Web Map Options for Local Government use of Natural Resource Inventory Data

Produced for:
NYS Department of Environmental Conservation
Hudson River Estuary Conservation and Land Use Program

By: Don Meltz, AICP - Don Meltz Planning and GIS
December 31, 2017

This Project has been funded by the New York State Environmental Protection Fund through the Hudson River Estuary Program of the New York State Department of Environmental Conservation
Contents

Contents ................................................................................................................................. 2
Introduction ............................................................................................................................. 3
Proprietary vs Open Source .................................................................................................. 4
Software Options .................................................................................................................... 6
Boundless .................................................................................................................................. 6
Two Business Models ............................................................................................................. 7
Costs ........................................................................................................................................ 8
Cost Summary ........................................................................................................................ 9
Putting it all together .............................................................................................................. 10
Spanning Ecosystems ............................................................................................................. 11
  Desktop Interoperability ...................................................................................................... 11
  Server Interoperability ........................................................................................................ 11
Web Maps .............................................................................................................................. 12
  AGOL .................................................................................................................................... 12
  WebApp Builder .................................................................................................................. 14
Summary of Interoperability ................................................................................................. 15
Website Hosting Requirements ............................................................................................. 16
Required technical capabilities ........................................................................................... 16
Do-it-yourself options and sources of training ..................................................................... 17
Types of firms that develop web maps and the qualifications to look for ............................ 17
Typical consultant price range for a municipal-scale web map product ............................... 18
Long-term technical support needs, and expenses for maintenance and updates ................ 18
  What’s the best solution for Local Governments? .............................................................. 19
A Generic Local Government Situation ............................................................................... 19
  Special note on ArcGIS Online Public Accounts ............................................................ 20
Introduction

The Hudson River Estuary Conservation and Land Use Program (Estuary Program) provides training and technical assistance to municipal officials and conservation partners in the Hudson Valley. They encourage natural resource-based planning and foster resilience of natural systems and human communities in the estuary watershed. Estuary Program staff promote municipal natural resource inventories (NRI) as a foundation for land use and conservation planning, and have been supporting municipal NRI efforts through grants and technical assistance.

As more communities undertake NRIs, interest in the use of Geographic Information Systems (GIS), and more specifically - web maps, to view and disseminate inventory data is growing. These municipalities want to provide interactive viewing capability and greater public accessibility to NRI and other spatial data offered by web mapping, but face technical and financial barriers to establishing their own systems.

Estuary Program staff want to assist local governments in understanding and evaluating the options available to them for creating interactive web maps in order to facilitate sharing NRI data. To that end, the Estuary Program commissioned this report to provide an overview and discussion of:

- The various software and web map options available.
- The website hosting requirements for including an online map on a municipality’s current website.
- The required technical capabilities of the person in charge of maintaining such a web map.
- The do-it-yourself options and sources of training.
- The types of firms that develop web maps and the qualifications to look for.
- The typical consultant price range for a municipal-scale web map product.
- The long-term technical support needs, and expenses for maintenance and updates.
Proprietary vs Open Source

There are two very broad “eco-systems” that Geographic Information System (GIS) software, and all software, fall into - Proprietary and Open Source. Proprietary software is developed and sold in a closed system. Private companies write and sell the programs for a profit. The source code is usually a closely guarded secret. Open Source software, on the other hand, is developed in an open system, where anyone who wants to see how a program is written can do so. The source code is freely available for everyone to look at, use, and modify, if they want.

Proprietary GIS software got its start in the late 1960s, 70s, and early 80s, when the Harvard Laboratory for Computer Graphics and Spatial Analysis picked up on an emerging need for large scale geographic inventories. They developed numerous computer software programs and systems designed to manage and analyze spatial data. ODYSSEY GIS was the first fully integrated vector based GIS program developed at the Harvard lab.

The lab was initially funded by the Ford Foundation, but ongoing costs were high. The Lab began selling the software it developed to large corporations and to the government to cover its costs. Working at the lab in the late 1960’s, and seeing the future value of GIS software, was one Jack Dangermond. He and a few friends started a private for-profit corporation called ESRI in 1969.

ESRI eventually developed ARC/INFO, which was largely based on the ODYSSEY program, leading to GIS software commercialization. The costs of a full-fledged GIS were high. Both the hardware and software were expensive.

Moving into the later 1980s, 90s, and early 2000s, computer memory and graphics capabilities improved. Computers became more plentiful and powerful. A strong competitor of ESRI at the time was MapInfo, another commercial GIS software company that was started as an RPI incubator project. MapInfo was just as powerful as ESRI software, had a more intuitive user interface, and was therefore seen as easier to use. However, ESRI was more effective at marketing their product to federal and state government agencies, and to large private corporations. This is the path commercial proprietary GIS software took to become mainstream.

At the same time, there was another path being blazed by a few non-conformists. In the early days of computing, computers were a novelty. They were expensive, and they were complicated. They required a whole new way of thinking. Entirely new languages were developed just to communicate with them. There were no books, few references, and little history to learn from. The hardware was generally supplied with the source code needed to run it.

Learning how to use computers required everyone to learn by reading code, and to share the information they had with others who wanted to learn. It was share and share alike, or no one would be able to gain. A certain culture began to develop around computers and computing.

As computers evolved, they became cheaper and more saleable. As money entered the picture, the culture began to change. Richard Stallman came on the scene in 1971 when he started working at the MIT Artificial Intelligence Lab. He became frustrated with the effects of this change in culture of the computer industry and its users. In 1983, he started the GNU project, promoting the development of “free” software. In 1985, he founded the Free Software Foundation (FSF), a not-for-profit organization.

In 1982, The United States military needed to comply with the National Environmental Policy Act (NEPA), which required software for land management and environmental planning. The US Army Corp of Engineers could not come up with the $15,000 cost of the ArcInfo software and the $60,000 cost of the minicomputer required to run it. The development of GRASS was started by the USACE-CERL (US Army Corp of Engineers - Construction Engineering Research Laboratory). The acronym GRASS stands for Geographic Resources Analysis Support System.

The Open Source Initiative started in 1998 as an educational, advocacy, and stewardship organization with three primary principals:

- Software must be free to redistribute
- Software must include access to source code
- Software must allow modifications and derived works, which must also be free, and with source code

In 1998 – GDAL/OGR was developed and released as a free command line data converter, now used in both open source and commercial GIS software.

In 1999 – GRASS was released as open source software under the GNU license.

In 2006, OSGeo – the Open Source Geospatial Foundation was formed. OSGeo is a not-for-profit organization with the mission to support and promote the collaborative development of open geospatial technologies and data.

Two software programs that were developed in this decade, and are now supported by OSGeo, are the desktop software QGIS (2002), and the server software GeoServer (2001).
Those are the two paths that have led to the two distinct eco-systems we have today. Proprietary and open source software. You can think of these as being roughly analogous to commercial and not-for-profit systems, although it’s not always a clear divide between the two.

Software Options

On the proprietary GIS software side, we have programs such as ArcGIS Desktop, MapInfo, and Manifold. These are all commercial software packages, and cannot be modified by the end user if there’s a need for some specialized functionality.

On the Open Source GIS software side, there is QGIS, MapWindow, and uDig, to name just a few. These are free of cost, and free to use and modify, if the user has the skills to do so.

The two major players in the GIS arena are ESRI on the proprietary side, and OSGeo on the Open Source side.

However, just because a piece of GIS software falls under the Open Source umbrella, does not mean there is no money involved. The folks who develop these programs do get paid. Yes, there are volunteers, as there are in most not-for-profit organizations. But there are also plenty of Open Source programmers who get paid to write code. Large corporations and government agencies that need specific, specialized functionality that is not yet available in proprietary software will often fund a special open source project to add that functionality. Once that’s done, it becomes a part of the software, and available for use by others. There are also other not-for-profits and foundations that fund open source software development.

The point here is, open source software, while free, should not be viewed as cheap, or low-quality software. Open Source GIS software is every bit as functional, stable, and useable as commercial proprietary GIS software. In many cases, it is even better.

Boundless

One of the areas Open Source GIS software is generally known to be lacking, however, is in marketing. Go to any open source software web page, and you will usually see a minimalist website. The bulk of the effort is put into writing the software code itself. Seeing this as a missing piece of a larger puzzle, one company has made an effort to fill this void.
In 1999, a not-for-profit organization formed called Open Plans. Open Plans’ mission was to provide low or no cost technical tools to planners and other not-for-profit planning organizations. Most of these tools revolved around transportation planning. As they soon discovered, the GIS tools they envisioned required more expertise and effort to develop. And once developed, they began to attract a market of their own.

Thus, OpenGeo was formed as an offshoot of Open Plans in 2002. Their flagship software program was called OpenGeo Suite, a combination of GIS server software, data storage, and online mapping tools. OpenGeo grew rapidly over the next decade, and in 2013, gained the interest of a venture capitalist. They then rebranded themselves as Boundless.

Two Business Models

Boundless both develops and packages open source software, marketing it as a viable alternative to commercial proprietary GIS solutions.

ESRI makes the bulk of their profit by selling software. There is an initial purchase price, and usually, an annual licensing fee if a user wants to continue using it and receiving updates.

Boundless provides added value by packaging the various pieces together into a common interface, and providing additional documentation, training, and ongoing support for the software.

While all the major pieces are available free of charge, Boundless does charge for access to some of the code that makes the connection between the various pieces, making the user experience a bit more fluid.

Boundless also provides custom solutions, for a price, to individual customers who have special/unique requirements, whereas ESRI does not.
Costs

Both ESRI and Boundless maintain and market a complete GIS “stack”. The stack referred to here is the group of software components that make up a complete and integrated Geographic Information System.

- Desktop tools
- Server software
- Data Storage mechanisms, and
- Web Mapping tools

The cost to customers will vary by the size of the organization, and are sometimes negotiable. But generally speaking, they compare as follows.

On the desktop side:

- ArcGIS Basic - $1,500 initial cost, $400/year annual license, plus $2,500 initial cost, $300/year annual license for each extension (spatial analyst, 3d analyst, network analyst, etc.)
- ArcGIS Standard - $7,000 initial cost, $1,500/year annual license (last time I checked)
- ArcGIS Advanced - $14,000 initial cost (I estimate ~$3,000 annual license, but this has not been confirmed)
- Boundless Desktop (QGIS) is free. However, Boundless will provide additional support if you have an enterprise maintenance agreement, - $200/year

On the server side:

- ArcGIS Server – Basic (extremely limited) $8,000, Standard - $16,000, Advanced - $32,000 initial cost, ($3,000, $5,000, $10,000 per year annual maintenance)
- There is a limit to the number of users allowed to sign into the server, which varies by license type
- Boundless Server (formerly Boundless Suite) - $8,000, $16,000, $45,000, $98,000 per year depending or the enterprise level (Number of CPUs, level of support needed, etc.)
- Boundless has no limit on the number of users per server. ESRI does.
- Boundless Server is based on GeoServer, which is available free of charge to those who do not need any support.

Online offerings:

- ArcGIS Online – previously a minimum of $2,500/year (5 user minimum). Now able to purchase a single user license at $500/year
- Boundless Exchange (GeoNode is free) - This is a relatively new offering by Boundless, and pricing is not readily available.
Training:
- Boundless in-person training - $500/person/day with 4 day minimum.
- ESRI has a similar training program with similar costs
- Training cost will vary widely based on location, number of trainees, topics covered, etc.

Cost Summary

Keeping within the ESRI stack:
- Desktop - minimum of $1,500 first year, and $400 annually after that for ArcGIS Basic.
- Online - minimum of $500 every year with a “500 credit” limit for AGOL. Extra credits can be purchased at extra cost
- Server - minimum of $8000 first year, and $3,000 annually after that for ArcGIS Server Basic.

Keeping with the Open Source stack
- Desktop - $0. QGIS is free
- Online - $0. The Boundless WebApp Builder is a free QGIS plugin.
  - However, there will be some cost in time devoted to learning how to use it. It is not nearly as user friendly as AGOL
- Server - $0. GeoServer is free.
  - Typically, the setup and use of a server is an area that will require some extra consultation and/or training cost, even for an open source solution.
Putting it all together

Let’s take a closer look at what’s meant by a full GIS stack, and how all the pieces work together.

Data

The data is at the heart of every GIS. Without it, there is nothing to work with. Both proprietary and open source GIS can use shapefiles as a data format. However, spatial databases are a more efficient and flexible way to store data. ESRI has the GeoDatabase, either file based, or the enterprise version. The enterprise version is needed in a multi-user environment where more than a single person might need access to data for editing or processing. OpenGeo and Boundless use a couple of different open source databases; PostGIS and SpatiaLite.

Desktop Client

The data must be manipulated and processed in some way, usually through a desktop program. ESRI has the ArcGIS Desktop series. Boundless relies on QGIS.

Online Client

Presenting the data and maps to a wider audience through a web browser requires some kind of online delivery service. ESRI has developed the ArcGIS Online system. Boundless uses GeoNode and their WebApp Builder, based on OpenLayers.

Server

The glue that stitches all of these pieces together, and helps keep track of the changes made in the data is the server. ESRI has ArcGIS Server. Boundless has GeoServer.

There is some overlap between these pieces, particularly when it comes to the server and online mapping parts. The ESRI’s server and online pieces overlap in functionality more so than do the Boundless server and online pieces. ArcGIS Online can, in fact, operate as its own server, if an organization requires. Boundless’ Exchange, in my view, is still a work in progress. The GeoNode code that it’s based on has been around for nearly a decade. But it is still not what I would call “mature”. Boundless will host Exchange on Boundless servers for a client, or it can be installed directly on the client’s server. However, the functionality does not match that of ArcGIS Online, from what I can tell.
Spanning Ecosystems

There is no need to stay within one ecosystem or the other. The lines between them are becoming more blurred. The data storage systems are becoming more interoperable. ArcGIS Server can open data from a PostGIS database. The online mapping systems can both read data served from either an ArcGIS Server, or a GeoServer. Both desktop systems can open data served from either of these servers. QGIS can open data from a GeoDatabase. There are some limitations in editing and saving when doing so, but they are becoming smaller all the time.

Desktop Interoperability

One function of sharing data is the ability to open and edit a variety of data formats. There are some differences in which data formats ArcGIS Desktop and QGIS can handle. ArcGIS would prefer you use File or Enterprise GeoDatabases. The enterprise, or multi-user version of the geodatabase is only usable in ArcGIS Standard or Advanced. QGIS prefers that you to default to a new format called GeoPackage which is based on a SpatiaLite database. PostGIS is used by QGIS for multi-user editing and versioning. Shapefiles however, are still the most universally accessible data format. Even though they have some significant usability limitations, they remain ubiquitous.

Both desktop programs have the ability to connect to, upload, and publish data directly to their respective servers. However, ArcGIS Desktop cannot publish directly to a GeoServer, and QGIS cannot publish directly to an ArcGIS Server.

Server Interoperability

In ArcGIS Server, there is a web interface for server managers to use. It can also be managed directly through ArcCatalog, which is a part of ArcGIS Desktop. ArcCatalog is also where the user can upload, or “publish” data, maps, geocoding services, etc. to the ArcGIS Server, if they have permission. Desktop users can also publish maps to the server via ArcMap. ArcGIS Server has some of the functionality of ArcGIS Online, but in a much cruder format. It uses a variety of customizable web-based viewer apps to present the map to the end user.

GeoServer does not have direct online mapping capability, although Boundless has developed a rudimentary tool called Composer that can do some of this. GeoServer also has a web interface for managers. And Boundless has developed the GeoServer Explorer plugin that allows direct publishing of data from QGIS to the server.
Both servers publish data as web services (WMS, WFS, and WCS, etc.) which can be accessed by desktop software, or displayed in an online map.

**Web Maps**

Online maps are simply another form of client software. They use the same published services that desktop software can use, except the URLs to the various services are embedded into the website’s code in some way. In order to simplify the building of web maps, a variety of online mapping platforms have been developed that greatly diminish the amount of coding that needs to be done to make a web map. Some examples are: Google My Maps, Mapbox, Carto Builder, and Mango.

ESRI’s answer to facilitated web mapping is ArcGIS Online.

On the Open Source side, the pieces have not been completely assembled yet, although all the parts are there. For someone who is not afraid of working with HTML, CSS and JavaScript, producing a functional webmap for free is certainly possible.

Boundless has built and combined a set of open source tools as it’s answer to ArcGIS Online, including Exchange as the content management system (based on GeoNode), and the QGIS WebApp Builder plugin (using the OpenLayers javascript library). GeoNode needs to be installed on the users server. However, Boundless will host Exchange on their servers for a fee (It is not clear to me at this time what that fee would be).

For some examples of GeoNode sites, see: [http://geonode.org/gallery](http://geonode.org/gallery)

**AGOL**

ESRI – ArcGIS Online, also known as AGOL, is unique in this area as it functions as a content management system, a web map designer and publisher, and a spatial data server. ESRI has made great strides over the last couple of years, improving usability and adding functionality to AGOL. The fact that it includes data storage capabilities means the user does not have to rely on a separate GIS Server in order to publish the data to be used in a web map.

When it first came out, AGOL required a minimum of 5 user licenses at $500 each, which meant an initial cost of $2,500 per year for an organization that wanted to use it. In mid-2017, however, ESRI did away with the 5-user minimum, and now sells individual single user licenses for $500 per year. With this price point, and the combined functionality of a server, data store, and web app publisher, it is the obvious choice for a small company or local government that wants get started with online mapping.
As shown in the graphic below, ArcGIS Online can use a wide variety of services published by an ArcGIS Server, or a GeoServer publishing Web Map or Web Feature Services.

One limiting factor with AGOL is its use of “credits” in its billing. A single use license comes with 500 initial credits. These get used up as more data is stored on the system, and features are turned into feature services to be used in a map. It is not so much the using up of credits that is a concern, but the arcane system that ESRI uses to apply them. It is difficult for new users to estimate what the end cost will be for hosting data on the ArcGIS Online system. For an overview of AGOL service credits, see: [http://www.arcgis.com/features/plans/credits.html](http://www.arcgis.com/features/plans/credits.html)

As a test for this report, a single layer consisting of the municipal boundaries of Columbia County NY was uploaded to an ArcGIS account, and published as a Web Feature Service. This process used 7.52 credits to produce the tiled feature service. Storage costs for the feature service used another 0.99 credits per month. Given these numbers, I estimate approximately 20 to 25 county-wide layers could be uploaded to an AGOL account, published as feature services, and stored for a full year without using up the full 500 credits allotted. This does not, however, include the storage of other non-published data, or the use of the analytics features that are a part of AGOL. Also, once the generation of the tiles is performed during the publishing process, the only cost would be for storage. Therefore, future years would not use up nearly as many credits as would be required in the initial setup.
If large amounts of data need to be stored and served, or if multiple layers need to be updated on a regular basis, GeoServer should be considered as the next logical step in building a small government GIS.

**WebApp Builder**

Boundless’ QGIS WebApp Builder is gaining in functionality, and can be used to embed maps into a website running on the user’s server. But the functionality and ease of use is not nearly at the same level as AGOL. To come close to AGOL’s capabilities, a content management system, such as GeoNode, or OpenGeoPortal, has to be included in the mix. And these are not nearly as integrated with each other nor as easy to use as AGOL is.

For someone who already has access to a server (either physical or virtual), and is looking for a totally free solution, the WebApp Builder is something they should look into. But the learning curve will be steep.
Summary of Interoperability

- Both ArcGIS Desktop and QGIS can connect to an ArcGIS Server and view its published data.
- Both ArcGIS Desktop and QGIS can connect to a GeoServer and view its published data.
- Both ArcGIS Desktop and QGIS can connect to an ArcGIS Online service, and view data published from it.
- ArcGIS Online can use published data from both an ArcGIS Server and a GeoServer.
- Both ArcGIS Desktop and QGIS can open a WFS served from an AGOL account. However, ArcGIS Desktop will require an extra $2,500 Data Interoperability extension.
- Boundless Exchange, GeoNode and the Boundless WebApp Builder can use WMS and WFS services from a GeoServer or ArcGIS Server to populate a web map, but there is a much steeper learning curve to make it useful. There will be some custom coding involved in order to customize the map, and embed it into a web page.
- Publishing directly from ArcGIS Desktop to an ArcGIS Server, one can maintain the symbology applied to the data.
- Publishing directly from QGIS to a GeoServer, one can maintain the styles applied to the data.
- Data cannot be published directly from QGIS to an ArcGIS Server, nor directly from ArcGIS Desktop to a GeoServer. It must be done through the server’s interface. And in these cases, the symbology/styles must be recreated within the server, or added to the server separately.
  - Note: There are some third-party extensions that can bridge this gap.
- Sharing maps produced with the desktop programs between the two systems remains difficult. The data is easily shared, but formatted map documents must be recreated within each desktop client.
  - ArcMap .mxd files cannot be opened directly in QGIS, and QGIS .qgs files cannot be opened directly in ArcMap. However, there are some third-party extensions and plugins that attempt to work around this limitation.
Website Hosting Requirements

While most small municipalities now have computer hardware capable of running desktop GIS software, there are some unique requirements for hosting online maps. The typical website hosting platform used by municipalities is not sufficient for hosting an online mapping system. Web maps can be easily embedded into an existing website or web page. But, there are some behind the scenes processes that must be accommodated in order to produce that embeddable map in the first place. This usually means a separate server, either a physical computer with access to that broadband connection, a computer housed off-site somewhere that can act as a virtual server, or a third party account (such as ArcGIS Online) that can act as a server. At the very least, a database has to be set up that has geospatial capabilities, and is connected to the internet. A few options for virtual/cloud servers include Amazon Web Service (AWS), and Google Cloud Servers. If the municipality wants to use its own hardware, there remains the need for a reliable broadband connection wide enough to accommodate any anticipated web-map traffic.

All of this will usually incur some cost, even for the open source option. It is possible for a person or an organization to implement a full service GIS stack at zero cost by using Open Source software, if they already have the hardware and the technical ability to do so. However, while Open Source is free of monetary cost, it is not free of labor cost. Setting up such a system will invariably require some outside consulting, personal training, or a great amount of time for the person in charge to learn how to do it on their own. And time is never really free. Also keep in mind, even proprietary software requires some amount of technical training to use properly.

Required technical capabilities

Unless a municipality is going to outsource the entire web mapping process, there are some technical abilities the person in charge of maintaining or setting up the web map must have. The most basic of these abilities is:

- How to embed a web map into a web page (usually by using an iframe)
  - This usually requires some knowledge of HTML and CSS, and possibly JavaScript, and JavaScript libraries

If a server is to be maintained by the municipality:

- Knowledge of how servers work (Either Windows Servers, or Linux Servers)
  - How to set up and maintain a server, including security options
  - How to connect the server to the internet by opening “ports”
  - How to install and configure GeoServer/ArcGIS Server software on the main server
  - How to upload data to the server
  - How to properly symbolize the data for use in a web map
  - How to publish data as services, able to be incorporated into a web map
If the data used in the web map is to be maintained by the municipality:

- Data Sources
- Basic desktop GIS software operation
- Some understanding of map projections

**Do-it-yourself options and sources of training.**

Producing a useable online map requires a unique set of skills. It requires some technical abilities, some knowledge of geography, and an artistic eye in order to convey information in such a graphic format. This is one reason GIS remains a specialized area within the larger information technologies (IT) field. However, if a person is generally comfortable with technology and the learning curve involved, there are some avenues they could pursue to learn how to build a web map on their own. Usually, the best bet is to investigate the chosen software provider’s website first.

ESRI has recently made all of its online training courses free to anyone who has a current software license (https://www.esri.com/training). Some of the online courses are open to non-ESRI customers, but most are not.

Boundless has an extensive library of online resources, including white papers, videos, and webinars (https://boundlessgeo.com/gis-resources). The bulk of these are open for public viewing. They also have a few online training courses that they charge for (https://boundlessgeo.com/boundless-training). However, the documentation supplied with the software is complete, and includes step-by-step instructions on how to perform most of the tasks needed to use it (https://connect.boundlessgeo.com/Documentation).

There is a plethora of online web mapping tutorials and YouTube videos, some better than others, and far too many to list here. My suggestion is - start with the documentation included with your software of choice, and then do a web search for the topics you need extra help with. For instance, the documentation included with most online mapping applications will guide the user through the process of making an online map. At the end of that process, it will often produce a snippet of code that allows the user to insert a map into a web page. Typically, this is in the form of an “iframe”. What may not be obvious to the user is, that iframe code can often be modified by changing some of the attributes, such as the height, in order to make the inserted map fit better into the existing web page layout (https://www.w3schools.com/tags/tag_iframe.asp).

**Types of firms that develop web maps and the qualifications to look for.**

Developing online maps is a specialty. This is not something a typical website developer/designer usually does, or will be able to do. The website designer should be able to help the municipality incorporate a web map into and existing web page, or add a new page to an existing website that holds just the web map. However, developing the map itself requires specialized knowledge and skill. In addition, GIS consultants typically specialize in a narrower field within GIS, and may not have all the skills needed to produce a web map. Those that do,
often focus on larger clients, such as state or county governments and regional organizations. However, there are a few GIS consultants that will work with smaller agencies with limited budgets. It’s best to approach a prospective consultant with a specific set of criteria for the web map, and a budget. On smaller projects, efficiency is key. Letting the consultant know you’ve done your homework and have a well-defined scope, even though the budget is limited, will allow the consultant to quickly tell you if the project is viable or not.

Typical consultant price range for a municipal-scale web map product.

Costs can vary widely, and will depend greatly on the starting point of the data to be included in the web map. If a municipality has already assembled a GIS database for a comprehensive plan, open space plan, or natural resource inventory, that will save quite a bit of effort. Typically, the cost for assembling such data will be in the $2,000 to $3,000 range. Data costs will increase with the amount and complexity of data needed for the project. If that cost can be borne by a previous planning project, the cost for developing a web map will be much lower.

However, there is usually still some cost involved in preparing the data for a web map. The data will have to be transferred to the online system. That will typically require some additional cleaning and organizing. The data may have to be re-symbolized for use in the online map, as maps designed for print seldom translate well to maps designed for the screen. Starting costs for this will be around $800, and will rise depending on the number and complexity of the layers being used.

The small government agency should expect to spend at least $2,500 and possibly up to $4,000 or more to have a consultant set up an online map from start to finish.

Long-term technical support needs, and expenses for maintenance and updates.

Ongoing maintenance of the web map will also incur some costs. Tax parcel boundaries change yearly, and nearly every other layer used will be updated at some point. The municipality will have to either hire a consultant to perform this maintenance, or provide some training time to the person in charge of maintaining the web map. The cost for a consultant to update one or two layers on a preexisting web map are minimal, and should take less than an hour (~$85-$100). If the user feels comfortable updating these same layers, the cost would be close to $0.

Most of the ongoing costs will be for maintenance of the server or online account. Servers need to be monitored to make sure they remain accessible. They also need to be updated occasionally, and security patches need to be installed. A typical Amazon Web Service account with a server capable of running a small agency website and online map will cost around $30 per month just for the server. Any maintenance by a consultant or employee would be an added cost in dollars or time.
What’s the best solution for Local Governments?

The primary question to ask here is – Does the municipality want to use GIS internally only, or do they want to publish something online?

- For internal use by one or a few users, the obvious choice is QGIS.
- For publishing online maps, ArcGIS Online cannot be beat. Even though QGIS does not publish directly to AGOL the way ArcGIS Desktop does, the limitations are minor.

The next question to ask is – How much help will the municipality need getting things set up?

- Are the users comfortable enough to go it alone, managing, symbolizing, analyzing data, or will they need help from a consultant?
- Is any assistance available from county or state agencies?

Ultimately, the deciding factor is the technical capabilities of whomever is going to be in charge of maintaining the system. Although great strides have been taken to make the online map publishing experience as easy as possible, it is still not as easy as word processing, or even simple website building. There is a lot of new terminology to learn. The data sets are much larger. They come in unusual formats.

A Generic Local Government Situation

The following comments will apply to the majority of municipalities in the Hudson River Valley. However, every local government will have a different capacity for implementing a web mapping solution. Answering the questions above may lead your local government agency to reach a different conclusion. It will depend heavily on the comfort level, technical capabilities, and past experience of whomever is in charge of maintaining the system.

Desktop:

- QGIS does it all, and it’s free. I always recommend QGIS. Symbology does have to be redone if it was initially done using ArcGIS. It does not carry over.

Server:

- Avoid the complexity of setting up and maintaining a server, if at all possible. Usually, there is no need for a server (See the Online/Web Mapping heading below). Local municipalities should avoid this as long as possible.
- There may come a point were the data gets large enough, and the work flows get complicated enough were a server could be useful.
- But there are significant training and maintenance costs involved, even with the free and open source server options.

Online/Web Mapping:
• ArcGIS Online in its current form, can’t be beat. ArcGIS Online ($500/year) is now at the right price point, and includes some server-type capabilities, such as online data storage. It is the easiest system to use (for now).

Special note on ArcGIS Online Public Accounts:

ESRI offers what’s called a “Public” ArcGIS Online account that is free of charge. However, reading the ESRI End User License Agreement (EULA) there is a statement regarding online account public plans that says: “Customer may not use this subscription to power a Value-Added Application for its own business use unless Customer is an educational institution using the Value-Added Application for teaching purposes only, a qualified NGO/NPO organization, or a media or press organization.”

While the capabilities of these free accounts appear to fill all the needs of a small government agency, such use by a government agency is not authorized under the EULA. They are designed for personal use, or for educational, press, or not-for-profit organizations (NPOs) only. Certainly, a town or village could use the free account to give AGOL a test drive, to see if it’s something they want to invest in. But they cannot legally use it to post a public facing map on their website.

On the other hand, ESRI has in the past offered their software at greatly reduced price (~$100) to Conservation Advisory Councils (CACs), treating them similar to a NPO. These low-cost software packages include the full ArcGIS Desktop program, and include access to an ArcGIS Online account. A CAC might also be considered a NPO by ESRI regarding a full AGOL account. If a CAC is interested, they should call an ESRI sales representative to find out if they might qualify for such a free account.