



Visualising water quality

year

7

Geography

For the draft
Australian Curriculum

Water:
Learn it for life!

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Visualising water quality

Introduction

When investigating their local environment, students have many valuable, hands-on opportunities to gather and map data which allows them to answer meaningful and relevant questions. For instance, younger students can add simple environmental data such as water quality parameters to maps using Google Maps. For instructions about how to do this refer to the *Water: Learn it for life!* Year 7 Geography resource Mapping our Waterway.

As geography and science students progress to higher year levels, they collect more complex environmental data to answer more complex questions. They can use spatial data visualisation tools to analyse the data to discern useful patterns and relationships.

Spatial technologies such as geographic information systems (GIS) allow us to display and analyse data visually and may also offer the potential for new insights into the data because multiple layers can be analysed simultaneously. Increased use and relevance of spatial technologies across society means that the software skills demonstrated in this resource can be applied widely across many fields of geography or science—providing students with relevant, in-demand industry skills.

However, learning how to use commercial GIS tools such as ArcGIS can be challenging for beginners. Fortunately, simplified versions of GIS software are available online. These free online tools enable students to become familiar with a GIS interface and to analyse layers of information.

ArcGIS Explorer Online (AGXO) is one of the many free, online spatial technology tools that students can use to upload and visualise their data. This curriculum resource provides a quick-start guide for students using AGXO to display their data. It is designed to be used after your students gather data about your local waterway.

Data visualisation uses graphical elements to represent data for a more efficient means of interpretation.

The AGXO software is available as a free download through any web browser with an active internet connection. You or your students will need to create an ESRI account in order to save maps for later use across devices. However, you should ensure that students do not contravene school privacy or internet use policies in doing so. If you are in doubt, check with your educational jurisdiction.

Draft Australian Curriculum: Geography links

There are many opportunities for schools to explore water and water-related issues in the draft Australian Curriculum: Geography. Currently, water is investigated as a stand-alone theme in Year 7 and could easily be incorporated in all other year levels. This resource is most appropriately aligned to the ‘Environmental challenges and geography’ unit in Year 10 and could be used as part of a wider inquiry-based exploration of water quality issues in our river basins and urban biophysical environments.

Table 1 highlights the appropriate content descriptions in Year 10 Unit 1 and some suggested ideas for implementation, addressing each content description.

Table 1: Year 10 Unit 1 Geography content descriptions

Content descriptors	Implementation ideas
Geographical Knowledge and Understanding	
Biophysical processes result in selected environmental challenges	After creating your maps, ask students to consider the differences in water quality along the waterway. Consider how different parts of the water cycle—such as run-off, precipitation, evaporation, transpiration and infiltration—affect water quality across the catchment.
Spatial technologies can be employed to visualise, map and analyse the distribution, causes and possible solutions to the environmental challenges	Map water quality data using AGXO. Examine land use surrounding your waterway using AGXO and consider relationships between water quality and how the land is used. Record the variability of the riparian zone along your waterway and analyse this in comparison to your water quality results. Students then use AGXO to create a map highlighting solutions to the problem.
Reflective geographical thinking and skills contribute to the effective management of the selected environmental challenges	After considering current solutions, students develop or evaluate a real-world strategy to reduce negative impacts along a waterway. They then take actions that can improve the quality of the local waterway.
Geographical Inquiry and Skills	
Independently design the inquiry to identify and locate data using fieldwork, library and online research, spatial technologies, maps, statistics, photographs and other images	Use the geographic inquiry model to structure your investigation about your local water quality. Focus questions for such an investigation might include, for example: <ul style="list-style-type: none"> • What is my local waterway and where does it come from and go to? • What is the water quality like in my local waterway? (now and historically) • How does my local waterway function? • How is my local waterway used? • What are the impacts of these uses on the environment, economy and society/ community across my waterway? • What is being done to minimise negative impacts of human use in the catchment? • What should and could be done to minimise negative impacts of human use in the catchment?
Select appropriate geographical methodologies to collect, organise and store data, including following protocols for consultation with the local Aboriginal and/or Torres Strait Islander communities	
Select appropriate geographical methodologies to organise and record relevant data for synthesis, storage, and retrieval using ICT and other methods following geographical conventions	
Analyse data to identify and explain order, diversity, trends, patterns, anomalies and generalisations.	

Source: <<http://consultation.australiancurriculum.edu.au/Geography/Foundation-to-Year-10>>

... Cross-curriculum priority: Sustainability

This lesson sequence provides a rich opportunity to discuss sustainable water management issues—particularly those related to your local catchment.

The issues that relate to the organising of ideas of sustainability could include:

- the importance of water to human and ecosystem wellbeing and prosperity
- the connectivity of water sources in Queensland which sustain ecosystems and industry
- the complexity of the systems that underpin both the natural and human water cycles
- the importance of managing and using water resources responsibly to ensure sufficient and healthy water supplies for the future for a range of uses
- the relevance of social justice issues to the management of water resources both in Australia and internationally.

Awareness of and understanding about sustainable water management issues encourage students to take action to address these issues.

Enabling actions include:

- monitoring water quality in your local creek or water body to inform management decisions
- revegetating a cleared area in or near your school to improve the biodiversity of your area
- making a personal or school commitment to reduce water use and pollution
- monitoring home or school water use
- developing a promotional campaign to reduce school or community water use.

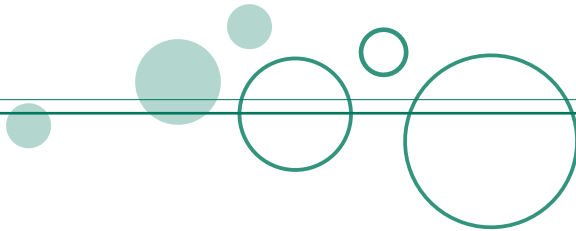
... Geographic Inquiry model

The Geographic Inquiry model is an important organiser in the draft Australian Curriculum: Geography. Used appropriately, the Geographic Inquiry model can help to structure inquiries that span a lesson, lesson sequence, case study or an entire unit of work.

A geographic inquiry typically starts with a ‘big’ question about the topic you are addressing. Four key questions are then used to organise the inquiry. Under each key question, focus questions fine-tune the investigation or research. This structure will vary depending on the depth of study, the time available and your educational needs.

A typical Geographic Inquiry model has the following key questions:

1. **What and where?**
This section defines the issue and where it occurs. Focus questions are general and relate to broader concepts within the issue. Historical and background information is relevant here.
2. **How and why?**
This section identifies the processes at work behind the issue. These processes might be natural or human processes or a combination of both. Students craft focus questions that help them understand what processes are evident in their study area and how the processes work to impact the area or issue being addressed.
3. **What impacts?**
This section identifies the main negative and positive social, environmental and economic impacts of the issue.
4. **What can and should be done?**
This section examines solutions to the problems identified in the ‘What impacts?’ section. Existing and potential solutions should be examined. There are opportunities to develop your students’ decision making skills by applying criteria and evaluating proposed solutions at this step.



Materials

For each student:

- Adding water quality data in ArcGIS Explorer Online (Resource 1)
- Completed data collection sheet

Preparation

- Photocopy Resource 1 for each student.
- Design the data collection sheet students will use for their field activity. Resources 2 and 3 provide examples of data collection sheets for quantitative and qualitative water quality surveys respectively.
- Book a computer room or laptop bank to ensure access if relevant.

Prior to the computer session, students collect and tabulate the water quality data. Resource 2 is a suggested template that could be used to organise the quantitative data collection such as water quality sampling data. 'A Waterways Health Check' (Resource 3) can be used if you are collecting more subjective data.

Some useful guides and resources on collecting water quality data are listed in Table 2.

For the computer session, allocate one computer with an internet connection per student. Ensure that each student sets up an ESRI Global Account

before undertaking the computer-based portion of the activity. This can be done at <<https://webaccounts.esri.com/>>. You should also ensure that your students can sign in and use their account on your school's network.

Follow these steps to register an ESRI Global Account with ArcGIS Online.

Steps:

1. Create an account at ArcGIS.com if you don't already have one.
2. From the ArcGIS.com website, click the 'Sign In' link on the upper right or access the sign-in page directly from <www.arcgis.com/home/signin.html>
3. Click the 'Register your ESRI Global Account' button.
4. Enter your ESRI Global account user name and password exactly as you spelled it when you created your account. Your user name and password are case sensitive when registering with ArcGIS Online (and when signing in).
5. Click the 'Register' button.
6. Read the terms of use and click the 'I Accept' button to agree to the terms.
7. Once you accept the terms of use, you will be signed in to the website and taken to your profile page.

Table 2: Water quality data collection resources

<p>Waterwatch Australia: Waterway monitoring. <www.waterwatch.org.au/monitoring.html> This Australian Government website provides some great links and resources that cover the basic indicators of water quality and methods for reliable data collection.</p>
<p>Queensland Community Waterway Monitoring Manual 2007. <www.qld.waterwatch.org.au/resources/community_wwmonitoring_manual.html> The Queensland Community Waterway Monitoring Manual, although not recently updated, is still a very detailed resource to assist with reliable data collection and equipment use. This manual was published by Waterwatch Queensland.</p>
<p>Massachusetts Water Resources Authority: Water quality testing manual for students. <www.mwra.state.ma.us/publications/waterqualitytesting/waterqualitymanual.htm> Although not from an Australian source, this link presents information on water quality indicators that can be measured, data collection methods and equipment care.</p>

Recording your location

While collecting data you will also need to record the latitude and longitude at each site via a GPS waypoint in order to display it in the correct location on the map. If your school doesn't have GPS and you cannot access a mobile phone or tablet computer with GPS on the day, you can get the location information from websites such as:

<www.getlatlon.com>

<<http://universimedia.pagesperso-orange.fr/geo/loc.htm>>

Manually identify your desired location on the online map. Using landmarks at each site that are visible on the satellite image, locate your field site on the map.

Using <www.getlatlon.com>, for instance, zoom into the map until you locate the sampling site. Double-click the exact location and record the latitude and longitude readings for that site in decimal degree format (e.g. -27.3814088698366, 153.0544424057).

The Geocentric Datum of Australia (usually referred to as GDA94, or just GDA) is a coordinate system for Australia. This means it is a system of latitudes and longitudes, or east and north coordinates, which we can use to keep track of locations. While most maps and GPS should use this datum, you may come across some that doesn't and the shift in coordinates could be confusing. For additional basic information about mapping and grid coordinates, refer to the Map basics fact sheet (Resource 4).

Software support

A range of support materials that can assist you in using ArcGIS Explorer Online (AGXO) are listed in Table 3.

Table 3: AGXO support resources

ArcGIS Explorer Online homepage

<www.esri.com/software/arcgis/explorer-online/index.html>

This web page provides access to ArcGIS Explorer Online and related products.

Blog post with links to the AGXO support forum and online help

<<http://blogs.esri.com/Support/blogs/arcgisonline/archive/2010/05/24/getting-started-with-arcgis-explorer-online.aspx>>

You can also search video sharing websites such as YouTube or Vimeo using terms like 'AGXO' or 'ArcGIS Explorer Online' to find instructional videos for the software.

<www.youtube.com>

<www.vimeo.com>



Managing the computer classroom

Teaching in a computer laboratory is a very different environment to teaching in a 'traditional' classroom. The layout of the room, the engagement with technology and the focus and structure of classroom pedagogy change significantly in a computer laboratory.

If you don't feel overly comfortable teaching in a computer laboratory there are things you can do to maintain your own sense of control while providing your students with rich learning experiences.

- Discuss the rules and expectations for the computer session with students before they sit down at the computer. Once in front of the computer, students usually just want to start using it.
- Minimise distractions. You can do this by ensuring each student is working on a computer on their own. If you don't have enough computers you could ask students to work in pairs. Any more than two students to a computer will prove problematic as students can get distracted easily when they are not operating the computer.
- If your school has remote access educational software such as AB Tutor, you can monitor your students' computer screens at any time during the lesson to ensure they are on task. Display this screen in front of the students through the data projector so students know they are being supervised. It also allows them to peer-monitor on your behalf.
- Chunk your instructions. Break your instruction into logical, achievable chunks for your audience. If your students are not confident with digital technologies you may need to focus on one or two software skills at a time. Explain what you are doing, demonstrate the skill, check for understanding and then ask students to practice the skills.


- Maintain students' attentiveness by developing a routine that ensures your students recognise that you are ready to move on to explain and demonstrate a new skill. Depending on the composition of the class you could even use a sound or action to indicate that you are ready to move forward. For example, you could use a visual cue such as raising your arm.
- Use capable students as class mentors. They will benefit from the additional responsibility.

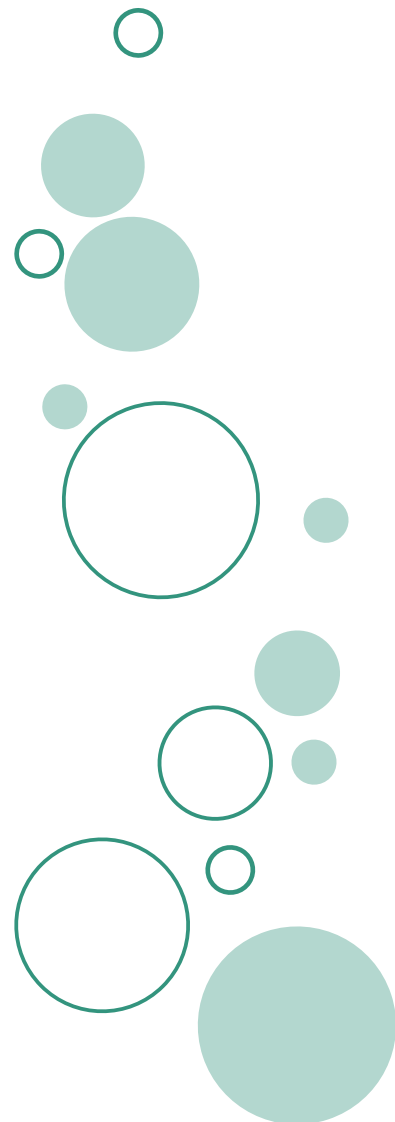
Adjust the pace according to your class. If you have a very capable class with regards to their information technology (IT) skills, you may be able to demonstrate more skills at once or allow the class to explore the software themselves.

Optional activities

The following activities offer ideas for extending the basic lesson sequence provided.

- Students are given a mock budget to help improve the water quality at a particular site in their local area. Select a site that requires attention and use AGXO's 'Add Features' tools to analyse water quality. Students then create a plan showing the changes they would make to the site to make it more sustainable. They can incorporate sustainability elements in their plan including economic, environmental and social considerations.
- Students map wildlife observations using AGXO. After collecting observations from a number of locations, they draw those observation areas on the map. Students then add their field data to the layer and display that data using the same skills covered in this resource. Before students collect their data they should carefully consider the type of map they need to create and ensure that they structure their data collection appropriately.

- 
- Students survey members of the community for their opinions on any number of geographic topics such as their views on the services and provisions in their area such as transport, water or recycling choices. Take time to demonstrate appropriate methods of data collection and survey construction so that your students collect data that will help them address their focus question. Use AGXO to construct a map to look for spatial patterns that may not be evident in a table of survey results. Summarise your findings by survey location, record the latitude and longitude and then create a comma separated values (CSV) table containing your location and survey data. Import the table into AGXO as described in Resource 1 to present your survey results geographically. There are even options to graph the data as part of your map.
 - Use the line tool to create isolines on your map. An isoline joins points of the same value for a particular parameter. Parameters might include contour lines, air pressure, ambient temperature, sound levels, species counts, water quality or wildlife observations. Collect data at a number of sites and extrapolate to generate the isolines. Before they create the isolines in AGXO, you should provide students with a number of hard-copy versions of their map to draft with. For instance, if you had collected air temperature data at a number of sites your students could mark those findings on a hard copy map as points. Using the collected point data, students could estimate and draw the air temperature isolines on their hard-copy map before using AGXO.



Resource 1

Adding water quality data in ArcGIS Explorer Online

Introduction

The health of Queensland's catchments is vitally important. The quality of the water in our local waterway and the environmental conditions of its surrounding area is monitored by water quality technical officers to aid decision-making about how to manage the waterway most effectively. You can find more information about how an ecosystem health monitoring program is conducted by going to www.healthywaterways.org/EcosystemHealthMonitoringProgram/Home.aspx

After you survey water quality in your local waterway and complete a data collection sheet, this activity will explain how an online mapping tool—ArcGIS Explorer Online (AGXO)—can display and assist you to analyse your findings on a selection of maps.

Procedure

» Preparing the data

ArcGIS Explorer Online (AGXO) imports data in one of three formats: CSV, SHP or GPX. In this example you will import a CSV file and you will need to prepare your data carefully before importing.

Open your spreadsheet program (such as Microsoft Excel or OpenOffice) and enter the column (or 'field') headings across the first row of the spreadsheet. A 'Name' field will be needed for the name of each location (i.e. Site 1, Site 2 etc.) and separate 'Latitude' and 'Longitude' fields to identify the location of each site. Add field headings to correspond to the heading on the data collection sheet.

CSV or comma separated values (.csv)—a file that stores tabular data as plain text. Commas are used to indicate new fields (columns) in the table.

SHP or shapefile (.shp)—ESRI's proprietary file type is widely used across many GIS platforms.

GPX (.gpx)—is a common GPS file type that displays waypoints, tracks or routes.

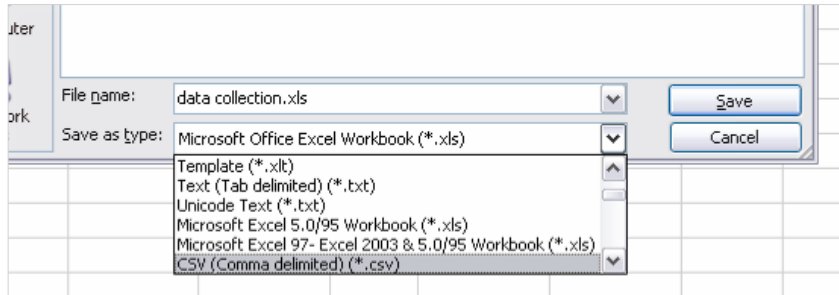
Then, allocating one row per site, enter the data that was collected in the field under the relevant heading. Your location data—the latitude and longitude—should be entered in decimal degrees and in separate columns. You can change the display settings of your GPS unit to view the location in the decimal degrees format, or you could search online ('GPS convert decimal degrees') for tools that easily convert location data from a geographic format (e.g. 21° 24' 11" S) into decimal format (e.g. 21.4031) such as the conversion calculator at data.aad.gov.au/aadc/calc/dms_decimal.cfm. Note that lines of latitude south of the equator and lines of longitude west of the Prime Meridian are converted to negative values in the decimal degrees system.

» Creating a CSV file

Once you have entered the data from your data collection sheet in a spreadsheet file you need to create a CSV file to use with AGXO. Make sure you save the spreadsheet file as a comma-separated values (.csv) file. To do this when saving your spreadsheet, look for the 'Save as type' or a similar field. Select CSV as the file type to save, as in Figure 1. Save the file in a folder that you can access later.

Resource 1 (continued)

Figure 1: Saving a csv file



» Using ArcGIS Explorer Online

Open ArcGIS Explorer Online (AGXO) at <http://explorer.arcgis.com>.

Sign in to your ESRI Global Account. By signing in you are able to save and access maps in the future. You will need to register your global account at www.arcgisonline.com before it can be used with AGXO. Your teacher will explain how to do this.

Select 'New Map' in the top left-hand corner of the screen to proceed. Note the location of the help button in the top right-hand corner of the screen (Figure 2).

Figure 2: Starting a new map

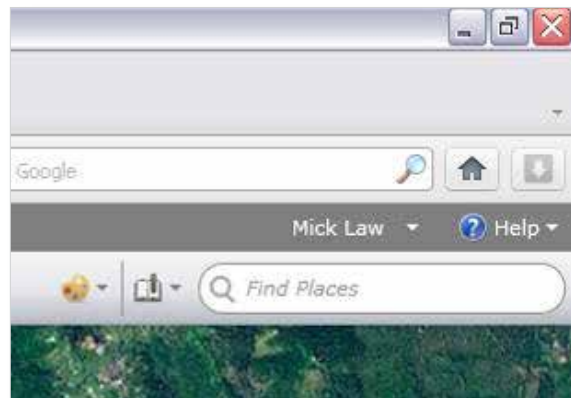


» Navigating AGXO

You will see a map of the world. Navigate, using your mouse. Click and hold the left mouse button to pan the map while maintaining scale, and roll the mouse's scroll button away from you to zoom in and towards you to zoom out. You can also quickly zoom to a spot on your map by double-clicking it.

Use the search box in the upper-right corner of your AGXO screen to find a particular location and be taken there on your map (Figure 3).

Figure 3: Search for a location



Use the Measure tool to measure distance, area or to identify the coordinates of a point (Figure 4).

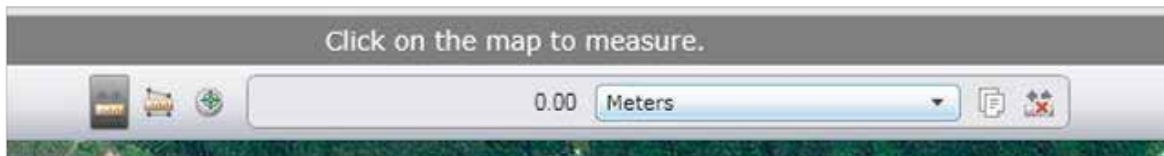
Figure 4: Measure button



Select your units of measurement from the dropdown menu (Figure 5). Click your cursor once to begin measuring and then again every time your line changes direction. Double-click your mouse to complete your measurement.

Resource 1 (continued)

Figure 5: Measure toolbar



In the bottom-left corner of your map you have a compass which opens up your scale bar and additional tools. There is also a navigation control tool if you don't have a mouse or prefer on-screen navigation. See Figure 6 to view the features of this tool.

Figure 6: On-screen navigation in AGXO



Using bookmarks

You can use Bookmarks to save locations and extents that you visit regularly. Navigate to a view of your current town, city or location in your map screen. From the 'Bookmarks' button menu click the plus symbol to add your current view as a bookmark. Give your bookmark a descriptive name for efficient future reference (Figure 7).

An extent is defined as the limit of the geographic area shown on a map.

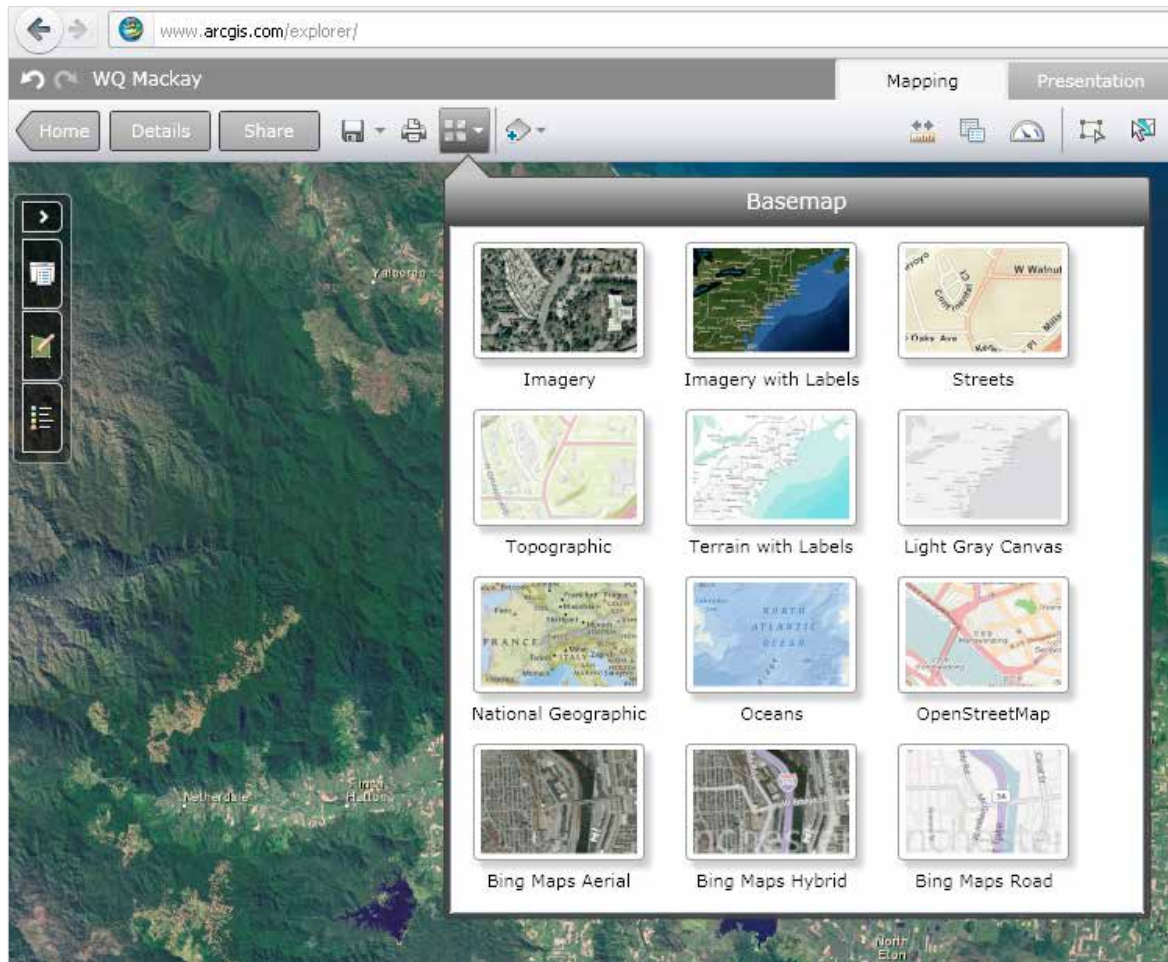
Now zoom into your catchment and create a second bookmark that contains all of your field sites. To navigate between bookmarks, simply click the 'Bookmarks' button and choose the bookmark location that you would like to view as shown in Figure 7.

Figure 7: Descriptive bookmarks



Resource 1 (continued)

Figure 8: AGXO basemaps



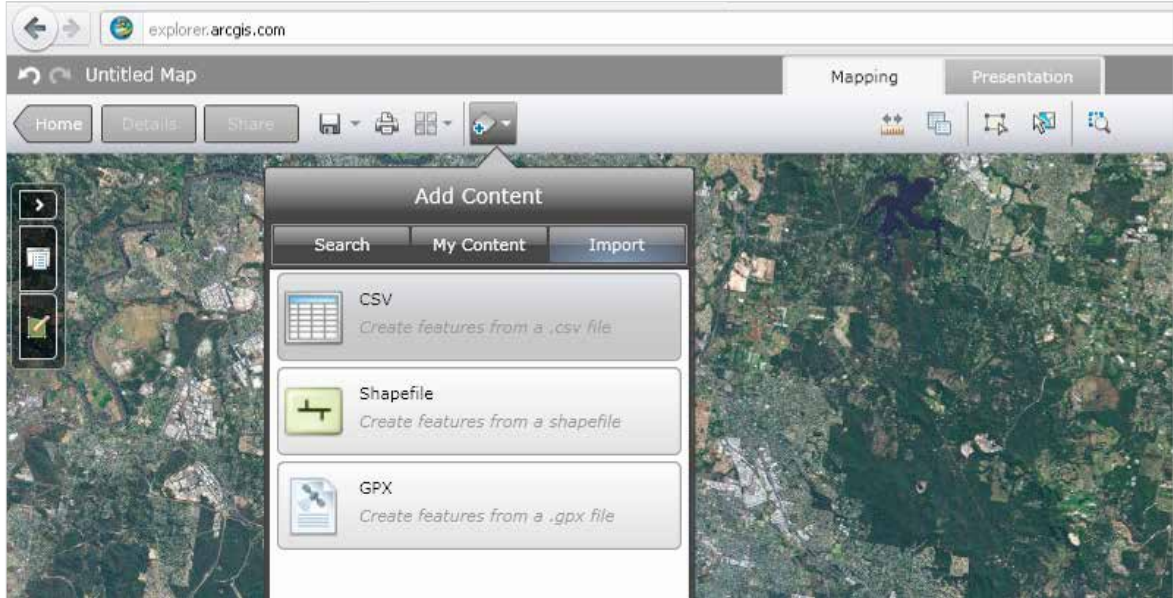
» Using basemaps

There are a range of basemaps provided that you can access. Click on the 'Basemap' button and select the 'Imagery' basemap to view them (Figure 8). Note that some of the basemaps will

not draw beyond certain scales. If you see a 'Map data not yet available' message, just zoom out until the image appears.

Resource 1 (continued)

Figure 9: Adding content to AGXO



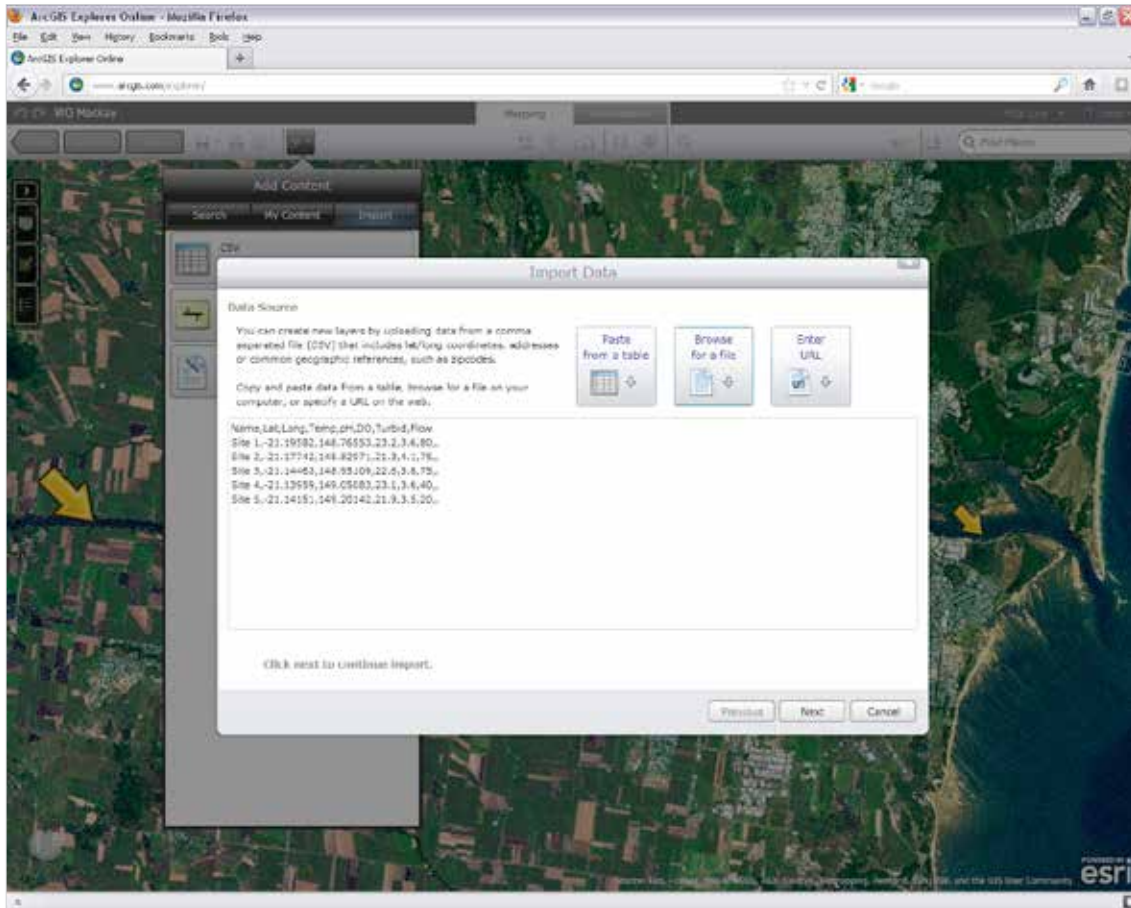
Importing the data

Import your data by clicking on the 'Add Content' button. Select the 'Import' tab and click on the 'CSV' button to import data from your CSV file (Figure 9).

Select 'Browse for a file' and locate the CSV file previously saved which contains your water quality data.

Resource 1 (continued)

Figure 10: Importing your CSV file



The CSV file format uses commas to separate the fields or columns in your table. Select 'Next' to continue.

Name your layer in the 'Layer name' dialogue box. You could call it 'Water Quality yourwaterwayname' where 'yourwaterwayname' is the actual name of your waterway. AGXO will automatically assign the type of data contained in each column of your table. Check the type of data that is contained in each column of your table by referring to the field footers in Figure 11.

The types of data available are explained in the adjacent text box.

Once you are satisfied with your selections, hit 'Import' and AGXO will use the latitude and longitude information to accurately place your sites on the aerial image background with your other data attached.

Text - text

Location – latitude or longitude in decimal degrees format

Integer – whole numbers

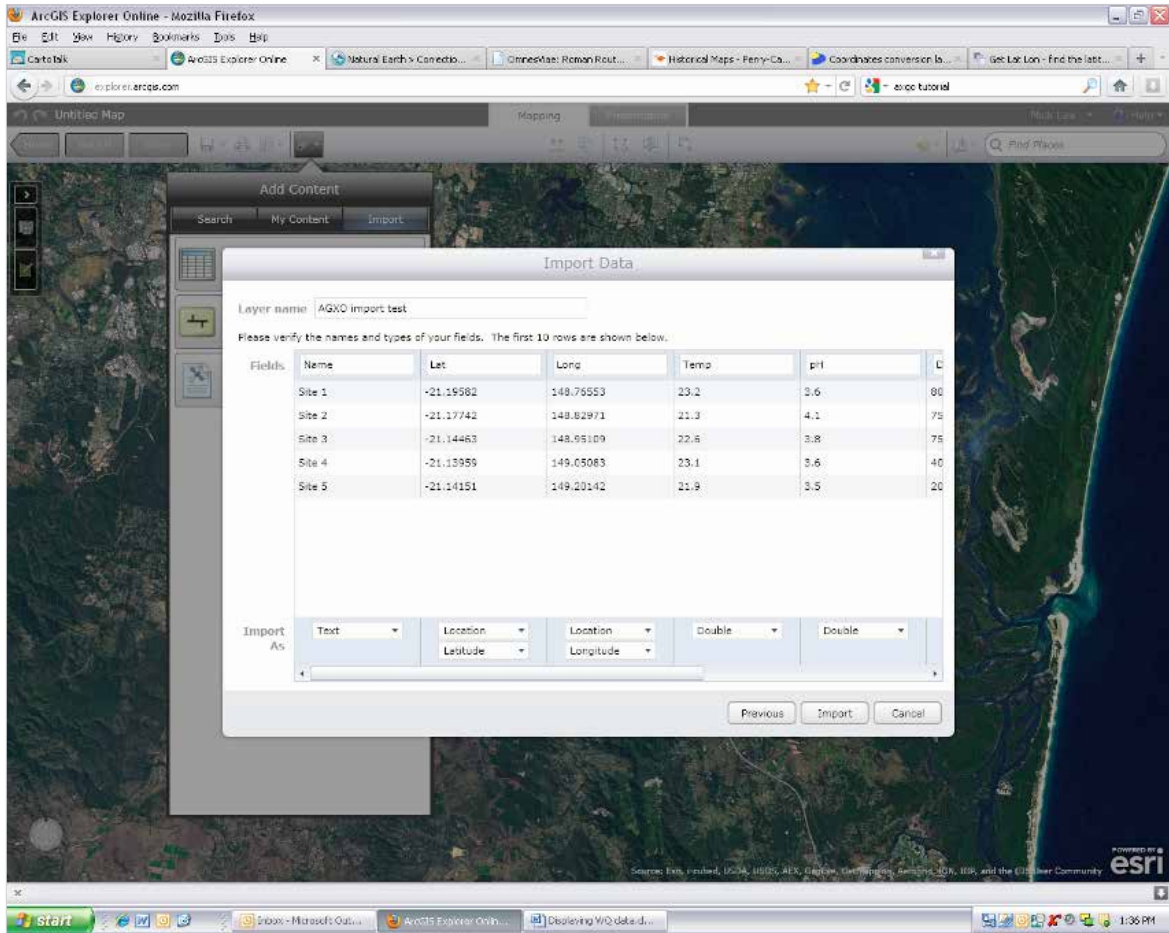
Double – decimal numbers

Float – advanced decimal numbers

Date – standard date format

Resource 1 (continued)

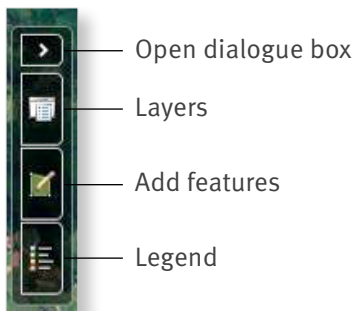
Figure 11: Cleaning your data



» Editing the data

To edit the symbol used to represent your sites, open the 'Layers' dialogue box (Figure 12).

Figure 12: Layers dialogue box

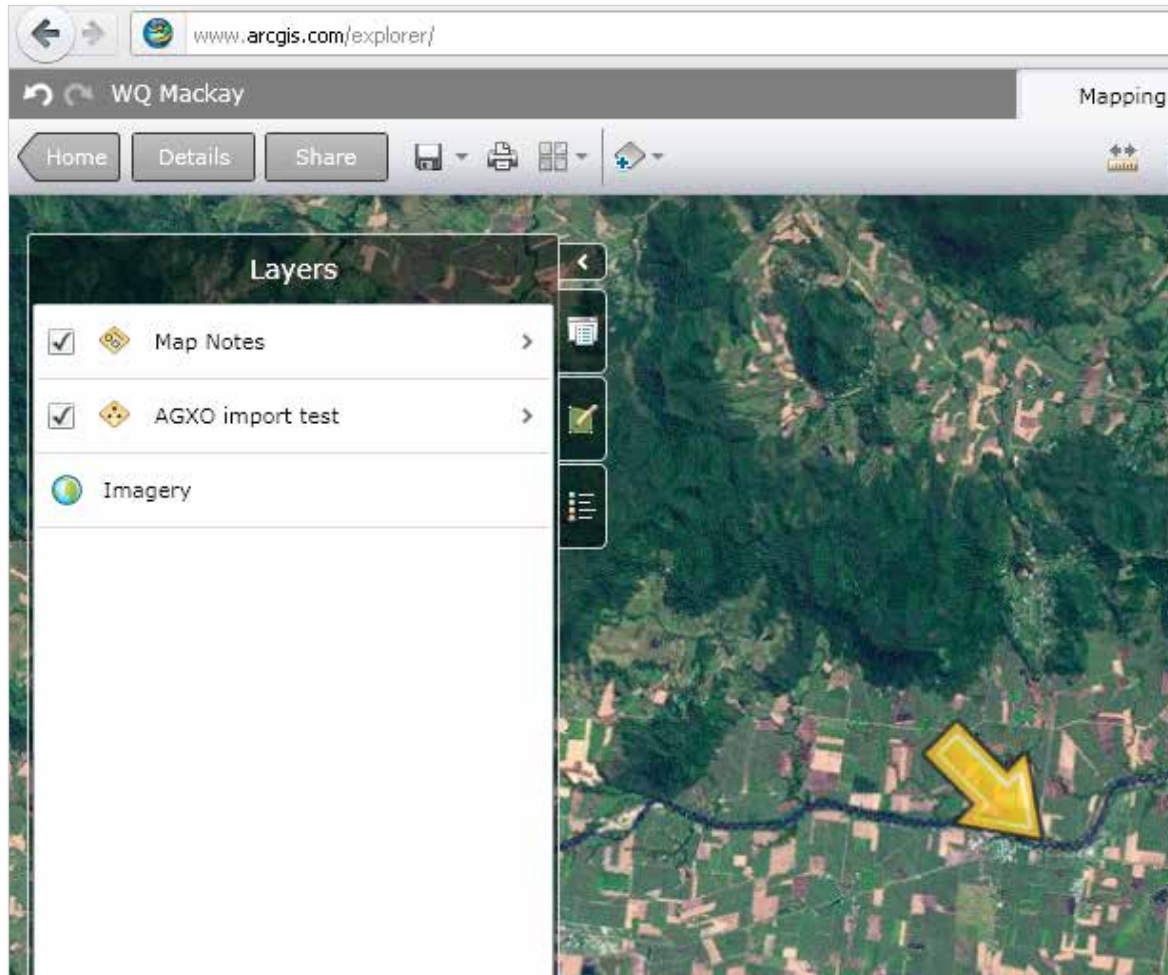


A layer is a collection of common features on a digital map such as drainage or vegetation types.

Resource 1 (continued)

From the menu, click the small arrow to open the dialogue (Figure 13).

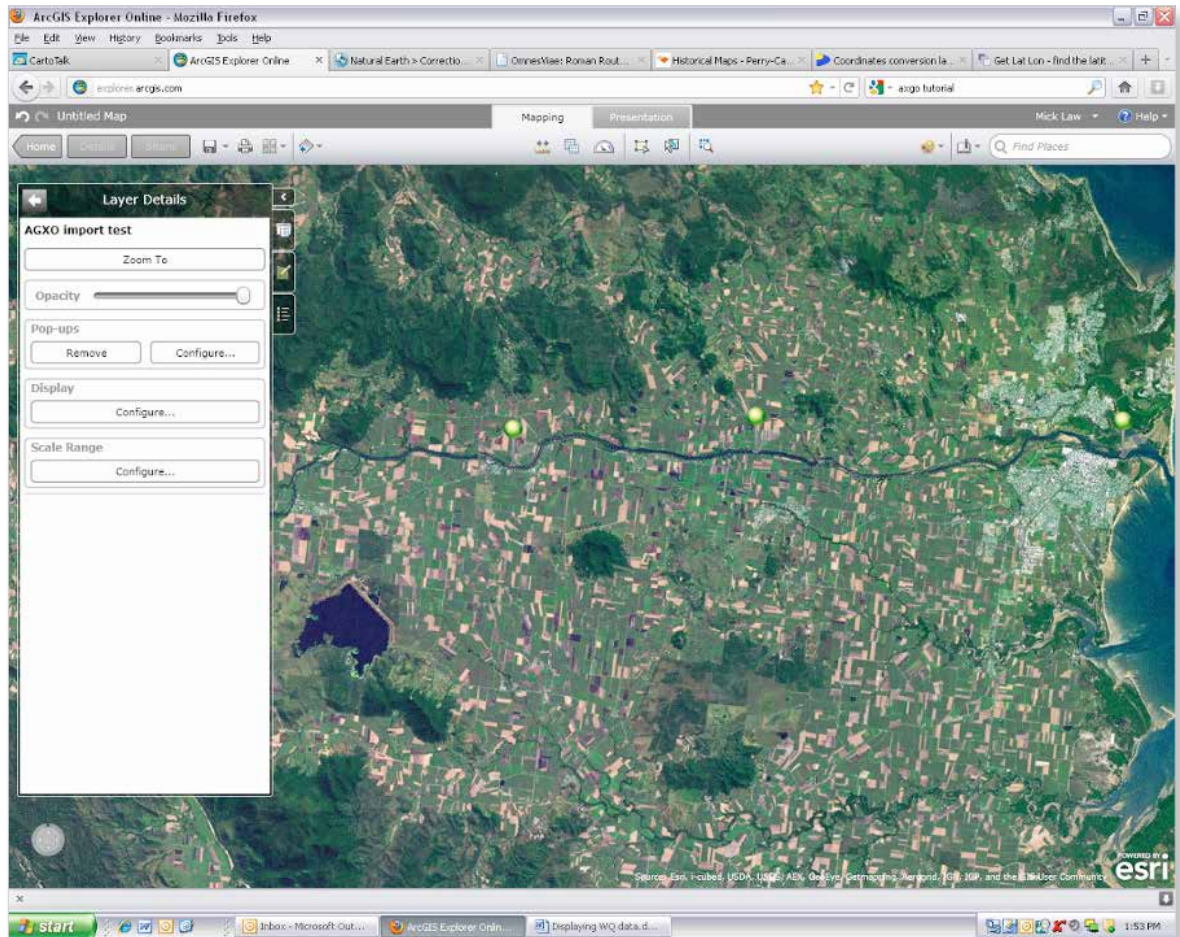
Figure 13: Map layers



Resource 1 (continued)

Click on the small arrow to the right of the 'water quality *yourwaterwayname*' layer to open its 'Layer details' section (Figure 14).

Figure 14: Layer details

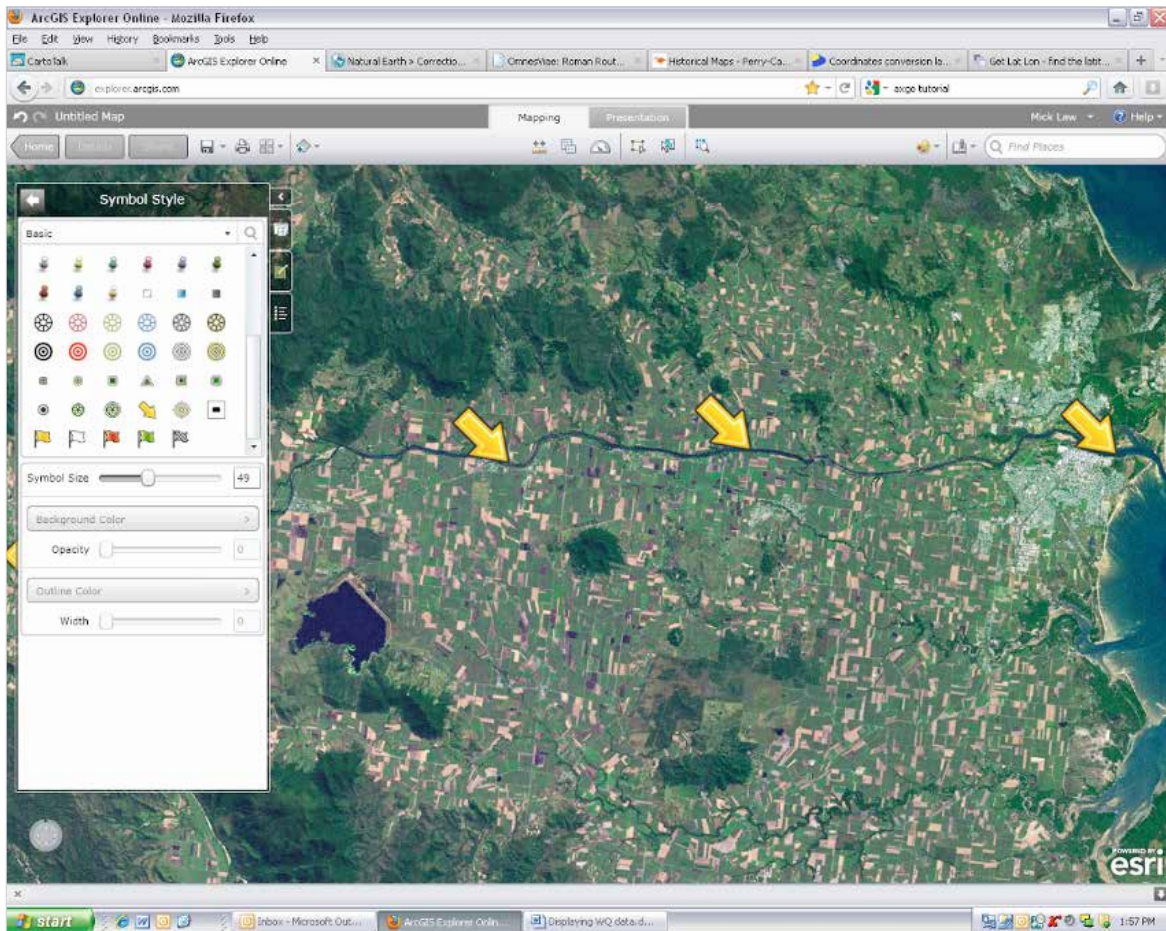


Resource 1 (continued)

Click on the 'Configure' button in the 'Display' section to change the symbol style. The default icon is usually a small green pushpin which can be difficult to see when layered on top of aerial

imagery. Change the icon to something that is easier to see (Figure 15). Click 'Done' to confirm your changes.

Figure 15: Editing map symbols



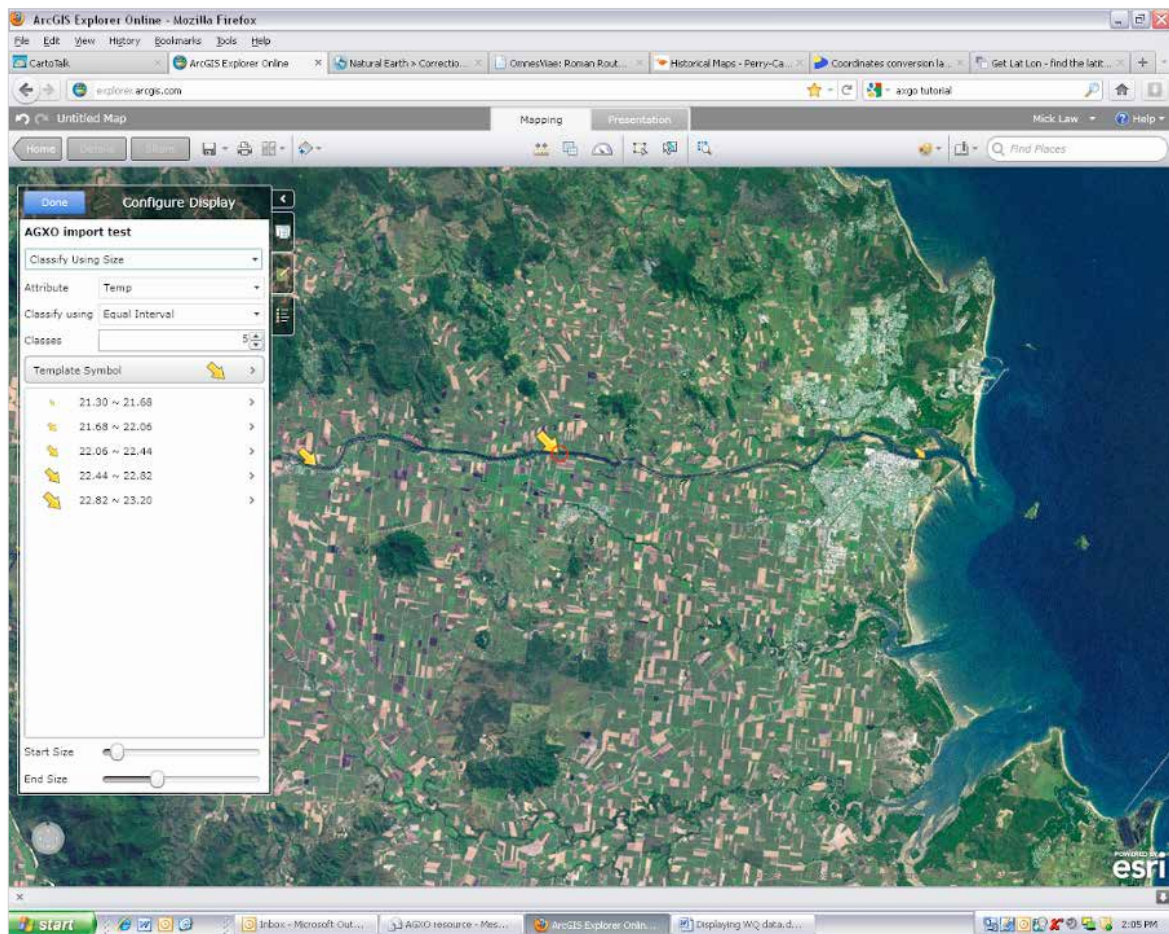
Resource 1 (continued)

» Using graduated symbols

Change your map to display map features—in this case, the data collection sites—using a variety of sizes. You need to link this to a field in your table. From the 'Configure display' screen, click on the

drop-down arrow and select the 'Classify using size' option to allow you to adjust symbol sizes according to the data collected at that site (Figure 16).

Figure 16: Graduated symbols

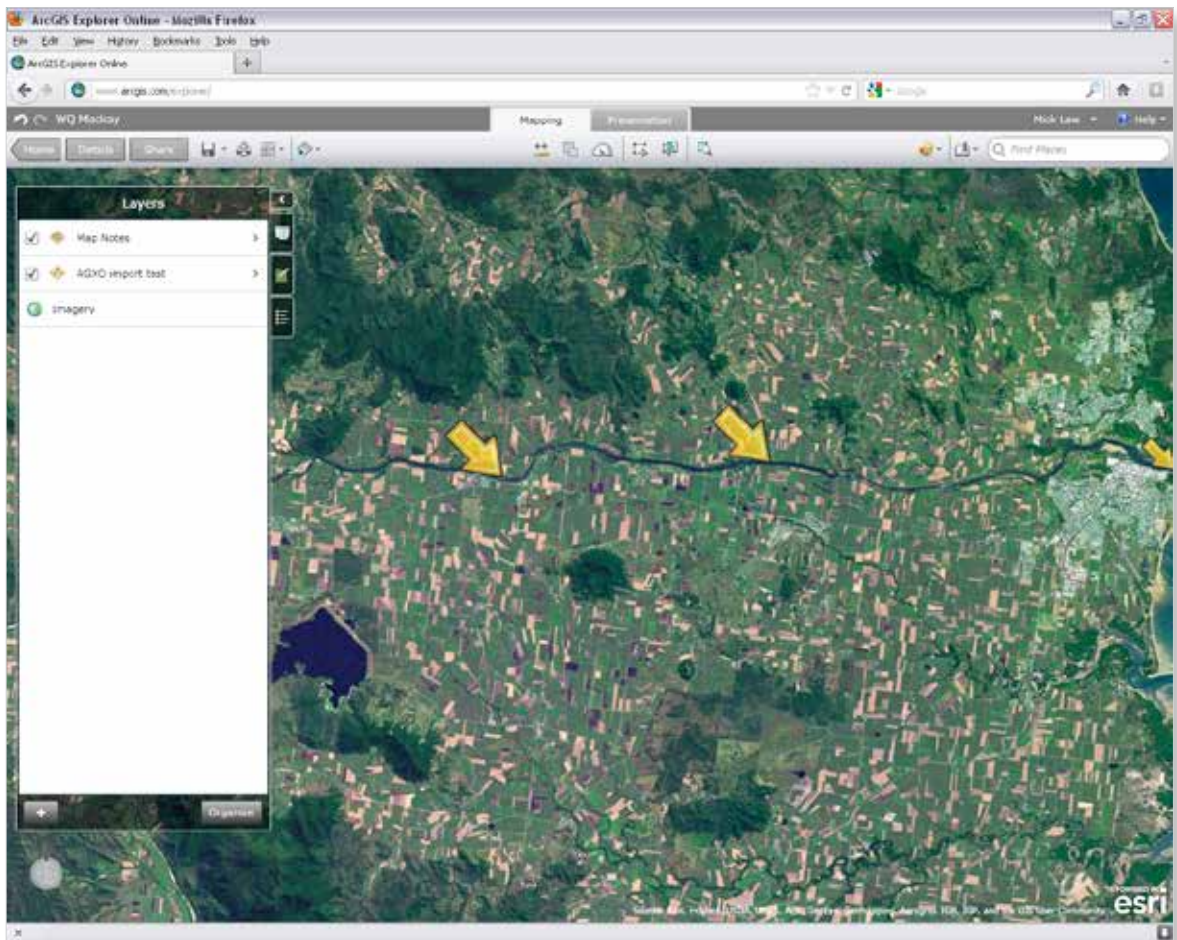


Resource 1 (continued)

You will need to tell the computer which field from your table you will be using to adjust the sizes of your symbols. In this example we will use Turbidity, showing those sites that received higher turbidity readings with larger symbols.

Select 'Turbidity' by clicking the relevant field in the 'Attribute' dropdown menu. Finally, select 'Done' to complete your changes and update the map (Figure 17).

Figure 17: Adjusted symbols



Resource 1 (continued)

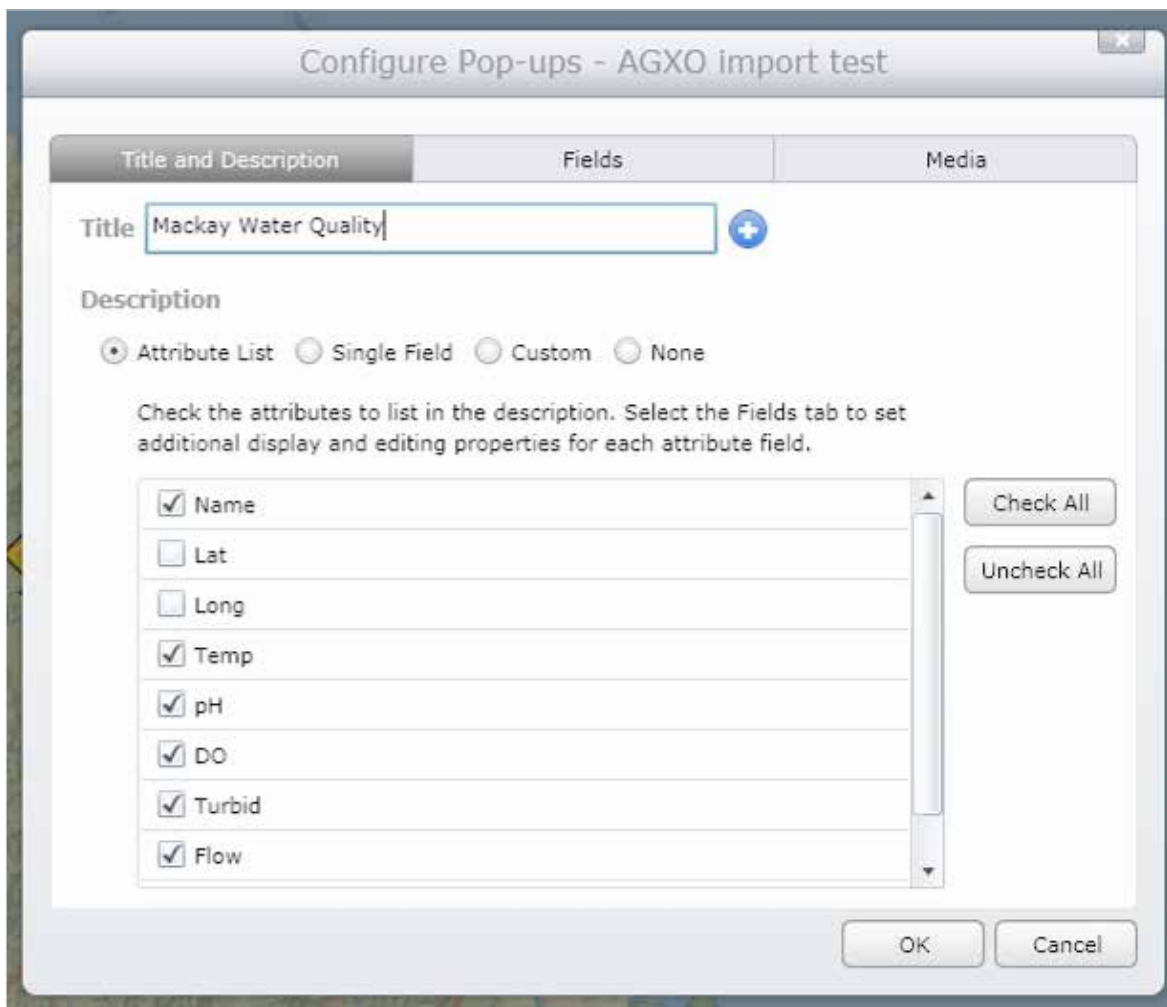
» Using pop-ups

Select the 'Configure' button under the 'Pop-ups' heading in the 'Layer Details' dialogue box to configure the content that is visible when the user clicks on the placemark.

In the 'Title and Description' tab, shown in Figure 18, you can choose a single field ('Single Field') or multiple fields ('Attribute List') from your CSV file from which to display data, or you can use the 'Custom' option to create a customised statement for each location using the data from your table.

Pop-ups are a feature of AGXO that allow you to see the information attached to each location. When you click on a map symbol, the pop-up box that appears contains information related to that point.

Figure 18: Pop-up title and description



Resource 1 (continued)

The 'Fields' tab, shown in Figure 19, allows you to edit how your CSV table's fields are displayed in AGXO.

Figure 19: Pop-up field manager

Configure Pop-ups - AGXO import test

Title and Description | **Fields** | Media

Check the fields you want available for editing.
Select a field to change its properties.

	Field	Display As
<input checked="" type="checkbox"/>	Name	Name
<input checked="" type="checkbox"/>	Lat	Latitude
<input checked="" type="checkbox"/>	Long	Longitude
<input checked="" type="checkbox"/>	Temp	Temperature (C)
<input checked="" type="checkbox"/>	pH	pH
<input checked="" type="checkbox"/>	DO	Dissolved oxygen
<input checked="" type="checkbox"/>	Turbid	Turbidity
<input checked="" type="checkbox"/>	Flow	Flow (m/s)
	FID	FID

^ Check All
v Uncheck All

Temperature (oC)

Display Properties
Decimal Places: 2
 Use 1000 Separator

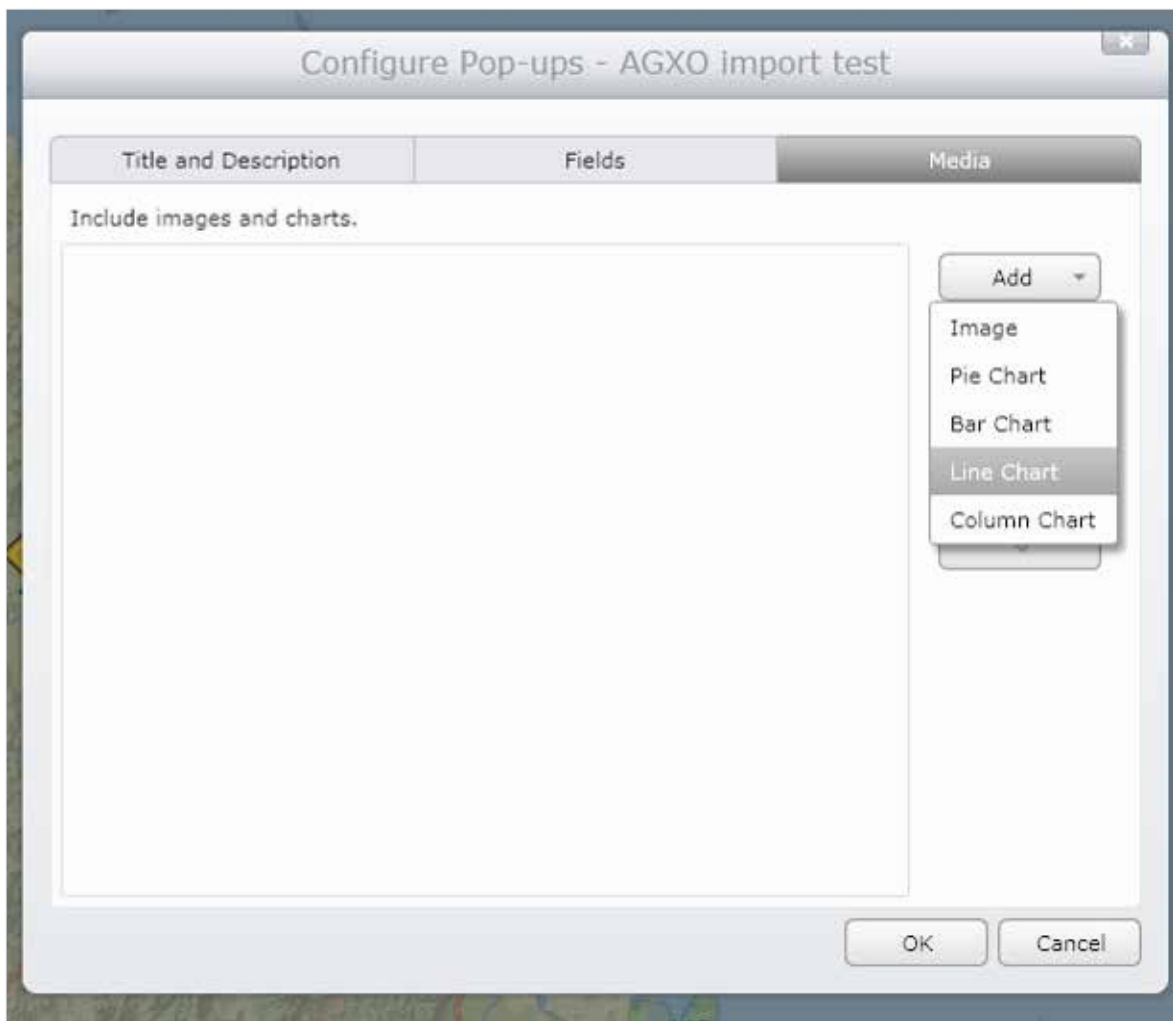
Editing Properties
Input as: TextBox
Editing Hint:

OK Cancel

Resource 1 (continued)

The 'Media' tab, Figure 20, allows you to insert images or charts into the placemark box. If you need to display your survey data you can present some of that data in graph format from within your map using this tab.

Figure 20: Pop-up media

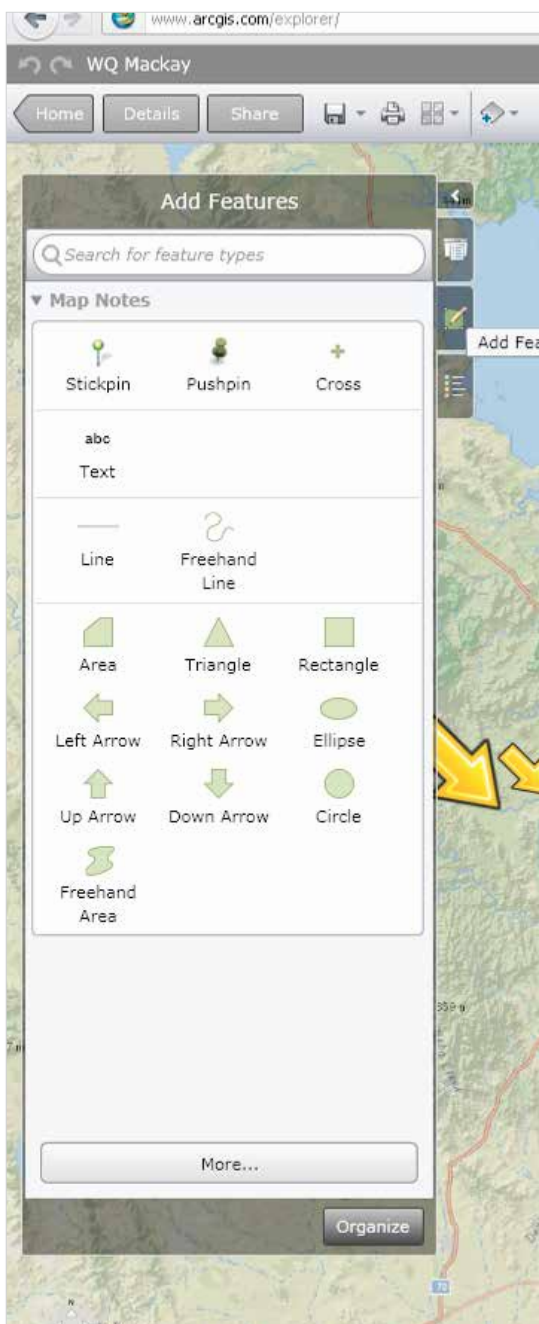


Resource 1 (continued)

» Adding extras

You can create your own freehand information on the map, including text, by using the predefined tools in AGXO. Make sure the 'Map Contents' window is open and click on the 'Add Features' button to access the shape, text and freehand drawing tools. Figure 21 displays the tools available.

Figure 21: Map notes



» Saving an image

Save a screen capture of your screen at any time by using the 'Print Screen' button on your keyboard. This button is usually found in the top-right corner of your keyboard adjacent to the F12 key. Some laptops may require you to press a 'Function' or 'Alt' key at the same time as you select 'Print Screen'.

Hitting the 'Print Screen' key creates an image of your screen at the moment you pressed the button. This image is available for you on the clipboard, so you can enter another application, such as Paint, and paste the screen capture using the paste function. You can then save the image to be used in another application such as Word or PowerPoint, or it could be shared as a stand-alone image file.

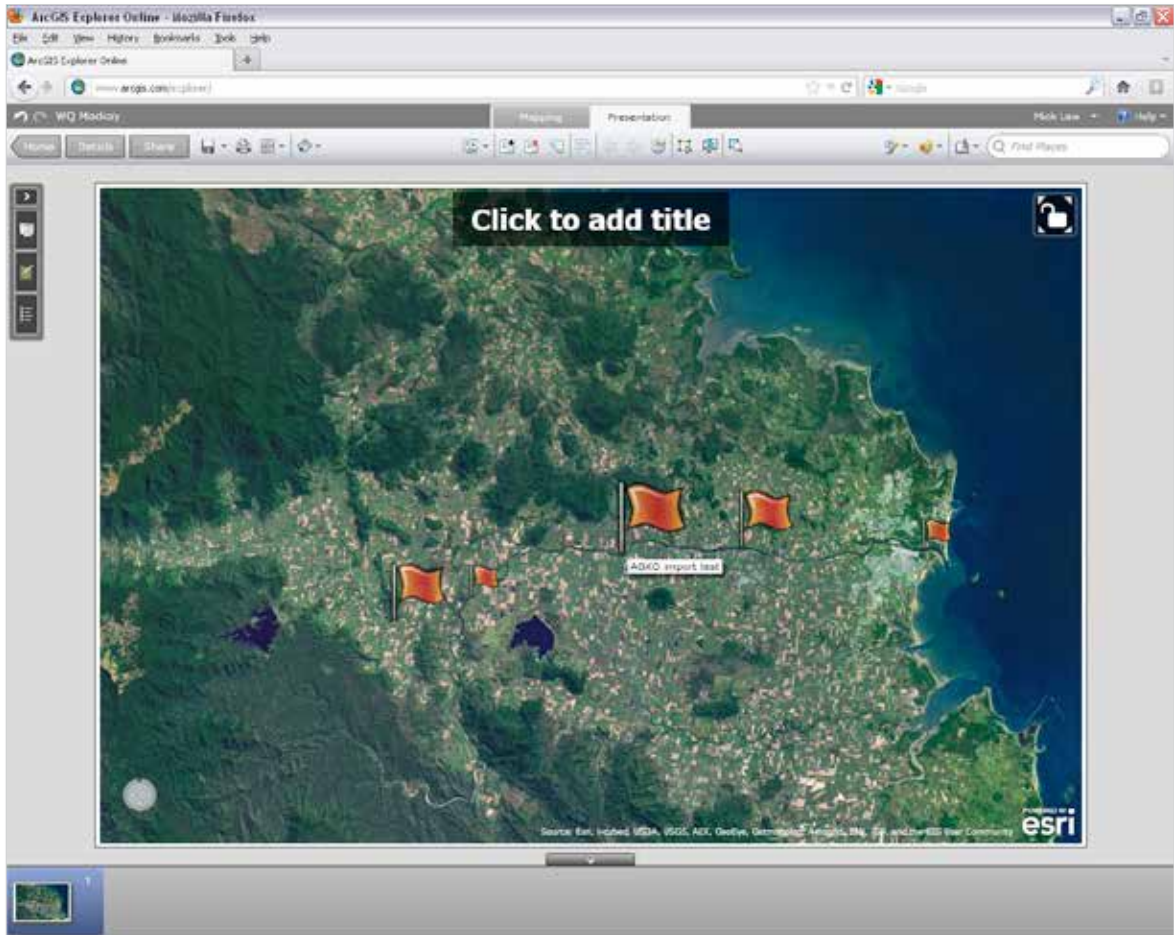
» Creating a presentation

Switch to the Presentation view by clicking on the 'Presentation' tab at the top of your screen. This tool allows you to create a slide, or a series of slides, that you can bundle as a presentation by taking a 'snapshot' of your map at any stage of your analysis and adding it to a separate slide. The presentation is saved within the map and you will need to re-enter AGXO in order to show your presentation.

For your first slide, navigate to a view that shows all of your field sites then click anywhere on the map on screen to add that view as a new slide. You can navigate around the map even in the Presentation view (Figure 22).

Resource 1 (continued)

Figure 22: The Presentation view



Select the padlock button in the top-right corner of your map to capture this view and permanently attach it to the slide—you can then move on and edit the map without changing the information saved on your locked slide. Click the 'New Slide' button (Figure 23) to add a new slide and zoom in to each site, or pair of sites.

Figure 23: Presentation tools with 'New Slide' highlighted

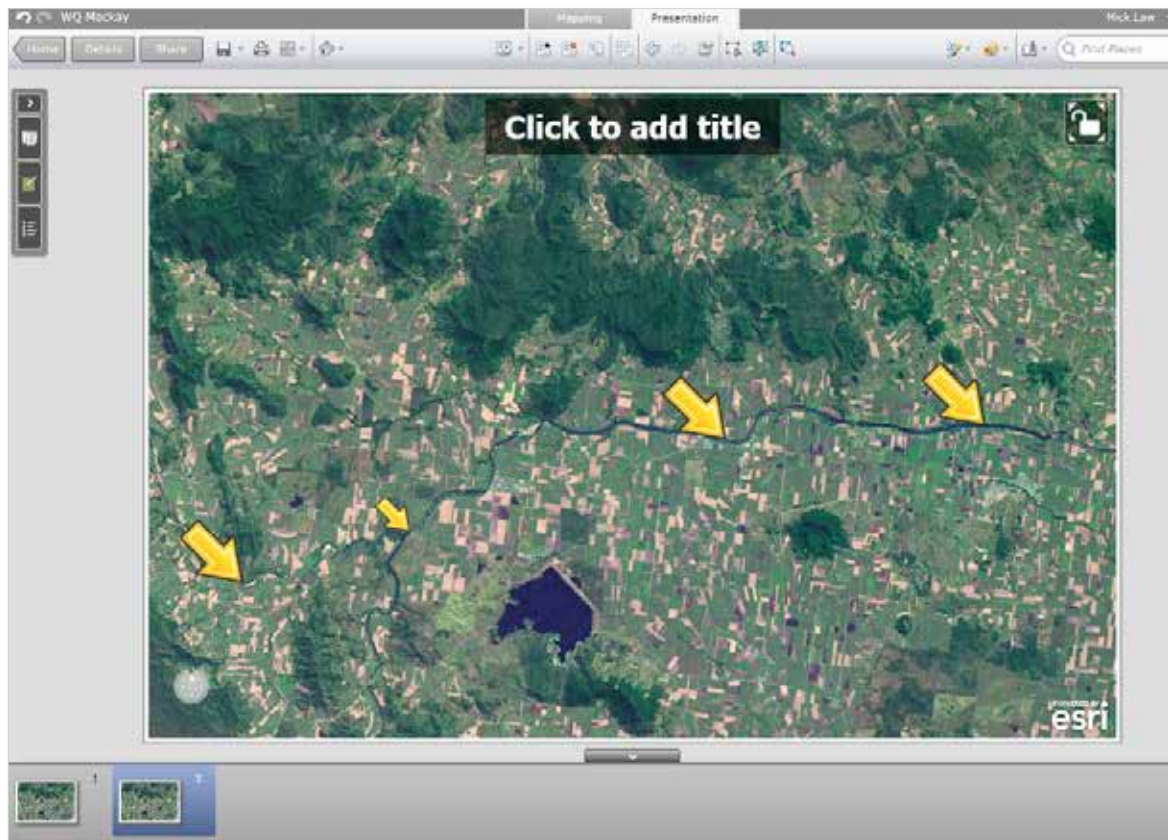


Resource 1 (continued)

The new slide is a copy of the previous slide except the view is not locked. Now zoom into your first few field sites and click the lock button. This will add the new view to your second slide. Create a new slide for each site or pair of sites highlighting significant findings on water quality

and continue in this way until you have created a presentation that is suitable for your needs. You can also format the title and symbols using the tools in the top-right corner of the map (Figure 24).

Figure 24: Slide ribbon is visible below current slide



Note: You will need internet access and you will need to be signed in to AGXO with your ESRI Global Account in order to access your presentation.

Resource 2

Water quality data sheet

An example of a quantitative water quality data collection sheet

	Site name	Latitude	Longitude	Date	Time	Temp	DO	pH	Nitrates	Phosphates	Turbidity
1											
2											
3											
4											
5											
6											
7											
8											

Resource 3

A Waterways Health Check

An example of a qualitative water quality data collection sheet

Site name	Lat	Long	Date	Time	Land use	Litter	Pipes drains	Extra structures	Smell	Water clarity	Vegetation	Invertebrate animals	Vertebrate animals	Total score
1														
2														
3														
4														
5														
6														
7														
8														

Adapted from 'A Waterways Health Check: rating your local waterway' <www.waterwatch.org.au/publications/healthcheck.html>

Resource 4



Map basics—a guide to the fundamentals of mapping

What is a map

A map is a spatial representation of the Earth's surface showing how things are related to each other by distance, direction, shape and size.

A map has five key components:

- **scale**—the relationship between the real world and the map
- **projection**—a mathematical formula that helps project the curved earth surface onto the flat paper surface
- **reference system**—a coordinate system to help maintain spatial accuracy
- **datum**—a base from which coordinates and heights can be measured
- **presentation**—cartographic practices that make the map easy to read.

Scale

A scale is the relationship between the distance in the real world and the distance on the map. Scale can be shown as:

- **ratio** (e.g. 1:1000)—one unit on a map represents 1000 units in real world
- **words**—1 cm equals 1 km
- **graphic**—a line marked with the distance of the real world indicated on the line

Small scale maps (e.g. 1:1 000 000) show less detail and cover larger areas such as a whole country. Large scale maps (e.g. 1:1000) show more detail and cover smaller areas such as a suburb.

Projection

A cartographer's (or mapmaker's) fundamental issue when making a map is how to represent the curved surface of the Earth on to a flat surface—ever tried to wrap a soccer ball without creasing the paper?

A cartographer uses mathematical formulas to reduce the distortion on a map. These formulas are called projections. Cartographers apply different projections to suit the purpose of the map.

Different projections can be applied to ensure one or more of the following remain accurate while potentially compromising those remaining:

- shapes
- distances
- areas
- angles of direction.



Copyright 2002 © – John Wiley and Sons Inc., From *Geography: Realm, Regions and Concepts 10e* by de Blij and Muller

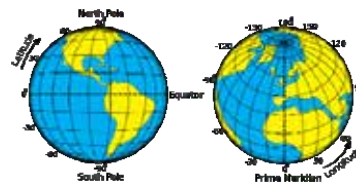
In the Mercator projection, for example, direction remains constant, and the shape of small objects is preserved. However, distortions appear as you move towards the poles as landmasses (shapes/areas) like Greenland, appear larger than they are.

Reference System

Geographic coordinates (latitude and longitude)

Latitude are imaginary lines running around the Earth parallel to the equator. The lines of latitude are measured in degrees (°), minutes (') and seconds (") or decimal degrees, north or south of the equator.

Convention says the equator is zero degrees (0°). The lines of latitude are called parallels with the extents being the North Pole at 90 degrees north (90°N) and South Pole at 90 degrees south (90°S).



Longitude or *meridians* are a series of imaginary lines running north–south around the Earth, connecting the North and South Poles. By convention, the prime meridian runs through Greenwich in England and is at 0° longitude.

Meridians, also measured in degrees, minutes and seconds or decimal degrees, are either east or west of this prime meridian up to 180° (approximately the International Date Line that runs through the Pacific Ocean).

Combining the latitude and longitude gives us a reference for any point on the Earth's surface. For example the Brisbane GPO is about 27°28'03" south and 153°01'40" east.

Resource 4 (continued)

Grid Coordinates (eastings and northings)

The other common coordinate system used is Universal Transverse Mercator (UTM) or grid system. Based on a mercator projection (common for world maps), the UTM system divides the surface of the Earth up into a grid.

To reduce distortion, it uses a series of 60 zones in the east–west direction (6° wide).

UTM or grid coordinates are expressed in metres measured from a false origin. Drawn down the middle of each zone is a line known as the 'central meridian'.

In each zone the central meridian is assigned a false easting of 500 000 metres. An easting value greater than 500 000 indicates it is to the east of the central meridian for that zone.

Northings are measured in metres from the south pole in the southern hemisphere and from the equator in the northern hemisphere. About 10 000 000 metres of northing are in each hemisphere.

The coordinates are represented with the zone number first followed by the easting and northing in metres. There are no negative numbers in eastings and northings.



In Australia the local version of the UTM projection system is the Map Grid of Australia (MGA94). Brisbane GPO, for example, is Zone 56 Easting 502744 Northing 6961782.

North

There are different types of north:

- *True north* is based on the Earth's axis or the direction of a line of longitude which converges on the North Pole.
- *Grid north* is based on the grid coordinate system and varies only slightly from true north.

- *Magnetic north* is determined by the Earth's magnetic field and is the direction your compass points.

The difference between true north and magnetic north is called magnetic variation. Maps are generally based on the true or grid north because they do not change over time like magnetic north.

Datum

Datums are the base reference for coordinate systems. The vertical datum is a base height from which all heights are measured. The horizontal datum is the base used to fix a position.



In Australia, the vertical datum is the Australian Height Datum (AHD), which is the mean sea level. Generally, all heights are measured from AHD. The horizontal datum in Australia is the Geocentric Datum of Australia (GDA94). This datum is internationally compatible and is suitable for GPS coordinates. Coordinates from previous datums (AGD66 and AGD84) can be converted to the new GDA94. All maps now produced in Australia are based on GDA94, however users should check the map to confirm what datum is being used.

Presentation

A map tells a story symbolically. Features like towns, roads and rivers need to be shown and labelled to effectively display spatial information. Cartographers use symbols to assist with the representation of the features. These are explained via a 'legend'. Placement of the symbols and labels rely on human input and experience and can become complicated. Over the centuries cartographers have developed this art so that points of interest can be clearly identified even on the busiest of maps.



For more information on mapping visit either the Geoscience Australia website (<http://www.ga.gov.au>) or Fundamentals of Mapping on the ICSM website (<http://www.icsm.gov.au>).

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