2022 NSW floods

DCS Spatial Services Case Study





Context

The 2022 eastern Australia floods, from late February to early April, were one of the worst flood disasters in recorded history. The east coast experienced a series of three intense weather systems that led to record rainfall and flooding. Twenty-two people died during the disaster and thousands were forced to evacuate as a result of hundreds of evacuation warnings in place.

The large extent of the disaster, across two states, presented unique challenges, in addition to the severity and duration. Between Sydney NSW and Gympie in Queensland, more than 30 locations recorded in excess of 1000 mm of rain.



High resolution imagery of flood extent captured by DCS Spatial Services.

Our response

DCS Spatial Services was, and still is, heavily involved with the NSW Government's flood response and recovery program, including:

- Customer and Emergency Management Services (CEMS)
- Environmental Spatial Programs (ESP)
- Cadastral Spatial Programs (CSP)
- Business Technology Services (BTS)
- Administrative Spatial Programs (ASP)
- Survey Operations

Customer and Emergency Management Services (CEMS)

Within CEMS, the Emergency Information Coordination Unit (EICU) ensures the emergency management sector has the best spatial and related data available to deal with multiagency emergencies. In this flood event, EICU, collaborated behind the scenes to coordinate information that supported strategies and operations for prevention, preparedness, response and recovery.

Activities undertaken in support of the 2022 NSW floods:

- Liaison officers and relief staff for emergency services personnel were provided to assist State Emergency Services (SES) with operational mapping and analysis activities at the State Operations Centre in Wollongong. This included mapping for evacuation orders and warnings and updating the Rapid Damage Assessment dashboard.
- An additional mapping/analysis support officer and a liaison officer for strategic planning on capabilities, data, and products at the State Emergency Operation Centre (SEOC) in Homebush for the majority of the event.

Post Catastrophe Imagery

- Following the 2022 NSW Floods, high resolution satellite and aerial imagery provided critical insight and data for the whole-of-government response and recovery.
- Imagery sources included Spatial Services aerial imagery, Copernicus Emergency Management Service (EMS) satellites, Nearmap, Geospatial Insurance Consortium (GIC) and flood extents from the National Recovery and Resilience Agency (now known as the National Emergency Management Agency, NEMA). Flood extents are created from the imagery and both the imagery and extents are hosted on the Spatial Collaboration Portal.

Rapid Damage Assessments (RDA):

- RDAs are surveys carried out by emergency services following disaster events. The surveys assess the condition of buildings in damaged areas so that emergency assistance can be efficiently managed and dispatched.
- CEMS collated, processed, and distributed data on impacts to properties and buildings collected in the field by the SES and multiple other agencies.
- Information was provided in various formats including xlsx, shapefiles, layer files, FGDB, PDFs and webapp. The processing and distribution of the data was completed nightly to be available by 6.00 am the following morning.
- Data provided was used across government agencies (state and Commonwealth) and nongovernment organisations working on response and recovery.
- Uses included planning the forward RDA collection in the field by SES, understanding the high priority areas for recovery support, development of government grants for floodimpacted people and assessment of grant applications.

Dashboards

- CEMS developed an online interactive dashboard to consolidate impact data of the flood event from a variety of sources, including impacted communities, details of the impacts, and the recovery/support being provided for the event.
- A dashboard was created to identify impacts at LGA level as well as clean-up activities and baseline data on impacted communities.
- The dashboard included a page for each of the four recovery domains of Built, Social, Economic and Environment. It provided data related impacts and the associated recovery activities across government.

Mapping products and cartographic support

- Impact Maps reports were created for more than 34 agencies.
- Mapping products included Natural Disaster Declared LGAs which were updated as new LGAs were declared, Suburb Impact Ratings which coded suburbs based on their level of flood impact, Potential temporary housing sites and Handover to Recovery map books.

Spatial analysis support

- CEMS showed a comparison of flood gauge data to compare current floods with previous events to determine severity.
- This support provided analysis of land use areas within flood extents, analysis of complex addressing titles within impacted LGAs to be used to assist determination of grant eligibility, and analysis on the number of properties within the flood extents.
- This analysis also assisted Service NSW to develop a solution for determining grant eligibility for impacted people.

Data sourcing

 Data sourcing was undertaken across CEMS for numerous datasets that went into the Resilience Dashboard as well as for recovery committees, mapping, and analysis products.



The Hon Victor Dominello MP Minister for Customer Service and Digital Government at the SEOC.



CEMS Director Gareth Carter oversaw EICU operations.



CEMS developed an online interactive dashboard to consolidate flood impact data.

Environmental Spatial Programs (ESP)

Imagery captured by DCS Spatial Services was used by the State Emergency Operations Centre in flood response, recovery and will be used in preparation for future natural disasters. The imagery enables comparative analysis and damage assessments to be undertaken over multiple capture dates. As part of our flood recovery work, ESP provided flood extent data with the EICU delivering impact assessment mapping and data throughout the flood response.

An online dashboard, used to consolidate and visualise recovery data, was also developed directly to assist Resilience NSW (now known as NSW Reconstruction Authority) and featured the following:

Imagery planning

- Planning appropriate Areas of Interest (AOI) for capture required analysis of various inputs and considerations including areas of concern from emergency service agencies.
- These identified areas included previous flood capture extents, imagery resolution, time constraints, estimated flood peak, weather, aircraft maintenance, and other aviation constraints.

Imagery capture

- Upon completion of the planning phase the team activated flight operations for imagery capture. High-resolution imagery in true colour and near-infrared was rapidly captured during and within hours after the peak of the event, adjusting for clouds where possible.
- As part of Spatial Operations, the Environmental Spatial Programs (ESP) team flew over the flood extent at Lismore, Grafton, Ballina, Richmond, Windsor, Singleton and Wisemans Ferry capturing high resolution imagery.

Imagery download, processing and provision

- Once images were captured by the ESP team, imagery was rapidly processed and made available to government agencies.

The imagery mosaic products were made available via Nextcloud and the Spatial Collaboration Portal, as well as the NSW Flood Imagery Viewer.

- This imagery was highly utilised by agencies such as the NSW Telco Authority's Telecommunications Emergency Management Unit, which analysed the imagery to rapidly assess impacts to areas where access was not yet available, and to find routes to deploy emergency technicians to restore telecommunications.
- This imagery was also used for flood debris clean-up management and planning, flood mitigation planning, impact assessments, flood extents, as well as research and gathered significant interest from the community and media.



High resolution true colour and near-infrared imagery of flood extent.



This imagery enabled comparative analysis and damage assessments.



Imagery was also used for flood debris clean-up management and flood mitigation planning.



Imagery capture of Lismore flight path.



Flood imagery over Ballina airport.



Imagery mosaic products were available for viewing on the Spatial Collaboration Portal, in the NSW Flood Imagery Viewer.



Images were captured during and within hours after the peak of flood.



Flight operations occurred after an in-depth planning process.

Cadastral Spatial Programs (CSP)

As part of assessing the impact of the 2022 flood events, emergency responders needed to identify the extent of damage to properties in flood affected areas. However, the level of flooding often obscured or displaced physical house numbers making it difficult to identify the location and extent of each property.

To overcome this, the NSW Digital Cadastral Database (DCDB) was used to link Global Navigation Satellite System (or GPS) coordinates recorded at the location of damaged properties to unique land parcel identifiers and property addresses maintained by DCS Spatial Services.

Another application of the DCDB during the flood events was by NSW Public Works Emergency Temporary Accommodation Program for installing emergency housing pods. The DCDB, combined with the State's Digital Elevation Model, was used to assess the slope and aspect of land parcels to ensure that the housing pods and associated services were setup in suitable locations.



Leets Vale before.



Leets Vale after.

Cadastral Development Programs

To ensure emergency service organisations achieved the best results, the Cadastral Development Programs team leveraged a daily property damage assessment data feed to prioritise the spatial upgrade of property boundary data. As cadastral accuracy was improved in these areas, information captured by emergency service organisations in the field better aligned with cadastral boundaries and addressing data.

These upgrades helped ensure efficient processing of insurance claims and government grants to support the local community. Furthermore, local councils will benefit from more accurate property boundary data to assist in the re-build effort for the accurate location of multiple services such as water and sewage.

Cadastral Development Programs response to the flood emergency has been significant, with 92 flood upgrade jobs completed within 22 LGA's and more than 18,000 land parcels being spatially upgraded as at the end of April 2023.



Lower MacDonald Upgrade before.



Lower MacDonald Upgrade after.



Lower MacDonald - Flood. Source: Sydney Morning Herald March 24th, 2021.

Business Technology Services (BTS)

The BTS team provides specialised technical support, specialised ICT project management skills, maintenance and system administration of frontline customer service applications, portals, and services.

Their work includes:

The NSW Flood Imagery Viewer

- The NSW Flood Imagery Viewer enables easy access to all available flood imagery. It contains layer widgets
 to separate current and previous events along with an imagery swipe tool to allow users to compare imagery
 layers.
- Imagery was made available faster than many crews could get on the ground, which allowed for remote decision-making. This meant quicker access to sites and improved safety measures for first responders.
- Imagery was also provided as web services that could feed into individual ESO's Common Operating Pictures, so they could analyse the flood impacts against their own internal data which provided significant operational insights.

Data processing and management

 In the March round of images there was a total of 12 layers (six true colour and six colour infra-red) with a size of approximately 27 GB.



NSW Flood Imagery Viewer is a key web application used to view high resolution flood imagery.

Administrative Spatial Programs (ASP)

Administrative Spatial Programs' NSW Point service was a critical tool available for whole-of-government use.

NSW Point is one of the services under Administrative Spatial Programs and offers a range of address and location web services such as bulk address validation and location web services designed to be embedded into government online forms and applications.

NSW Point's work included:

- Supporting multiple applications across government used to collect critical information about flood recovery tasks from affected residents and assist in locating and mapping affected areas.
- Being used as part of the automated customer validation process which allows grants and funds to be dispersed to affected residents in much shorter timeframes.
- Feeding into emergency service mapping tools to locate affected customers and infrastructure. This is particularly critical in regional areas where addressing in third-party services such as Google Maps may not be accurate.



NSW Point provided critical services during emergency flood response.

Survey Operations

DCS Spatial Services surveyors were deployed for the first time as part of a whole-of-department and whole-of government response to the NSW flood event.

Their roles focused on Peak Water Level assessment:

- DCS Spatial Services' surveyors from the Lismore and Coffs Harbour office supported NSW Public Works and the SES by accurately mapping the Peak Water Level of the floods around Yamba, Iluka, Grafton, Lismore, Casino, Kyogle, Maclean and Rappville.
 - The team continued to undertake this work as they were able to access other flood affected areas.
- This survey work will enhance flood modelling to better inform future flood mitigation strategies and improve the resilience of communities around Northern NSW rivers.

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