

# Arches: A Decision Support Platform for Stewardship of Cultural Heritage Resources

## Modelling, collecting, managing, visualizing, and integrating information to preserve, protect, and restore Cultural Heritage Resources

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Managing the information necessary to appropriately describe movable (and immovable) cultural heritage resources is a challenge. Identifying the significance, condition, and threat exposure of cultural heritage resources in a constantly changing world and then determining the most effective protection strategies for them can be even more challenging.

To enhance the ability of organizations tasked with identifying, protecting, and preserving cultural heritage resources, the Getty Conservation Institute (GCI) initiated the development Arches, an open-source information management, integration, and visualization platform for cultural heritage data. Since its first release in 2012, the GCI has continued to fund the development Arches software platform, extending the platform's ability to manage the information needed to preserve and protect heritage resources around the world.

Arches provides semantic data modelling capabilities, the ability to deploy sophisticated data management applications with little or no software coding, and built-in high-performance search and data visualization tools. The Arches platform includes full geospatial data management and display capabilities (as well as real-time integration with the esri GIS suite and open-source alternatives), thesaurus management services, sophisticated temporal data representation capabilities, data entry workflow support, bulk data import/export services, and an integrated mobile application for both iOS and Android devices. Arches is built upon a modular software design, and provides a robust API (Application Programming Interface) to support integration with other systems, as well as a plug-in architecture to allow software developers to extend Arches and deploy custom capabilities.

Improving the preservation of cultural heritage resources requires a planning horizon that includes developing a pre-emergency inventory of heritage resources, acquiring resource condition and threat assessment information during the emergency, and long-term resource stewardship of heritage resources after an emergency (and before the next one). Arches can play a key role during each of these resource management efforts.

A core strength of Arches, and one of its initial design goals, is its ability to support the creation of a comprehensive inventory of cultural heritage resources tailored to the specific requirements of a region or administrative area. For many organizations, an Arches cultural heritage inventory includes databases of archaeological resources (e.g.: sites, finds of coins, tools, sherds, etc.), built heritage (e.g.: architectural structures, other human-made objects), historic landscapes, activities (e.g.: investigations, surveys, restoration efforts, condition assessments, emergency response activities), people/organizations (e.g.: individuals or groups that engage in activities), bibliographic resources (e.g.: literature and other documentary evidence describing heritage resources, activities, and people/organizations), and digital resources (e.g.: images, video, audio, documents, 3-D models, and other digital representations of cultural heritage resources). Depending on the requirements of an organization, an Arches cultural heritage inventory may contain additional databases (e.g.: cultural periods, collections, archives, or models for more specific resources such as maritime craft).

Of course, an up-to-date and well managed inventory of cultural heritage resources is an essential tool for the long-term stewardship of a region's heritage. Inventories ensure that an organization is aware of the location and geospatial extent of its resources, as well as the type, significance, condition, and ownership of its heritage resources. Consequently, Arches heritage inventories provide a means for forecasting the potential threats that may adversely impact specific resources. For example, a spatial analysis that compares the distribution of heritage resources to areas of potential high ground acceleration due to an earthquake may be used to quantify the threat exposure of specific resources to seismic activity.

When events such as natural disasters, urban development, or conflict (e.g.: hostile actions, looting, etc) occur and threaten heritage resources, Arches can provide additional information management capabilities and situational awareness. The Arches platform includes a module ("Arches Collector Manager") to implement and manage distributed field data collection efforts, and mobile apps for iOS and Android devices that allow users (with appropriate access privileges) to collect data and securely update an Arches inventory with their mobile device of choice.

The Arches Collector Manager module allows the person or people coordinating an emergency field data collection survey to define the geospatial extent, duration, database fields, and the people who will be invited to participate in the assessment of heritage resources. By using Arches Collector Manager, an emergency field survey manager can pinpoint the precise area that a team should be deployed to in order to begin data collection activities (Figure 1).

Arches Collector Manager allows the survey manager to identify who should participate in the data collection effort, either by selecting specific user accounts or by including members of an Arches user role (for example, members of the "Crowdsourcing Editor" group). This capability allows the survey manager to optimally deploy people in the field at the most important locations and time. Further, Arches Collector Manager allows the survey manager to simplify the data collection effort by selecting just those database fields and records that will be updated as part of the field survey. Finally, the survey manager may choose when they wish to activate the survey, which then allows field personnel to download the survey details and begin collecting data (Figure 2).

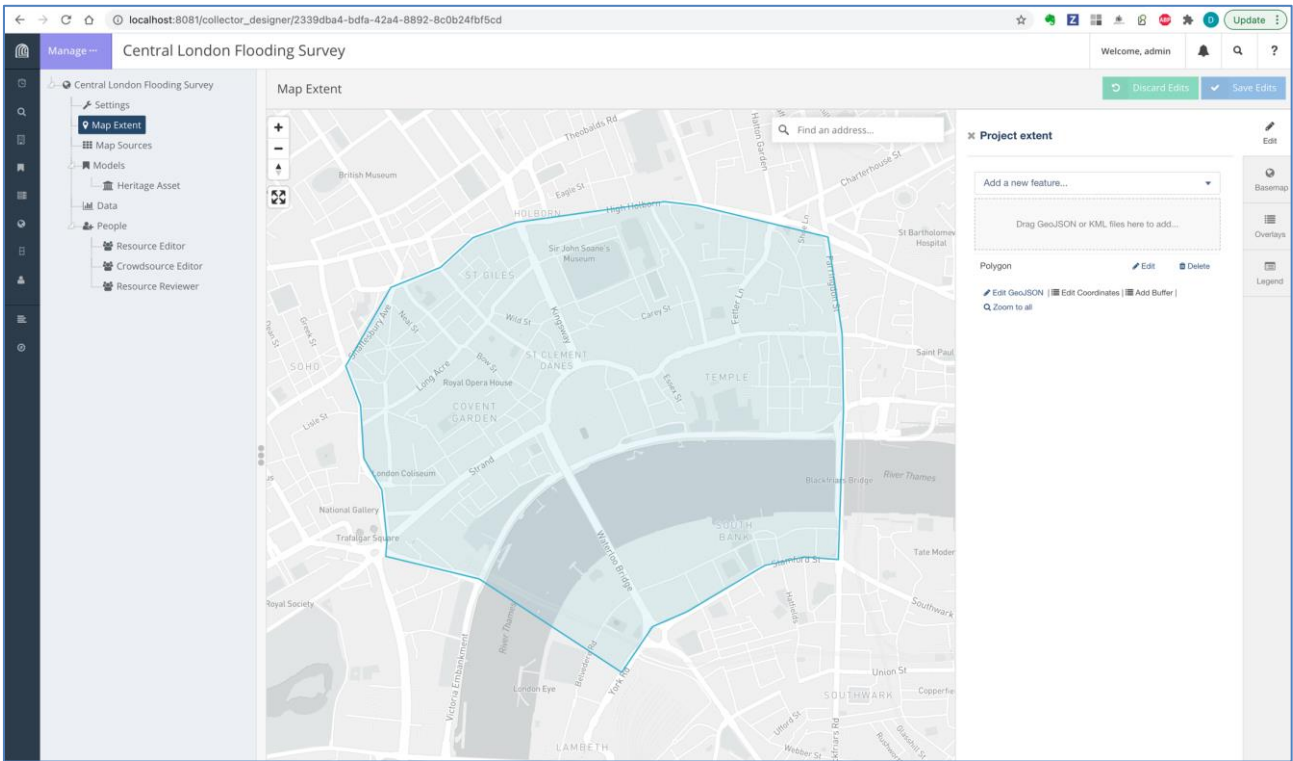


Fig. 1. Arches Collector Manager Module showing how a field survey manager may define the location and extent of a field survey.

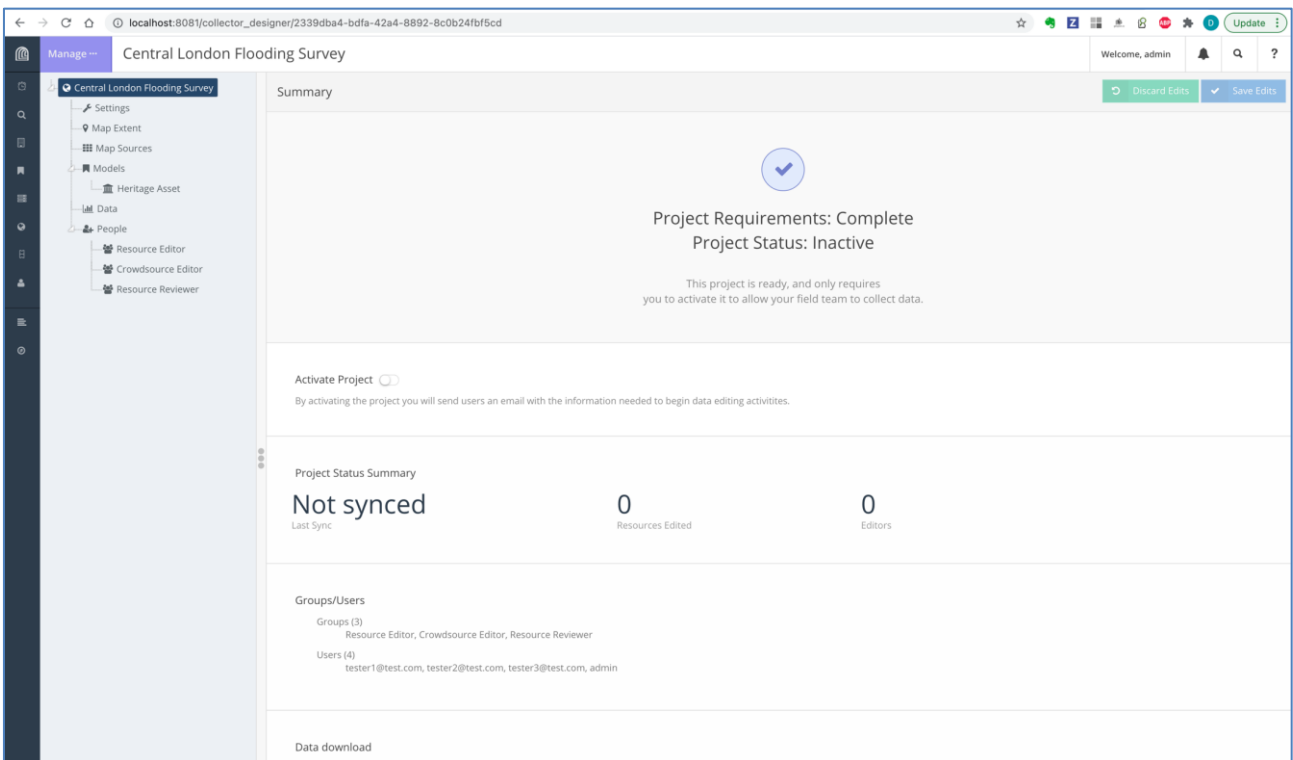
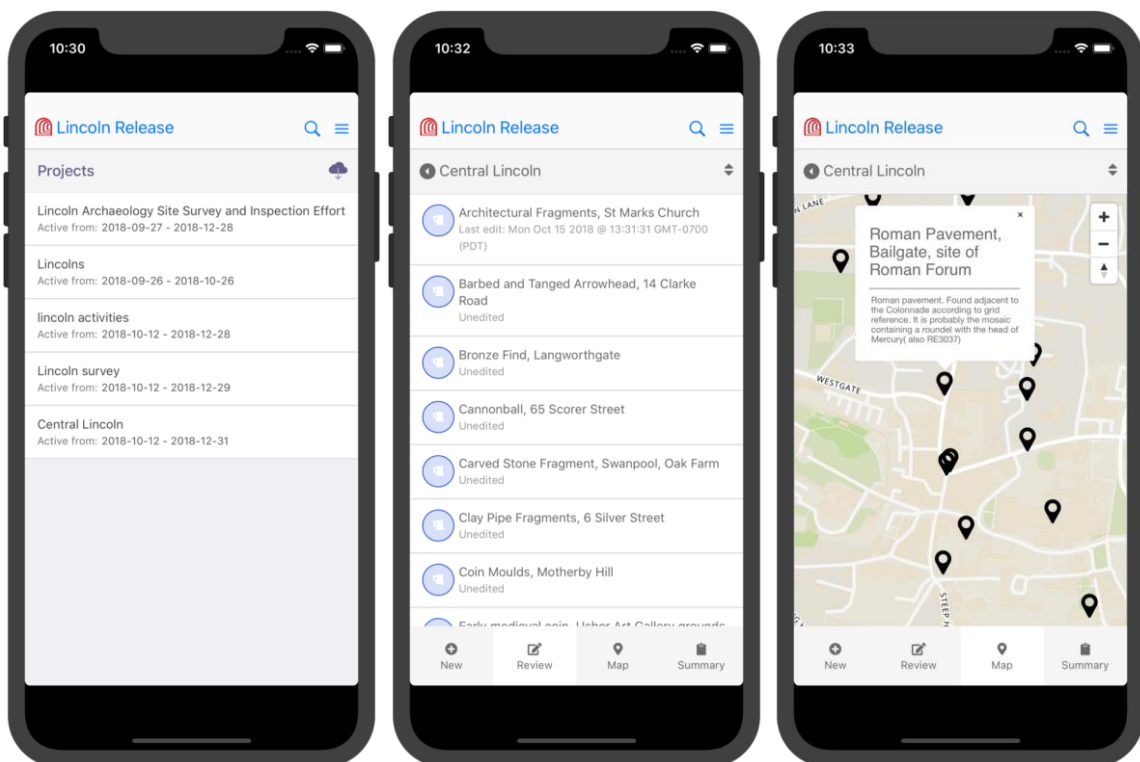


Fig. 2. Arches Collector Manager Module. The tree on the left of the image shows the information that can be specified for a field data survey. The panel on the right shows the current state of the survey.

After a field survey has been defined using Arches Collector Manager, survey members can use “Arches Collector” (Figure 3), an iOS and Android app, to log on to Arches and download the information created using Arches Collector Manager to define the location, duration, and heritage resource records that require updating as part of an emergency survey. All members of the survey team must provide credentials to log into the survey data. Arches Collector will use the permissions granted to a specific user to determine what data the person may access and update. Once a user has used Arches Collector to log in, they may begin updating information for existing heritage resources, or add new resources that may be discovered as part of their field investigations. All survey information is stored on the user’s mobile device so that they may collect data even if cell or WiFi networks are not available. Once a user establishes connection with a network, they may synchronize their data with the Arches server. Each time a user synchronizes their mobile device with Arches they will receive the most up-to-date information for the resources in their survey area, even if the data was provided by another field survey team member. Typically, field data collection efforts would include updated information on the condition and on-going threats to a heritage resource, as well as images and video of the resource.



*Fig. 3. Arches Collector. The image on the left shows a listing of field survey projects this user has permission to join. The middle image shows a listing of heritage resources in the survey area that require inspection. The image on the right shows the location of heritage resources in the field survey.*

As survey team members synchronize their observations with the Arches server, Arches automatically updates the inventory in real-time. Arches geospatial data management capabilities can then be used to display maps showing the condition and status of heritage resources in the field survey area. This provides an event coordinator and other stakeholders access to up-to-the-minute information on the condition and extent of heritage resources, improving the situational awareness of decision makers.

Once the immediate concerns of an emergency have been mitigated, Arches may continue to play a central role in the restoration of damaged resources and planning for the protection of resources against future emergencies. For damaged resources, Arches can be used to manage the restoration activities, material sampling and analysis, analytic laboratory data, and modifications that may have been made to a heritage resource as part of its restoration. And the information managed by Arches may be integrated with other datasets to analyse and forecast the potential for future threats to an area's cultural heritage resources.