APPROACHING THE CROWDSOURCE WITH ARCGIS ONLINE FOR MANAGEMENT POND AND MOAT SYSTEMS IN THE IMPERIAL CITADEL OF HUE, CENTRAL OF VIETNAM

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ABSTRACT

In recent years, Geographic Information System (GIS) has been considered as a vital role in Natural Resources. With the development of web-based GIS technology in recent years, it is enable to collect spatial data and share data in cloud service, even for general GIS users. Sharing data with decision makers and the public is an essential part of urban planning and natural resources management. ArcGIS online provides an easy-to-use platform for creating web maps and sharing these web maps as web apps or via social media. The Imperial Citadel of Hue, Thua Thien Hue Province recognized as a UNESSCO World Heritage Site in 1993, has to be the most romantic and poetic city in Vietnam with a complex of monuments attracted many tourism in the whole countries as well as in the worlds. The moat and ponds system plays a crucial meaning of spirituality, contributing to the harmonious beauty and environmental landscape of Hue's monument structures. It is considered as an indispensable factor in hydraulic flow circulation for monuments protection as well as water drainage control of more than 500 hectares of land in Capital city (Kinh Thanh).

In order to contribute to the ability of providing, sharing and updating visual information and data on moat and pond systems for decision-makers, the application of ArcGIS online will necessary and consistent with the current trend of GIS development. This research uses ArcGIS online - a cloud application of ESRI to establish a Moat and Pond System Management Map in Citadel City.

1. INTRODUCTION

In recent years, Geographic Information System (GIS) has been considered as an vital role in Natural Resources. Many natural resources managers such as bilologist, botanists, ecologists, environmental regulators, hydrologists, planners, miners, petroleum engineers, foresters, and farmers has utiliezed efectively the analytical power of GIS for help in making critical decisions (ESRI, 2014). With the development of web-based GIS technology in recent years, it is enable to collect spatial data and share data in cloud service, even for general GIS users (Zhang *et al.,* 2013). Sharing data with decision makers and the public is an essential part of urban planning and natural resources management. ArcGIS online provides an easy-to-use platform for creating web maps and sharing these web maps as web apps or via social media (Chappell, 2011).

The Imperial Citadel of Hue, Thua Thien Hue Province recognized as a UNESSCO World Heritage Site in 1993, has to be the most romantic and poetic city in Vietnam with a complex of monuments attracted many tourism in the whole countries as well as in the worlds. Located at the northern bank of the Huong River, the Imperial Citadel is protected by a high outer walled fortress, a surrounding moat system and the abundant ponds system inside. The moat and ponds system plays a crucial meanings of spitituality, contributing to

the harmonious beauty and environmental landscape of Hue's monument structures. It is considered as a indispenable factor in hydraulic flow circulation for monuments protection as well as water drainage control of more than 500 hectares of land in Capital city (Kinh Thanh). However, due to the negative impacts of natural disasters, lack of suitable urban planning, population growth pressures as well as environmental issues, the moat and ponds systems has declied in quality and quantity. Some moat part and ponds have been faced with risk of abandon, encroachment for private purposes, leveling, change in shape, declining water quality, household waste container.

In several recent years, the City Authorities and Hue Monuments conservation Center has focused on the mangament, protection and restoration moat and ponds system. However the fact that ponds system is deformed, smaller and smaller revealed the managment on ponds encroachment vilotations have not been concerned adequately in many wards (Thua Thien Hue Newspaper, 2014). Curently Thua Thien Hue on its way to be a centrally - governed city and atttibuted as a world's culture heritage city, national and international festival city (QD 597/QD-TTG date 16th April, 2013 of The Prime Minister). Therefore, in order to contribute to the ability of providing, sharing and updating visual information and data on moat and pond systems for dicision-makers, the application of ArcGIS online will necessary and consistent with the curent trend of GIS development.

This research uses ArcGIS Online - a cloud application of ESRI to establish web service application for management of Pond and Moat System in Hue Citadel City.

2. MATERIAL AND METHODOLOGIES

2.1 Study area

The study area is limited in the Imperial Citadel located in the northern part of Huong River covering 4 wards (Thuan Hoa, Thuan Thanh, Thuan Loc, Tay Loc, and Phu Binh) with a total area of 520 ha (Figure 1). The moat system is surrounded by four roads Le Duan, Tang Bat Ho, Dao Duy Anh and Huynh Thuc Khang. The Citadel of Hue city is located in the tropical moonson region with high precipitation. It is located in the downstream of Huong River, where the topography is flat and depressed, with the slope range from 0.2 to 0.3 degree. With high temperarturte and an tropical moonson climate, this area has relatively high precipitation and frequently is inundated that afecting the drainage system of urban areas.

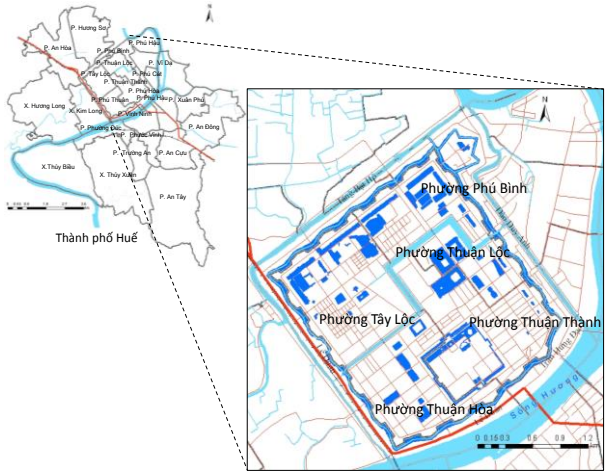

Figure 1. Location of the study area

2.2 Research methodologies

The term of "Crowdsource" is proposed by Charlie Fitzpatrick - the ESRI's Education Programs Manager. He published an artical mentioning Crowdsource entitle "Fun with GIS 128: Crowdsources Your Fieldwork" on GIS Education Community website. With the magic power of Arcgis Online Organization, it is enables to publish editable features services for general GIS users (Charlie Fitzpatrick, 2012; Zhang *et al.*, 2013). ArcGIS Online is a collaborative, cloud-based platform that allows members of an organization to use, create, and share maps, apps, and data, including authoritative base maps published by ESRI. Through ArcGIS Online, it is enable to get access to ESRI's secure cloud, where we can manage, create, store, and access data as published web layers, and share via web links, groups, social media, web maps, and mobile apps.

The procedure of establishing web-GIS applications for management ponds and moat systems involves two main steps: creating map in ArcGIS Desktop and publishing it in ArcGIS Online. Based on the objectives of project for management ponds and moat system in the Imperial Citadel of Hue, the data was first collected from various sources including articles, researches as well as fieldwork, and then was analyzed and processed. ArcGIS Desktop 10.2 was used to set up the spatial data and map of Moat and Pond System Management. We created the feature class using data collected editable feature services. The Editable Feature Service is enable the map users or the "Crowdsource" can create, delete, query, and update data of Pond and Moat system for better management. Then the map was shared and published into ArcGIS Online by logging in with the registered account. Currently ESRI provides a 30 - day free trial and we used this free trial to implement this work. We published the map as a web service through the "sharing as" function of Arc Map 10.2.

3. RESULT

In ArcGIS Desktop, we set up the spatial data with UTM map Projection for zone 48 and the datum of WGS84. The layers were created including the layers providing the general information on Pond and Moat system in Hue Citadel such as Administrative, Pond, and Moat system and the. The Administrative layer showed the boundary of wards (polygon) and its attribute (Name, Area). The Pond layer presented the spatial data of ponds system (polygon) and theirs attribute (ID, Name, Origin of pond, Area, Perimeter, Depth, Forming history, Level management, Using status, Temperature, pH, CO, DO, COD, BOD, Total Nitrogen, Total Phosphorus, Photo). And the Moat layer showed the spatial data of moat system (polygon) and its attribute (Name, Origin of moat, Forming history, Depth, Width, Length). A total of 40 ponds and 1 moat were collected and managed in this research.

Besides providing the general information on Pond and Moat system, we created a point feature class "Environment status" using data collected editable feature service with attributes matching the information to be collected (Site number, Site name, Initial of data collector, Date, Water quality, Surface cover, Shape status, Environment problems). We added an Open Street Map as a base map for providing the user with reference information and save the map document for publishing in ArcGIS Online (Figure 2).

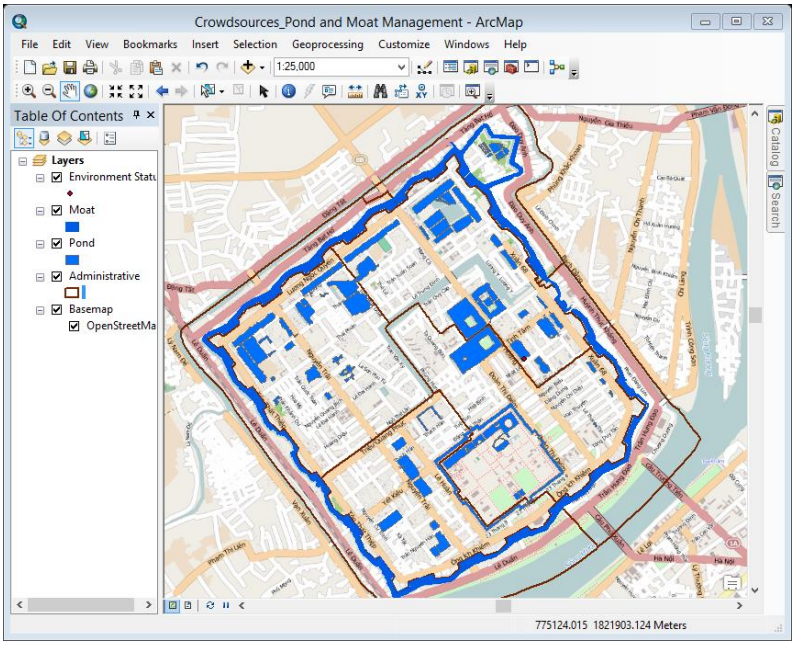

Figure 2. Preparing map data in Arc Map

The settings are required to configure the services after sign in ArcGIS online account in Service Editor: (1) Connect My Hosted services, (2) Activate Feature Access and ensure all operations are engaged, so users or "Crowdsources" member can create and modify the data (3) Choose the degree of sharing (4) Click Analyze to identify any issues and make sure the map can be publish as a service, and finally (5) Publish the service by hitting the "Publish" button (Figure 3).

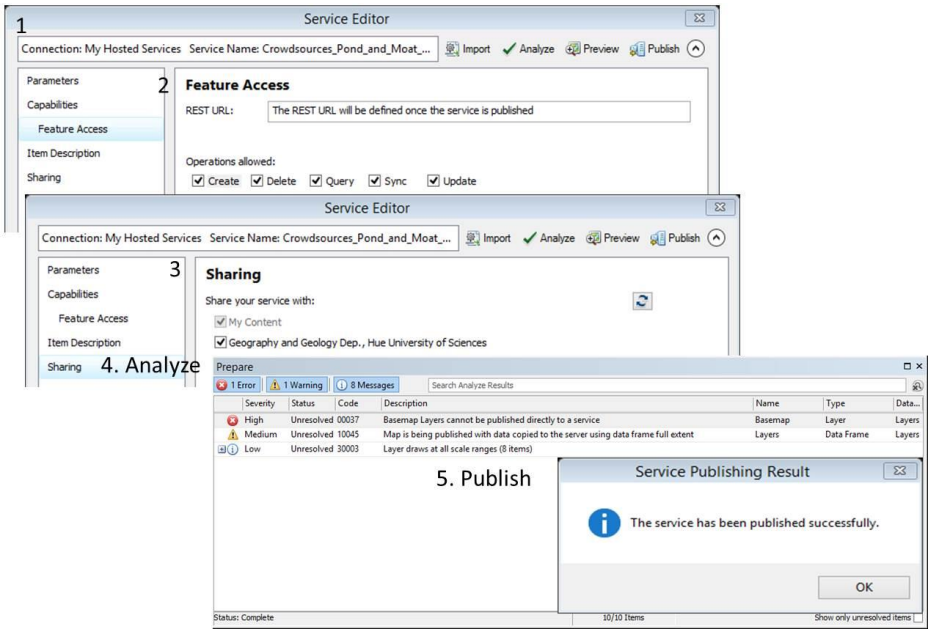

Figure 3. Settings in Service Editor

The new web service "Crowdsources Pond and Moat Management" can be accessed at www.arcgis.com. This web service was shared with "the public" so users can search for the service's name even without signing in (Figure 4).

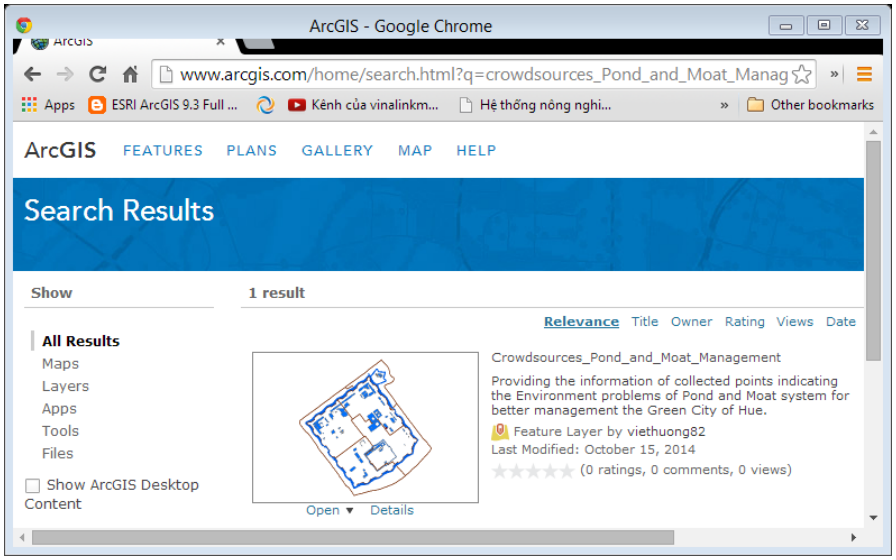

Figure 4. Web service accessed at www. arcgis.com

When open the map, first you can choose the suitable base map for the web map and then you can examine the information on the Pond and Moat systems by zoom in/out, select feature to identify the attribute of each pond (Figure 5), or even you can edit, change symbol, and configure pop-up.

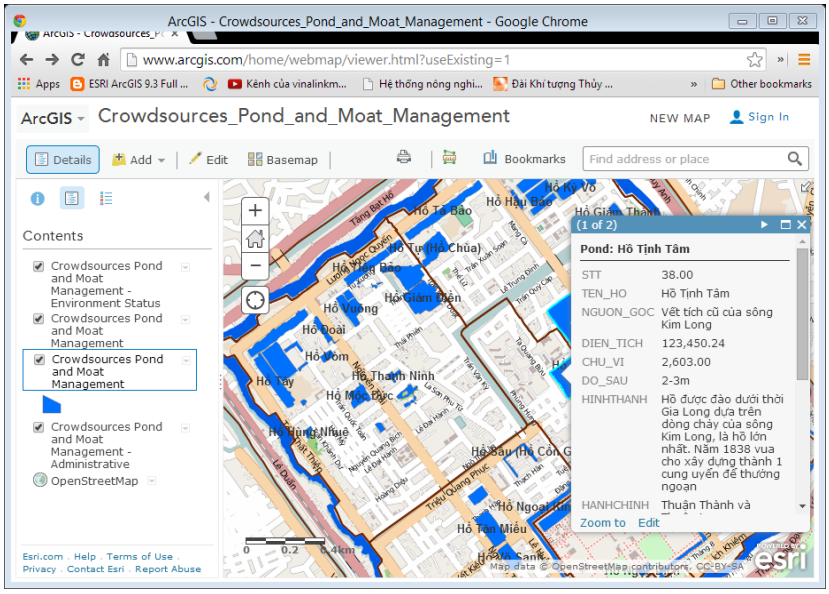

Figure 5. Identify the information of pond in ArcGIS online

The status of environment of the pond and moat system can be create, edit, delete, and update information by the "Crowdsources" in this map web server. In order to add a new point, click on the Edit button, click on the Crowdsources Pond and Moat Management - Environment Status layer in the table of contents, click on the correct collected point location on the map, then enter the corresponding attribute information (Figure 6). To delete a point, scroll down to the bottom of the attribute window to select the Delete button.

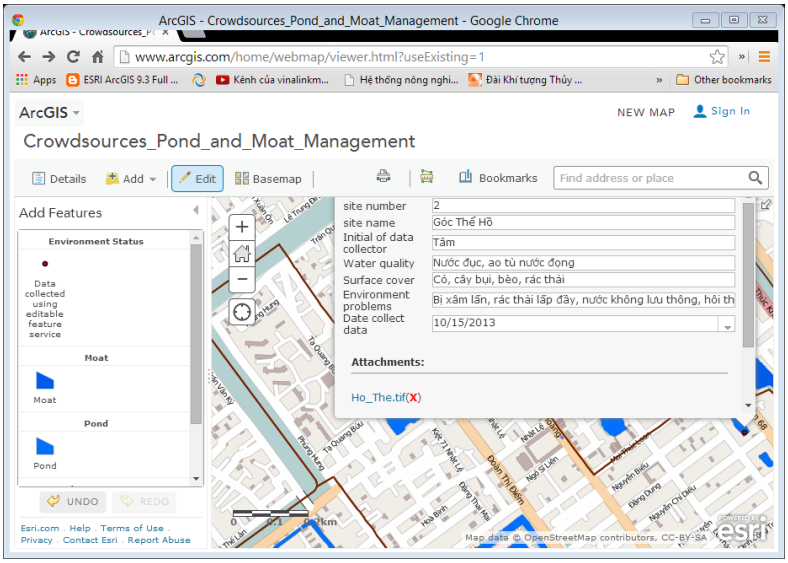

Figure 6: Added new point in map web service

This map web service also can open, collect and update data in the field using the ArcGIS apps for iOS and Androids phone by you or anyone else in the "Crowdsources".

4. CONCLUSION

This study has demonstrated the capability of approaching crowd sources with ArcGIS online for Pond and Moat system Management. The advantages of this web service application are (1) not require a local web server which often make us meet much difficult in complex server setup, process as well as maintenance missions, (2) increase the participation of local community/crowdsources in the protection of environment resources, (3) provide the visualization tools for authorities, managers and decision maker in making plan for protecting the green environment of Hue City.

5. REFERENCES

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