A Time of Need – Coordinating Spatial Disaster Management in South East Queensland

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SUMMARY

The region of South East Queensland (SEQ) is the most densely populated area of Queensland, and is expected to hold 4.4 million people by 2030. It covers an area of approximately 23000 square kilometres (the size of Israel) and is governed by 9 local governments. It is primarily populated along 240km of coastal region, from Noosa to Cooloongatta. The landscape ranges from sub tropical rainforests covering the hinterland, dry eucalypt forests to beaches, and contains a number of significant river, catchment and lake systems, which supply the majority of the current SEQ population with a source of clean drinking water. The diversity of landscape and sheer length of coastline increases the SEQ regions susceptibility to a wide range of disaster threats, including flood, bushfire and tsunami.

Currently, the approach to disaster management in the SEQ region is handled independently by 3 major sectors:
1) The Queensland State Government Department of Community Safety, who is responsible for response for the entire region,
2) Local Councils, who are responsible for the lands and response coordination within the confines of their council boundaries and jurisdiction, and
3) Volunteer organisations such as the State Emergency Service (SES), who have teams responsible for areas within the SEQ region.

The primary focus of this paper is to increase awareness and promote the importance of spatial data management before, during and after an emergency response. Additionally, it highlights the individual roles and responsibilities of disaster management groups with respect to resource allocation and custodianship, including the collection, collaboration and dissemination of spatial datasets. It also examines the roles of each sector and their current program of response, including the significant role of the volunteer organisations. Finally, it assesses whether there are significant response, time and economic benefits to having a more coordinated response for the region, and how this coordination might be implemented.

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1. INTRODUCTION

The region of South East Queensland (SEQ) is the most densely populated area of Queensland, and is expected to hold 4.4 million people by 2030. It covers an area of approximately 23000 square kilometres (the size of Israel) and is governed by 9 local governments;

- Brisbane
- Gold Coast
- Logan
- Lockyer Valley
- Redland
- Scenic Rim
- Somerset
- Sunshine Coast
- Toowoomba

It is primarily populated along 240km of coastal region, from Noosa to Cooloongatta. The landscape ranges from sub tropical rainforests covering the hinterland, dry eucalypt forests to beaches, and contains a number of significant river, catchment and lake systems, which supply the majority of the current SEQ population with a source of clean drinking water. The diversity of landscape and sheer length of coastline increases the SEQ regions susceptibility to a wide range of disaster threats, including flood, bushfire and tsunami.

2. DISASTER MANAGEMENT GROUPS

Generally, there are 4 major groups that are involved in any disaster management, and these are outlined with their respective SEQ counterparts in Table 1;

Group	Role	SEQ players

1	Organisations that perform the same tasks during an emergency that they do day to day	• Department of Community Safety
		  o Queensland Fire & Rescue Service
		  o Queensland Ambulance Service
		  o Emergency Management Queensland
		• Queensland Health
		• Queensland Police Service
		• QBuild
		• Department of Transport & Main Roads
		• Department of Environment & Resource Management
		• Council disaster management groups

2	Organisations that are generally inactive during ”normal” periods, but increase in activity during an emergency. These groups are often volunteer organisations.	• State Emergency Service (SES) • Rural Fire Service
3	Organisations that retain their pre-emergency structure, but take on additional tasks during an emergency that are outside their normal scope of business. These are often Government departments involved with Social Services	• Queensland Health • Centrelink • Australian Defence Force
4	Private citizens working towards a collective goal	

Table 1: The 4 major groups involved with disaster management

More specifically, the Queensland disaster management system has three levels:

- Local Government
- State Government
- Disaster district

Each level maintains its own governance structure and disaster coordination centre, and additional support can be gained from the Commonwealth at the request of the State. Figure 1 depicts the Queensland Disaster Management System, including the link to the Commonwealth for National-level support when required.

In the event of a disaster, each level is activated, and at other times undertakes training o ensure readiness.

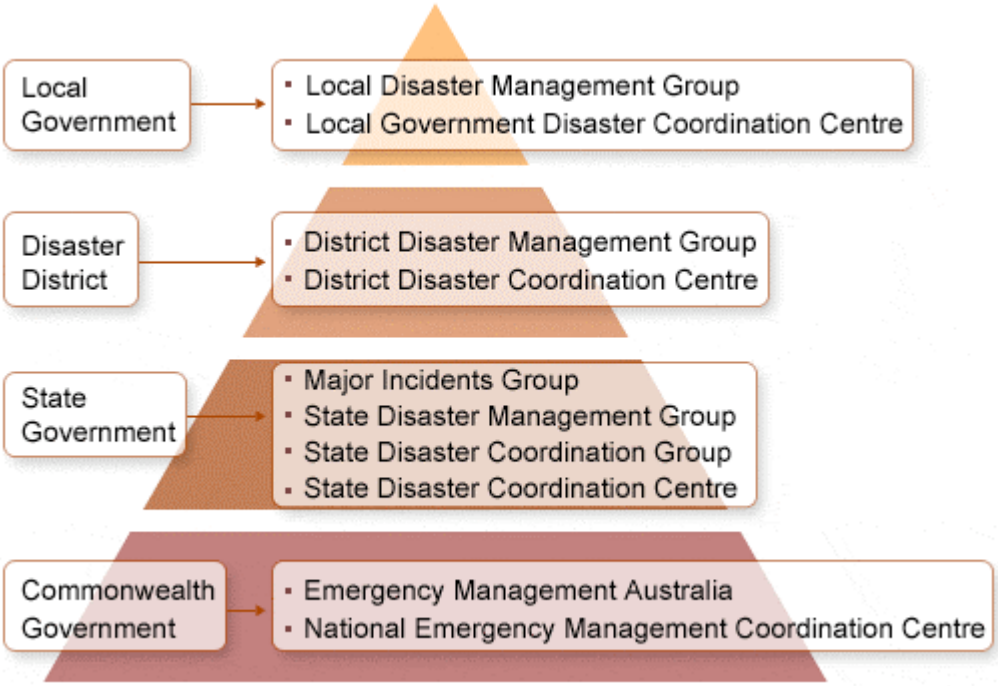

Figure 1: The Queensland Disaster Management System

SEQ is also home to the head office of the Department of Community Services, who are the State Government's emergency response and disaster management agency.

The Department of Community Safety includes three operational divisions intimately involved in disaster management and response: Queensland Ambulance Service, Emergency Management Queensland and Queensland Fire and Rescue. Through these divisions, DCS supports the work of thousands of volunteers in the State Emergency Service and Rural Fire Service

3. CURRENT DISASTER MANAGEMENT PLANS

Each council within the SEQ region has a its own Disaster Management plan, with several councils making these publicly available through their website. Of the publicly available management plans, many mention the 5 concepts of disaster management:

- All hazards approach
- Comprehensive approach
- All agencies approach
- Prepared community
- Recovery

The disasters that may potentially occur in SEQ, as identified by council Disaster Management Plans are can be broken into two categories, Natural and Non-natural. These are listed in Table 2.

Natural Disasters	Non-natural disasters

• Flooding
• Tsunami
• Extreme weather
  o Cyclone
  o Tropical Storm
  o Storm Surge
• Wildfire
• Landslip
• Earthquake
• Heatwave
• Epidemic
• Pandemic
	• Power grid failure > 48 hours
	• Terrorist attack/Criminal attack
	• Chemical
	• Biological
	• Radiological
	• Building collapse
	• High rise/major building fire
	• Dam failure
	• Major traffic accident
	• HAZMAT spill
	• Infrastructure failure > 48 hours
	• Oil spill/waterway contamination
	• Infrastructure failure or collapse
	• Major water accident
	• Rail accident
	• Gas line incident

Table 2: Identified SEQ potential disaster events

Only a few of the publicly available management plans specifically address each potential event, and none of the plans specify what spatial data may be required for particular events.

4. SPATIAL DATA MANAGEMENT

4.1 Data sets

Spatial datasets required for disaster response can be classified as base data layers and emergency data layers (Mansourian et al 2004). Base data layers consist of fundamental information that is used in the majority of mapping products, such as road, geodetic and parcel information. Emergency layers are those that are required for disaster response, such as emergency services locations, medical services and accommodation.

Currently in SEQ, the number of councils and other organisations (SES etc) means that no one body currently holds all the data required to respond to a disaster. While most organisations hold base layer information, such as the parcel layer DCDB (Digital Cadastral Database) and the State Digital Road Network (SDRN) which are licensed from the State Government, Council specific data is not currently shared. Nor are emergency data layers, and this silo storage of information leaves large areas of SEQ vulnerable and under prepared in the

event of a disaster. If a disaster in Brisbane incapacitates its major hospitals, there is little data available in house to identify and establish the location of alternatives.

Due to the nature of a disaster or emergency, often the organisation that holds the critical data is at risk of being effected. In the instance of a disaster in SEQ, most councils have a disaster management centre, but these centres are at risk of being incapacitated themselves. If this occurs, what mechanisms do they have to respond with quality spatial data?

The establishment of partnerships amongst the SEQ councils and government departments will ensure that that the required spatial data is available in the event of an emergency. There must be a focus on sharing of data *before* any incident. This will facilitate planning, reduce response timeframes and ensure availability of information to key stakeholders. All stakeholders need a common view of events. This is not a technology issue; it is a people and policy issue.

To ensure the availability of spatial data in the event of an emergency, a list and series of datasets pertinent to each particular potential disaster should be compiled, and held by the relevant authority or group. This would ensure that event specific data is available readily, and would allow the focus of dataset development to be classified by risk analysis. A data management structure should also be established, allowing the classification of datasets into categories. Several of the key State Government players and councils already use the Australian Standard ISO 19115:2005, for Metadata, so it would be appropriate to use this standard initially, pending further research and collaboration.

The major types of dataset required in a disaster event differ based on the type of data user. Table 3 outlines the different types of mapping roles for different users. Relevant datasets for each disaster type will possibly differ from a point to a line or polygon feature dependent on user.

Level	**User**	**Role of Mapping**
Jurisdiction	State Control	• Oversight • Point based Features • 1:500000 – 1:1000000
Region	Incident Control Centre	• Overview of number & location of incidents • Point line or polygon features • 1:100000 – 1:250000
Event/Incident	Incident	• High level resolution, mapping of details covering area of concern • Point line & polygon features • Detail scale 1:10000 – 1:50000

Table 3: Mapping role for different users in disaster management (ICSM 2007)

4.2 Data management and distribution

It is the responsibility of custodian agencies to ensure their data is collected, managed and utilised for the benefit of their stakeholders. For government bodies these are primarily the people and businesses within their borders. In a disaster management context, this means custodians should ensure their data is available to all relevant authorities and, where appropriate make information derived from this data available to the public.

Providing that datasets can be standardised to ensure interoperability, the design of SDI (Spatial Data Infrastructures) to undertake data distribution should be relatively simple. An SDI is an incredibly valuable tool, and a well designed interface can improve response time, quality of decision making and increase efficiency and effectiveness. The role of SDI in disaster response is examined in depth by Mansourian et al (2004). Once an SDI solution is developed, it needs to be tested across all council platforms, as well as external users.

Public domain spatial systems, such as Google maps should not be discounted as a possible solution for a multi user SDI, as these are often very familiar interfaces and have a wealth of spatial information and data that some groups would find impossible to maintain in house.

4.3 Symbology

ANZLIC (Australian and New Zealand Land Information Council) and ICSM (Intergovernmental Committee on Surveying and Mapping) have developed a series of map symbols used to represent features relevant in an emergency or disaster. These are categorized as shown in Table 4. Also listed is the point frame type for each category.

Category	Definition	Point frame shapes
Incidents	relevant to a natural event, civil activities, policing and counter terrorism	Diamond
Operations	relevant to planned and operational responses to events	Circle
Assets	infrastructure and assets relevant to an incident or event or operational response	Rectangle

Table 4: ANZLIC and ICSM emergency and disaster map symbols

To date there is no symbology in place for line or polygon features, but these maybe be annotated with the standardized point symbols.

The National Spatial and Information Management (NSIM) Working Group in conjunction with the Emergency Management Spatial Information Network Australia (EMSINA) are developing a common all hazards symbol set for Australia, although it is yet to be finalised.

There is also the set of symbols developed by the FGDC (US Federal Geographic Data Committee), and these are being looked at by a number of South East Asian groups for use.

4.4 Aspatial data attributing

Attributing of aspatial data is possibly the next most important objective after standardizing data layers. By using a standardised format and field naming convention, data is instantly interchangeable, regardless of platform or user.

While the fields that are used should be decided in cooperation, it is essential that each feature have a unique ID to avoid data clashes across organisations. This is fairly common practice in large spatial databases now days, so should not present a large problem to organisations.

The format of fields is paramount to data interoperability. As such, it is advisable that Australia Standards, such as AS 4819:2003 *Geographic information – Rural urban addressing* and AS 4590-2006 *Interchange of client information* be adopted to ensure uniformity.

4.5 Updating data during a disaster or emergency

While datasets generally remain fairly stable in times of peace, the ability to update them during times of emergency can aid in decision-making and response times. Critical information, such as road closures, fire or flood zones and contaminated areas needs to be able to be updates regularly and rapidly.

The requirement for both rapid and comprehensive assessments for impact, needs and damage puts a large emphasis on readily accessible data, and the use of 'mobile mappers' becomes important. Some councils use these PDA style units for asset management already, so the move to use them for disaster management is negligible. Several of the larger Group 1 & 2 Government departments use them to great effect in their day-to-day business. If datasets are to be standardized, this will eliminate the issues of program and platform differences between groups.

Due to fiscal, time and staffing restrictions, few of the Councils have dedicated disaster management personnel. This is a significant hurdle in ensuring a coordinated SEQ approach, as valuable time can be wasted in an event trying to establish what data and other spatial resources a Council or group might have. Ideally, a spatial professional should be a part of any Disaster Management team, as this would ensure data is up to date and standardized as per any guidelines that may be developed in SEQ.

4.6 Mapping Products & Distribution

The provision of spatial and mapping products is largely reliant on the availability of computers and the Internet. In the event of a major disaster, it has to be considered that computers and the Internet may be unavailable. As such it is critical that a series of base maps

be produced and stored where they can be accessed readily. This may necessitate the production and maintenance of several sets of base maps, but would ensure that some mapping products would be available should technology fail.

5. RECOMMENDATIONS

Throughout the research undertaken to compile this paper, several key recommendations have been identified. These recommendations, should they be implemented, would serve to improve the quality and efficiency of response in a disaster through the application of spatial data.

The recommendations are as follows:

- A SEQ disaster management council be developed to deal with the spatial component of emergency event management, comprised of representatives from local councils, Government agencies and departments, and key volunteer organisations such as SES.
- A policy be developed that outlines standards for:
    - data layers,
    - layer naming conventions,
    - aspatial data field naming,
    - aspatial data attributing format, and
    - symbology,
- to ensure data interoperability
- Key spatial datasets required for each potential disaster event be identified and compiled,
- Group 2 and Group 3 have at least one staff member that is responsible for working with the SEQ disaster management council,
- A SDI be developed to ensure data exchange, management and updating can occur by a variety of users in a variety of scenarios,
- A series of base maps be produced and maintained in case of technology failure.

Further recommendations and actions may be identified as the dialogue between the major groups that are involved with disaster response in SEQ continues to improve.

6. CONCLUSION

The ability of the SEQ region to respond to a disaster efficiently and effectively is highly reliant on having up to date, pertinent spatial data. The ability of response agencies to communicate and exchange this data in a disaster is important, and as such the relationships between them needs to be expanded to include spatial data.

This paper has highlighted several key recommendations, to be undertaken to ensure data interoperability and information exchange between those agencies and groups responsible for disaster response. While no significant economic analysis of establishing these relationships

currently exists, it can be reasonably assumed that an initial cost in updating, upgrading and developing datasets will be insignificant compared to the ability for groups to respond efficiently and effectively in an a disaster in SEQ.

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