of all operations. |
| **Field Base Map** | Incident site and impacted areas, including slick movement, response sites, equipment locations, sensitive areas, staging areas, etc. | To predict impact to sensitive areas and proximity of slick to response equipment. |
| **Operational and tactical planning maps**<br>*Help Planning and Operations with more detailed information about daily activities and to help assist in decisions for the next operational period. The information displayed helps identify risks and threats within the area of interest and what appropriate actions need to take place.* | | |
| **Boom map** | A series of tactical maps showing actual, intended and proposed boom locations. | To plan, approve, and manage boom deployment, monitoring, and retrieval. |
| **Dispersants map** | A series of tactical maps showing dispersant restricted areas, approved areas, and actual application areas. | To plan, approve, and manage use of dispersants on land, in water, or aerial. |
| **Transport map** | Shows access routes to the incident and any road closures. Provides an overview of the transportation network in the incident vicinity to support safe transportation, including location of airfields. | Facilitates land-based delivery of equipment, supplies, and personnel to and removal from the incident location. |
| **Air Operations Map** | Displays features important for air operations, used for accurate aerial surveillance. | Provides air operations with enough detail to aid in locating key features on an incident. |

| | | |
|---|---|---|
| **Skimming map** | A series of tactical maps developed to plan, approve, and manage the skimming operations. | To show planned execution zones, vessel tracks, oil trajectory, summary information of daily activities, etc. |
| **SCAT** | A series of maps to support and manage SCAT operations, showing current oiling status, maximum oiling status, and shoreline clean-up status. | For shoreline clean-up assessment and shoreline types clean-up recommendations. |
| **Operational shoreline/ land clean-up** | A series of maps including individual maps of each shoreline sector as well as a general overview one. | To support and manage shoreline and on-land clean-up. |
| **Environmental maps** | | |
| **Wildlife status map** | Map showing wildlife status and observations, for example, the locations of injured or dead wildlife. | To inform wildlife response groups where oiled wildlife has been found. |
| **Wildlife sensitive areas and hazing avoidance map** | A series of maps used for identifying and minimizing impact and hazing in sensitive areas and critical habitat. | |
| **Resources at Risk Map** | Environmental and Socio-economic sensitivity map, including: endangered species, wildlife management areas, refuges, water intake areas, tourist sites, etc. | To identify sensitive areas, such as endangered species' habitats or locations, cultural resources, and other areas at risk. |
| **Closures map** | A series of maps displaying closed areas for commercial and recreational fishing and hunting. | To inform industries where restrictions have been imposed due to the incident. |
| **Environmental quality maps and sampling** | Map of water and air quality sampling, and operational monitoring. | To support and report on water and air quality sampling, and environmental monitoring of operational activities. |
| **Facility maps**<br>*Provide a recognised view of the operating facility/control centre and surrounding area within the incident.* | | |
| **Safety and Security map** | Map showing personnel housing location, security check points designated, hot/warm/cold zones, access routes, etc. | To communicate and report safety and security operations as well as crew housing location and access routes. |
| **Facilities Area Map** | Map showing layout and location(s) of Incident Command Post (with directions and address), Staging areas supporting field operations, and Forward Field Bases. | Assists Logistics personnel in locating various resources and support functions in and around the ICP. |
| **Other maps** | | |
| **Public/media maps** | A high-level view of the incident. Can be at different scales. | Intended for the general public, media, or others who need a broad overview. Keeps the public informed of the incident's location |

# Appendix 9 – Map Elements

Based on the *NAPSG's Geospatial Standard Operating Guidance for Multi-Agency Coordination Centres* (NAPSG, 2013), the following cartographic elements should be included on a map:

| Description | Roles and/or Responsibilities |
|---|---|
| **Title** | basic description of the map, including incident name, map theme, geographic extent, time/date stamp of data |
| **Legend** | |
| **Scale Bar** | preferably a graphical one |
| **Logos and Data Disclaimers** | To recognise data sources, agencies, and other groups |
| **File Location** | Provide full path name for the network location of the map document. E.g. C:\GIS\Incidents\yyyy_IncidentName\YYYYMMDD\Products\ yyyymmdd_hhmm_IncidentName_Subjectmatter_Agency_ Size_Orientation.mxd |
| **North Arrow** | |
| **Author** | Person or group that created the map |
| **Date of preparation** | |
| **Graticule/grid** | a graticule of latitude and longitude marks and numbers that allows referencing of the mapped area to the specific area on the Earth |
| **Projection** | Name of the projection, datum, and units |
| **Data Sources** | who, what, where, when, why and how |
| **"Time Sensitive Data" Disclaimer Stamp** | for all maps that are time sensitive |
| **"DRAFT" stamp** | if map is a draft |
| **"Not for navigation use" disclaimer** | Important to remind audience that map is not to be used for navigation |

# Appendix 10 – GIS File Naming Convention

The following is an example of a typical GIS file naming convention used during an incident (Based and adapted from the *Geospatial Standard Operating Guidance for Multi-Agency Coordination Centres.* (NAPSG, 2013):

- All data files (*.shp, *.xls, *.dbf, etc.) must contain date and time, incident agency responsible for creating the map and subject matter qualifiers. Similarly, map document names (*.pdf, *.jpg, etc.) must contain date and time, incident name, subject matter information as well as size (e.g. 11X17, ANSI B, Custom32X66, A0, etc.) and orientation (i.e. portrait vs. landscape) of the map.
    - **Data file** – yyyymmdd_hhmm_IncidentName_Subjectmatter_Agency.
    - **Map document** – yyyymmdd_hhmm_IncidentName_SubjectMatter_Agency_Size_Orientation.***
    - Example
        - 20101023_2234_RenaIncident_ColourIndexMap_AMSA_A3_portrait.pdf – MODIS Colour Index of Ocean Features and Circulation Patterns along with trajectories for June 4, 2010
- For field collected data, also include a Source Code tag when naming the data file:
    - GPS_Name = Global Positioning System Collector's Name
    - FOBS = Field Observer
    - SITL = Situation Unit Leader
- For data/maps that were provided by Local, State or Commonwealth Agency tag with Agency's Acronym:
    - CalFire (or relevant state agency)
    - CDC
    - Etc
- File and folder names must not contain spaces, special characters, or periods, aside from file extension delimiters.
- The underscore "_" is the only allowable character for delimiting name elements.
- Feature classes within a file geodatabase must start with "i_" for incident.
- Capital letters may be used to make names easier to understand.
- The format for dates is 8 digits in year, month, day order (yyyymmdd).
- The format for time is 4 digits in a 24-hour format (hhmm).

NOTE: When adding non-standard tags ALWAYS notify GIS staff of their presence and meaning.

NOTE: It is the responsibility of each GIS responder to ALWAYS communicate the file naming convention that they are using to those with whom they are sharing the data.

# Appendix 11 – Data format conventions

The following is an example of a standard data format convention specification (based on and adapted from the NAPSG's *Geospatial Standard Operating Guidance for Multi-Agency Coordination Centres* (NAPSG, 2013):

| |
|---|
| • Acceptable Data Formats include - <<*Example: .xls, .dbf, .shp, File Geodatabase, KML*>> |
| • Post tables for GIS staff as .dbf for quick import into ArcGIS |
| • When working with Excel spreadsheets remember that cell values linked to calculations will not be translated between .xls and .dbf. If there are values of consequence that are linked to a calculation, create a new field for the data values and perform a paste special (Values only) before converting to .dbf. Make sure that there are no spaces in the header row and worksheet tabs. |
| ○ Also note Microsoft 2007and 2010 do not support saving as a .dbf; however, ArcMap now intakes .xls and has always accepted .CSV files. |
| • Tables posted for consumption of use outside of GIS should be in an MS Excel (.xls) or (.xlsx) format to avoid software compatibility warnings when opening the file. |
| • Acceptable Map [Output] Formats include - <<Example: .jpg, .pdf, .mxd>> |
| • When exporting to .jpg or .pdf use a resolution of 100 dpi (for printing hard copies 300 dpi is the recommended resolution) unless higher resolution is necessary to see detail. This reduces file sizes to accommodate file sharing and network limitations. |
| • Use Relative Paths Option when sharing .mxd's with others - Select the Document Properties option from the File Menu, followed by the Data Sources button in the "Map Title" Properties dialog. Then select "Store relative path names to data sources" and "Make relative paths the default for new map documents I create." |
| NOTE: When sending zip files, use same naming convention as associated data file (refer to above naming conventions). |

# Appendix 12 – Essential Data Layers

The following table lists examples of the most common data layers that would be used for a maritime incident, grouped by category (based on and adapted from the NAPSG (2013)'s *Geospatial Standard Operating Guidance for Multi-Agency Coordination Centres.)*:

| **Baseline** | |
|---|---|
| **Oil event data**<br>Data specific to an oil spill incident. | • ESI boundaries<br>• Platform/rig locations – offshore installations data<br>• Shoreline classification and biology<br>• SCAT shoreline divisions<br>• Dispersant use zones<br>• Prohibited dispersant zones |
| **Transport**<br>Access routes to the incident, evacuation routes, and other related transportation reference points. Support routing of public vehicles (evacuation/avoidance). | • Streets (name, hierarchy – primary vs. interstate)<br>• Private roads<br>• Traffic control points<br>• Access control points<br>• Road construction<br>• Transport resources - buses, school buses (with wheelchair access), ambulances<br>• Navigable waterways<br>• Boat ramps<br>• Vessel mooring areas<br>• Staging areas (potential and actual)<br>• Maritime infrastructure<br>• Anchoring points<br>• Railways<br>• Airports<br>• Helicopter landing zones |
| **Utilities**<br>Infrastructure that could be damaged or that could be hazardous. Provide guidance for access by first responders. | • Utility pipelines<br>• Power lines (underground)<br>• Sanitary Sewers<br>• Water Treatment Plants<br>• Storm water facilities - catch basins, storm sewers, outfalls<br>• Potable water mains<br>• Extremely Hazardous Sites and Hazardous Sites<br>• Public Service facilities (public works, water treatment, waste water treatment, electric plants) |
| **Land Ownership/Administrative** | • Address points (GNAF data)<br>• Population data (Census)<br>• Parcel boundaries<br>• Port areas<br>• Restricted areas<br>• Jurisdictions<br>• Maritime Boundaries<br>• Businesses located on the property<br>• Local Government Areas (LGAs) |
| **Infrastructure/Logistical use** | • Roads<br>• Police/fire stations |

| | |
|---|---|
| | • Hospitals/first aid stations<br>• Landmarks<br>• Aids to navigation<br>• Marinas<br>• Stockpile locations |
| **Communications**<br>Identify potential communication outages due to the incident. | • Mobile phone towers<br>• Radio communication<br>• Main Internet hubs/lines |
| **Topography** | • Bathymetry<br>• Coastline<br>• Gazetteer/localities<br>• Topographic data (localities, cities, roads, airfields, etc) |
| **Environment**<br>Physical environment conditions that may influence hazard behavior or response. | • Estuaries, river entrances<br>• Water intake areas<br>• Wetlands<br>• Commercial and recreational fisheries<br>• Endangered/threatened species<br>• Protected marine areas<br>• Resources at risk |
| **Biological resources** | • Birds<br>• Fish<br>• Habitats (coastal and benthic)<br>• Invertebrate<br>• Marine mammals<br>• Reptiles/amphibians<br>• Shellfish<br>• Terrestrial mammals |
| **Human resources** | • Historic sites<br>• Indigenous sites<br>• Marine parks, reserves, RAMSAR<br>• Recreation areas – beaches, tourist spots |
| **Basemaps** | • Seafarer charts (as dynamic mosaic) – vector and raster<br>• Topographic maps (various scales)<br>• Aerial photography<br>• Satellite imagery<br>• Bing/Google maps (hybrid/street/satellite) |
| **Predictive** | |
| **Dynamic datasets**<br>Perspective on incident within context of current conditions. | • Atmospheric conditions (wind direction, etc.)<br>• BoM weather forecasts<br>• Environmental Data Server (EDS)<br>• Tides<br>• Overflights<br>• Vessel locations and tracks (AIS)<br>• Access points |
| **Incident specific**<br>Visualisation of incident location and extent. | • Location and extent of tactical area or incident boundaries (point, line, or polygon)<br>• Oil slick location and extent<br>• Shoreline sector boundaries<br>• Modelled trajectory forecasts |

| | |
|---|---|
| | • MODIS, SLAR, SSAR<br>• KSAT reports |
| **Incident command**<br>Incident operations sites and zones | • Incident command post<br>• Staging areas<br>• Mobile weather station<br>• Wildlife recovery centres<br>• Equipment storage locations<br>• Oil collection sites<br>• Access locations (beach, boat ramps, marinas, managed areas)<br>• Hot/warm/cold zones<br>• Shelter sites<br>• Decontamination site<br>• Forward Operating Centre<br>• Evacuation zone<br>• Wildlife recovery centre |
| **Field observation** | |
| **Imagery** | • Aerial imagery with date |
| | • Oblique aerial imagery |
| **Population** | • Daytime population<br>• At need populations (schools, day care centres, public meeting places, senior's homes, universities etc.)<br>• Wildlife populations and T/E critical habitats |
| **Field observations** | • Oiled wildlife<br>• Oiled shoreline<br>• Impacted assets<br>• Overflight paths |
| **Logistical** | • Booms – locations, types, and deployed configuration<br>• Staging areas<br>• Waste management areas<br>• Beach closures<br>• Road closures |

# Appendix 13 – GIS MEDIA PACKAGE POLICY

The following is an example of a GIS media package policy; it would require to be adapted to suit jurisdictional needs and as per existing policies (based on and adapted from the NAPSG (2013)'s *Geospatial Standard Operating Guidance for Multi-Agency Coordination Centres.)*:

To further ensure the security and/or confidentiality of all incident related data:

- Do not share files through web applications unless the data are complete, ready-for-use, and where applicable you have been given the proper authority.
- When sharing GIS files, ALWAYS attach a projection file. Projection files are REQUIRED to be posted with all GIS data file formats. Projection to be used should be determined before emergency situation.
- When using web applications to share files, use the meta tag to alert GIS users as to status of the data/map/etc. (i.e. FACT, DRAFT, etc.)
- Clear data and map transfer with your Operation Centre Manager or Director, as needed, when sharing data and map products between ICP, DOC and/or MOC GIS Staff and/or through web applications. Data should not go out through the GIS shop directly.
- The Public Information Officer is responsible for sharing ALL data and/or maps with the media.
- Public Access to *<<jurisdiction>>* GIS Data During a Disaster
- When the need to distribute certain types of GIS information is first apparent, certain assurances must be made. In order for a data layer to be made available publicly in a GIS press package, it must meet the following eight criteria. The questions must be applied individually to each data set that is to be included in the GIS press package. A "No" answer on any of the following questions should prohibit the release of the specific data layer in the press package.

    1. Is the Incident the source of the information (the data is not base data)?
    2. Data is essential in the press package; otherwise the press package will not make sense?
    3. Has the data has been cleared to be in the press package by its authors, GIS Manager and the Public Information Officer (PIO)?
    4. Has the data been cleared to be released by the incident PIO in this briefing cycle (if any doubt see question 3)?
    5. Has the data been checked for quality and consistency?
    6. Is the data or subject matter releasable and not described on the Release Constrained Data layer list?
    7. Is the data still current with recent events?
    8. Does the data have metadata (see standard in definition)?

Additionally, if the data passes the above questions with a "Yes" answer to all of them, the data must be immediately vetted.

# Appendix 14 – National Geospatial Products and Programs

### The International Disaster Charter

The International Disaster Charter is an international collaboration among over 20 space agencies and service providers to provide national disaster management authorities and humanitarian organisations free satellite imagery and products for immediate response to a significant disaster.

Since it started in 2000, the Charter has to date been activated for more than 500 disasters in over 120 countries. The Charter gives access to a constellation of satellites equipped with radar and optical sensors at various resolutions.

During a protracted marine spill incident, the Charter may be activated and satellite imagery may be received in a variety of formats and resolutions to support the incident. Therefore, you need to consider any remote sensing expertise that will need to be included in the IMT.

Direct activation of the Charter will be done at the discretion of the Control agency, and through an Authorised User, which in Australia is Geoscience Australia. To request activation, contact AMSA in first instance.

### Geoscience Australia data

Geoscience Australia is Australia's National geoscience advisor organisation. It provides free for public use, national topographic and hazard-related data sets via web services. A variety of web service protocols are supported, including Open Geospatial Consortium (OGC) services and ESRI mapping and image services: http://www.ga.gov.au/data-pubs/web-services/ga-web-services.

### Foundation Spatial Data Framework (FSDF)

The FSDF is an initiative sponsored by the Australian and New Zealand Land Information Council (ANZLIC), is the peak intergovernmental organisation leading the collection, management and use of spatial information in Australia and New Zealand.

The FSDF provides a common reference for the assembly and maintenance of Australian and New Zealand foundation level spatial data in order to serve the widest possible variety of users. It delivers national coverage of the best available, most current, authoritative source of standardised and quality controlled foundation spatial data. Access to these can be made via the ANZLIC site.

### National Map

The National Map is a public tool for accessing and mapping open Commonwealth, state and local data and users' private data. Managed by the National Archives of Australia (NAA), the online application provides a map-based view to data, but does not store any data. Selected data viewed on the map is typically accessed directly from the relevant government department or agency.

### Australian Maritime Spatial Information System (AMSIS)

The AMSIS is a web based interactive mapping and decision support system that improves access to integrated government and non-government information in the Australian Marine Jurisdiction.

AMSIS contains many layers of information displayed in themes of Maritime Boundaries, Petroleum, Fisheries, Regulatory, Environment, Native Title and Offshore Minerals. The data has been sourced from Geoscience Australia, other Australian government agencies and some industry sources.

**Emergency Management LINK (EM-LINK)**

EM-LINK is a joint EMSINA, Geoscience Australia and Emergency Management Australia initiative aimed at cataloguing all known public and private emergency management related webservices in Australia. An information flyer is available from the web site link, and the EM-LINK page contains further information as well as an online form to request access to the catalogue. Relevant layers of interest listed in the catalogue should be preloaded into a GIS in readiness for an incident.

# Appendix 15 – State and Local Geospatial Products and Programs

The following are links to some examples of relevant State and local systems and programs that could provide additional data during an incident. Note however, that most will require authentication in order to gain access.

National Environmental Maritime Operations (NEMO) System (requires login)
https://amsa.nogginoca.com/login.html

Spatial @ AMSA
https://www.operations.amsa.gov.au/Spatial/

Domain Awareness Information System (DAIS) (requires login)
https://www.operations.amsa.gov.au/dais/

# Appendix 16 – List of Referenced Links

Australian Maritime Safety Authority (AMSA) (2018), *National Environmental Maritime Operations (NEMO)*. Retrieved June 2018 from https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations

Emergency Management Spatial Information Network Australia (EMSINA), 2010, *All Hazards Symbology Project – July 2010*. Retrieved June 2018 from https://www.emsina.org/allhazardssymbology

Hook, S. et al., 2016, *Oil Spill Monitoring Handbook*, Commonwealth Scientific and Industrial Research Organisation (CSIRO). Retrieved June 2017 from https://publications.csiro.au/rpr/download?pid=csiro:EP158596&dsid=DS2

International Petroleum Industry Environmental Conservation Association (IPIECA) (2015), *Work Package 5: Common Operating Picture – Recommended Practice for Common Operating Picture architecture for oil spill response*. Retrieved on June 2016 from https://www.iho.int/mtg_docs/com_wg/MSDIWG/MSDIWG7/MSDIWG7-2.7D-OGP-IPIECA_COP_architecture.pdf

National Alliance for Public Safety GIS Foundation (NAPSG) (2018), *Capability and Readiness Assessment Tool (CARAT)*. Retrieved June 2016 from http://www.napsgfoundation.org/carat/

National Alliance for Public Safety GIS Foundation (NAPSG) (September 2013*), Geospatial Standard Operating Guidance for Multi-Agency Coordination Centres*. Retrieved September 2017 from http://napsgfoundation.org/wp-content/uploads/2013/10/NAPSG-SOG-V-3-FINAL.pdf

National Oceanic and Atmospheric Administration (NOAA) (2018), Office of Response and Restoration. Science of Oil Spills; accessed 16 August 2018 from https://response.restoration.noaa.gov/about/media/science-oil-spills-course-charleston.html

National Research Council, *Successful Response Starts with a Map: Improving Geospatial Support for Disaster Management*, Washington, DC: The National Academies Press, 2007. Accessed June 2017 from: http://www.nap.edu/openbook.php?record_id=11793&page=163

National Wildlife Coordinating Group (September 2014), *GIS Standard Operating Procedures on Incidents*. Accessed June 2017 from: https://www.nwcg.gov/sites/default/files/publications/pms936.pdf