

Week 10 Cookbook: GIS Tutorial Chapter 6

Creating GIS Data: Digitizing and More

Week 10 Overview

- 10.1) What is Digitizing?
- 10.2) Your Turn: GIS Tutorial Chapter 6 (Page 194 to 217 only!)
- 10.3) Creating Shapefiles
- 10.4) Spatial Reference
- 10.5) Spatial Reference in Massachusetts
- 10.6) Adding Attribute Fields = Making shapefiles meaningful

This week is all about Digitizing = Creating your own, original GIS data

Chapter 6 of your GIS Tutorial takes you through the process of on-screen digitizing step-by-step. Digitizing is easy, but can be quite tedious and time-consuming.

More importantly, you learn how to create new shapefiles and how to add attribute data to your shapefiles to make them meaningful and intelligent!

Consider printing this cookbook for your convenience

10.1) What is Digitizing?

Digitizing = Creating new and original geospatial data. Or: Making reality (= the Earth) digital.

Here we can distinguish between two different types of digitizing: on-screen and in-situ.

On-Screen Digitizing of Spatial Features

Here you digitize points/lines/polygons from existing geospatial data sets, such as aerial photographs, satellite images, topographic maps, digital elevation models, Google Earth, etc.

Points	Building locations, mountain summits, etc.
Lines	Streams, contour lines, roads, etc.
Polygons	Building foot prints, wetlands, etc.

In-situ Digitizing of New Features

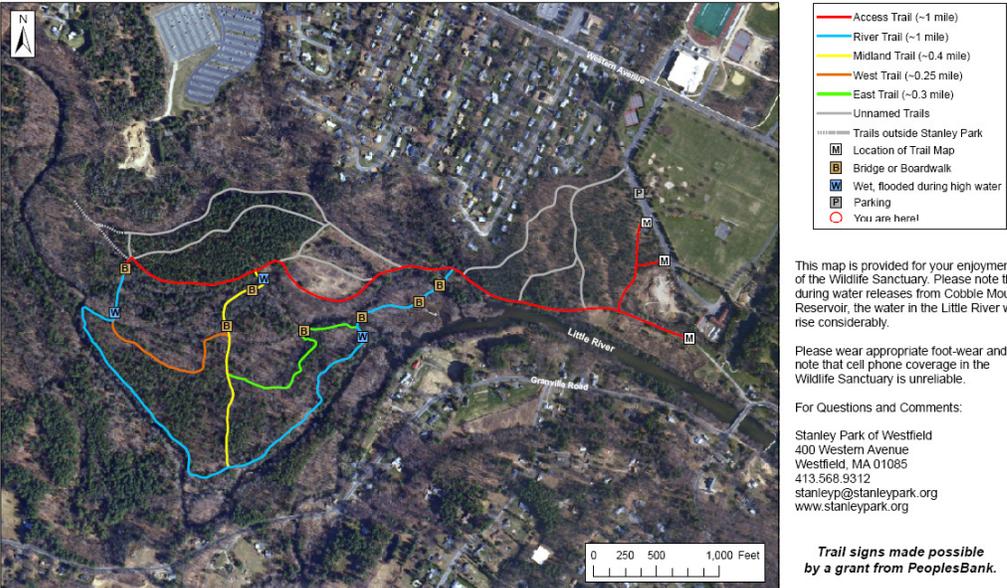
Here you go outside and digitize points/lines/polygons using a GPS receiver. The GPS receiver gives you latitude, longitude, and elevation. You make notes of feature types, feature attributes, etc. and add those attributes later in ArcGIS.

Points	Sampling locations along a stream, locations of temperature loggers, etc.
Lines	Hiking trails, edges of glaciers, mice trails, etc.
Polygons	Wetland boundaries, neighborhoods, etc.

10.1.1) Consider this Map

Welcome to the Frank Stanley Beveridge Memorial Wildlife Sanctuary

The Frank Stanley Beveridge Memorial Wildlife Sanctuary comprises 180 acres of managed trails and land along the Little River. The sanctuary contains a wide variety of native trees, wildflowers, ferns, and more. It is also a haven for many area birds and wildlife. Frank Stanley Beveridge was born in Canada on April 17, 1879. In March 1900, having traveled from Pembroke Shores, near Yarmouth, Nova Scotia, Frank arrived at Mount Hermon School in Northfield, Massachusetts with only a quarter, a dime and one Canadian dollar bill. He remained at Mount Hermon School for three years. In 1933, Beveridge founded Stanley Home Products, Inc. in Westfield, MA. In 1949, he established The Stanley Park of Westfield, Inc. on twenty-five acres of land. Today, Stanley Park consists of nearly 300 acres of formal gardens, a carillon tower, trails, sports fields and natural areas, such as the Wildlife Sanctuary.



Legend:

- Access Trail (~1 mile)
- River Trail (~1 mile)
- Midland Trail (~0.4 mile)
- West Trail (~0.25 mile)
- East Trail (~0.3 mile)
- Unnamed Trails
- Trails outside Stanley Park
- M Location of Trail Map
- B Bridge or Boardwalk
- W Wet, flooded during high water
- P Parking
- O You are here

This map is provided for your enjoyment of the Wildlife Sanctuary. Please note that during water releases from Cobble Mountain Reservoir, the water in the Little River will rise considerably.

Please wear appropriate foot-wear and note that cell phone coverage in the Wildlife Sanctuary is unreliable.

For Questions and Comments:
 Stanley Park of Westfield
 400 Western Avenue
 Westfield, MA 01085
 413.568.9312
 stanleyp@stanleypark.org
 www.stanleypark.org

Trail signs made possible by a grant from PeoplesBank.

Background image: Aerial photographs from 2005 provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs. The GIS mapping of the trails was conducted by students from Westfield State College. Map design and layout: Derek Strahan and Dr. Carsten Braun, Westfield State College (April 2009).

This is the new trail map for Stanley Park. The trails were digitized using a GPS receiver. Then, we created a polyline shapefile from the GPS data and added two attributes: a unique name for each trail and a unique code for each trail. That unique code is used in the Symbology to show the different trails in different colors.

10.1.2) The Basic Process

1. In ArcCatalog, you create a new empty shapefile. This serves as the ‘shell’ into which you digitize your spatial features. More about that in Section 10.3.
2. You open this empty shapefile in ArcMap.
3. You add whatever fields you need to the attribute table.
4. You digitize your spatial features and enter the attribute information.

10.2) Your Turn: GIS Tutorial Chapter 6 (Page 194 to 217 only!)

Chapter 6 is all about on-screen digitizing...the examples use a neighborhood in Pittsburgh (PA). However, please realize that these digitizing examples can be applied generically: you can digitize polygons, polylines, and points for many purposes or projects. You can also use different ‘base maps’ for digitizing: topographic maps, air photos, satellite images, ArcMap maps, etc.

The Three Big-Picture Skills in Chapter 6

1. Creating new shapefiles in ArcCatalog.
2. Adding new fields to the attribute table.
3. Digitizing and editing shapefiles.

These are crucial skills that you will need for the rest of the semester, so please take your time with this chapter. Digitizing is simple – that just takes some time getting used to the clicking and the tools. More important is learning how to add attribute fields – otherwise, all you have is a point, line, or polygon without any meaning.

Detailed Instructions for Chapter 6

- Create a new folder on your USB flashdrive: garp0244\week10.
Start ArcCatalog and create a folder connection to this folder.

Please note: as you work through Chapter 6 you will be prompted to create new shapefiles and to save maps...always create the shapefiles and maps in the garp0244\week10 on your USB flashdrive, NOT on the PC that you happen to be working on.

Page 194

- Create the new shapefile CommercialZone in your garp0244\week10 folder.

Page 196

- Add the CommercialZone shapefile from your garp0244\week10 folder.

Page 197

- Choose your \garp0244\week10 folder to edit data from (if necessary).

Page 205

- Please complete the Your Turn Box...but don't worry too much about details...

Page 207

- Save the map to your \garp0244\week10 folder.

Page 208 to 210

- Create the EvacShelter shapefile in your \garp0244\week10 folder.
- Choose your \garp0244\week10 folder to edit data from.
- Be sure to select Target layer = EvacShelter.

Page 212

- Create the EvacRoute shapefile in your \garp0244\week10 folder.

Page 217

- Please complete the Your Turn Box...but don't worry too much about details...
- Save the finished map to your \garp0244\week10 folder.

10.3) Creating New Shapefiles

Creating new (= empty shapefiles) is easy and you already practiced that when working through Chapter 6 of the GIS Tutorial. But, it is worthwhile to review the procedure and to explain a few of the details.

1. Start ArcCatalog and create a folder connection to the folder where you want to create the new shapefile.
2. In ArcCatalog, right-click on the folder where you want to create the new shapefile and select New – Shapefile.

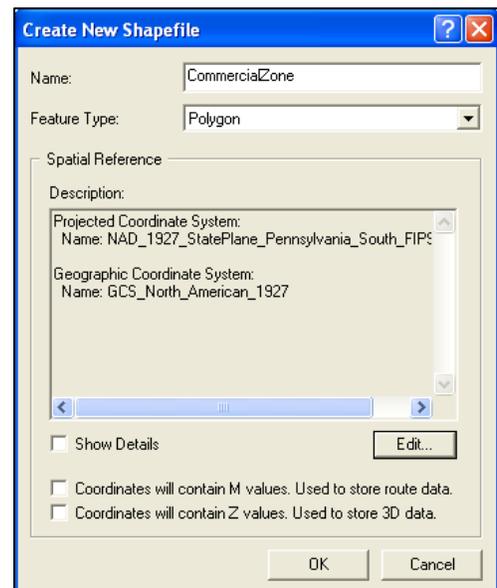
Steps 1 and 2 are critical to make sure that you end up creating the new shapfile where you want to...and not in some random place on the computer.

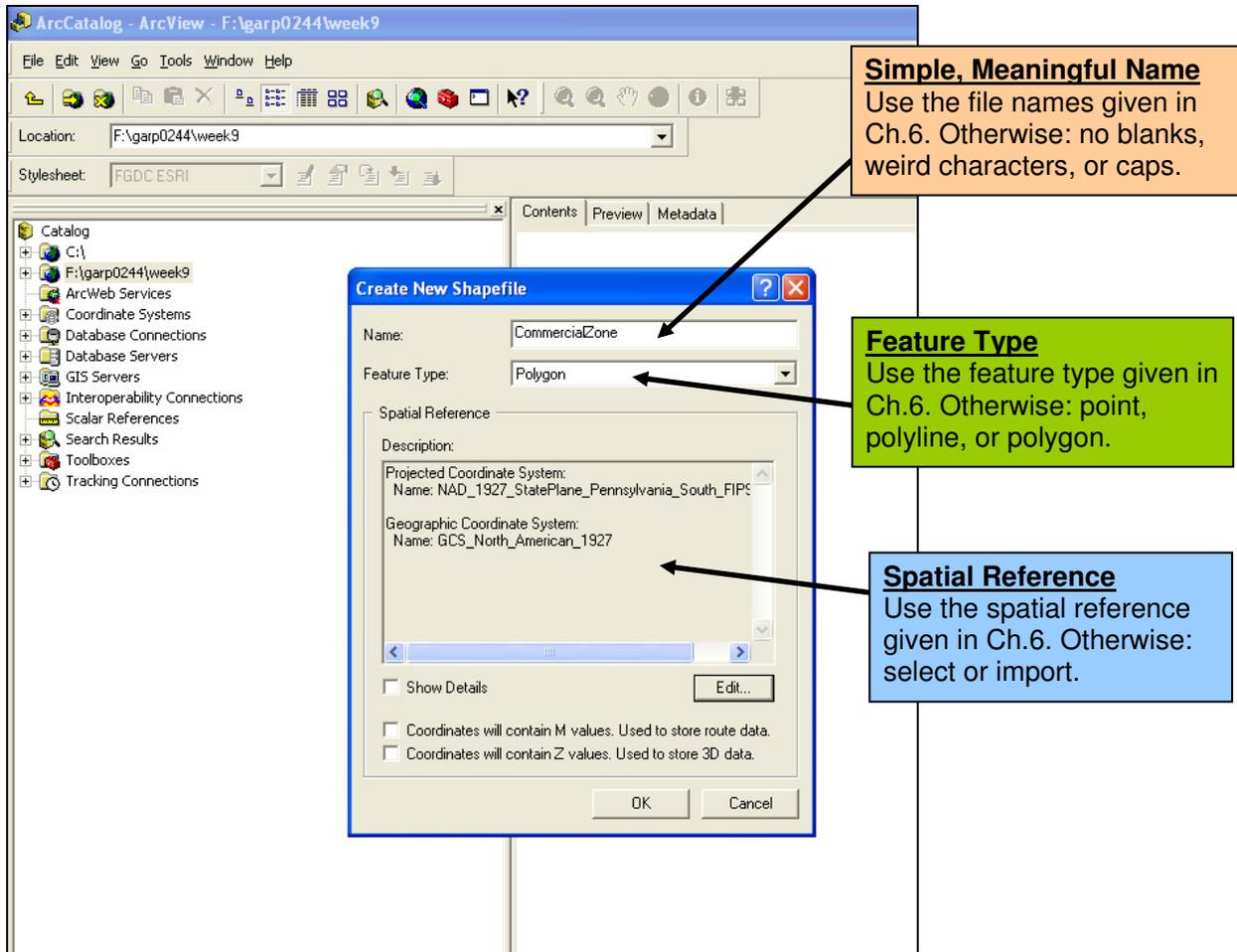
The Create New Shapefile dialog box:

Name: Select a meaningful name for your new shapefile. Do NOT use blank spaces, weird characters, and capital letters. Keep it all lowercase.

Feature Type: Select the appropriate feature type for your new feature (point, polyline, or polygon).

Spatial Reference: A shapefile has to have a spatial reference – otherwise ArcMap does not know where to display the shapefile on the map. See Section 10.4 below.





That's all that there is to creating a new (= empty) shapefile. But, that's all that is right now: an empty container for geospatial data. Now:

- Create your spatial data (= digitizing).
- Enter your attribute data to add meaning to your spatial data.

10.4) Spatial Reference

The Spatial Reference or Projection tells ArcGIS two things:

1. Where on Earth to map a geospatial data set.
2. How to convert the 3D shape of the Earth into the 2D displayed on your computer screen.

ArcGIS needs to know both things to accurately place a shapefile on your map.

Tip 1: Watch the multi-part Jing in the Week 10 folder!

Tip 2: Work through Page 172 to 181 in Chapter 5 of the GIS Tutorial to learn more!

Vector Data

= Latitude and longitude of your spatial features.

Raster Data

= Latitude and longitude of each grid cell.

Projection or Spatial Reference

The projection tells ArcGIS mathematically...

Where and how to map the latitude and longitude of your spatial features on the 3D Earth.

How to project the 3D Earth as a flat 2D map on your screen.

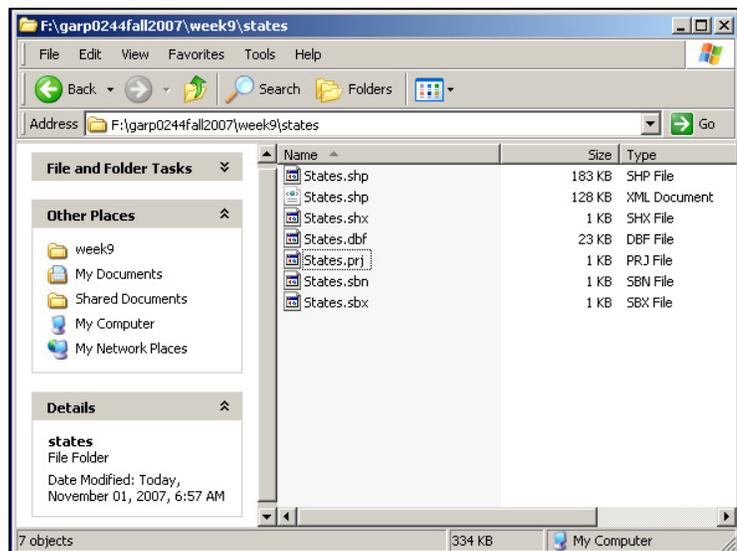
In practice, the projection or spatial reference is the *.prj file that is part of each shapefile family.

The projection or spatial reference is a small file that is/should be part of each shapefile (*.prj).

In the example on the right you see the States shapefile that we have been using extensively this semester.

States.prj is the projection file for this shapefile.

If this file is missing...ArcMap will try to perform an “on-the-fly projection”...which may/may not work.



➔ When creating a new shapefile (i.e. when you digitize) you need to define the projection or spatial reference yourself.

10.5) Spatial Reference in Massachusetts

From the MassGIS website (<http://www.mass.gov/mgis/download.htm>)

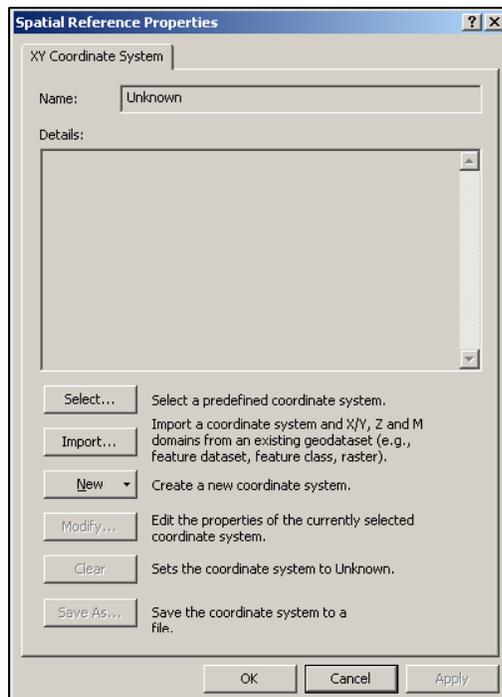
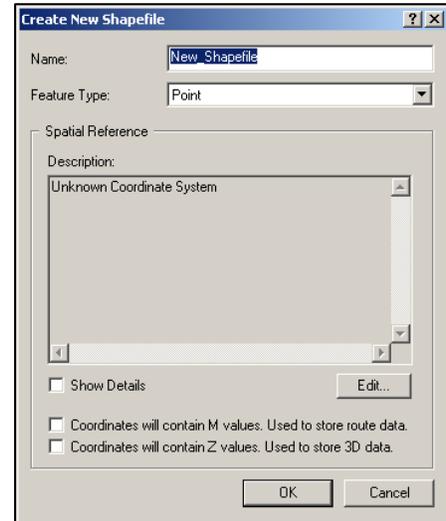
1. All data distributed by MassGIS are registered to the NAD83 datum, Massachusetts State Plane Mainland Zone coordinate system. Units are in meters.
2. Please note that if you are using data in other projections or in other units (e.g. feet) your data will not be spatially aligned to MassGIS data unless your GIS software supports on-the-fly projection.
3. Currently some shapefile .exes do not contain .prj files, which provides spatial reference information for ArcGIS 8.x and above.

Defining the correct spatial reference for a new shapefile can be difficult, but there is a simple trick if you are working in Massachusetts:

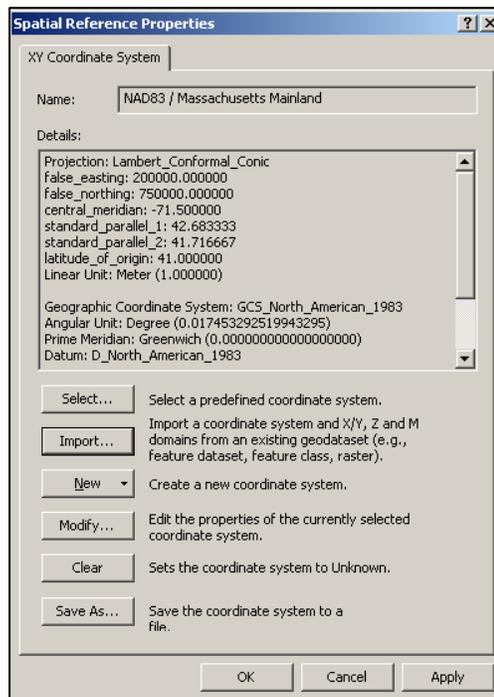
When creating a new shapefile in Massachusetts, simply import the spatial reference/projection from a MassGIS data layer that has a spatial reference/projection file.

How to Import a Spatial Reference

When you create your shapefile you select Edit... under Spatial Reference to open the Spatial Reference Properties dialog box. Now click Import... to import the coordinate system from an existing geospatial dataset. Browse to your \massgisdata folder and select any data layer that you downloaded from MassGIS.



'Empty' Spatial Reference



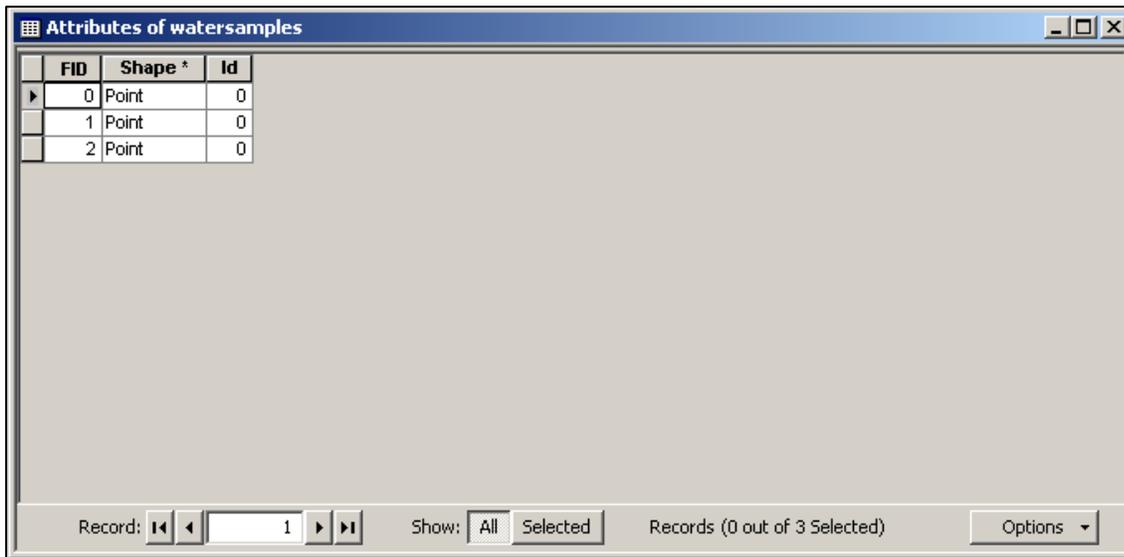
'Imported' Spatial Reference

Now you hit the Add button and the name and details of the spatial reference for your new shapefile will be added by importing the spatial reference from the MassGIS data layer. Now you click Apply and OK and you are done!

Watch the Jings in the Week 10 folder that explain how this works!

10.6) Adding Attribute Fields = Making shapefiles meaningful

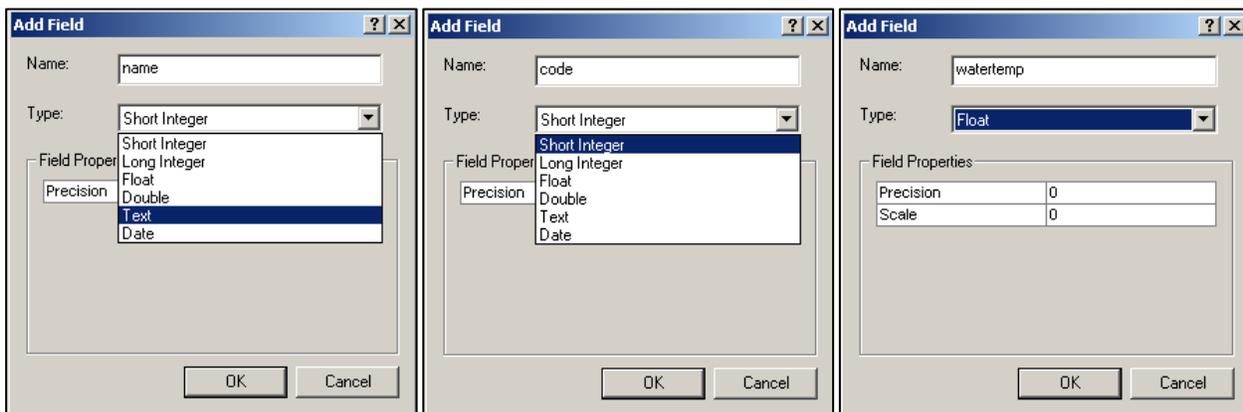
Let's assume you created a new point shapefile and digitized three points representing water sample locations along the Little River in Stanley Park.



If you open the attribute table you see three rows – one for each of the three points you have digitized. Otherwise, the attribute table is empty, since you have not yet added any attribute data into the attribute table. For that you first need to add fields to the attribute table by clicking on Options – Add Field...

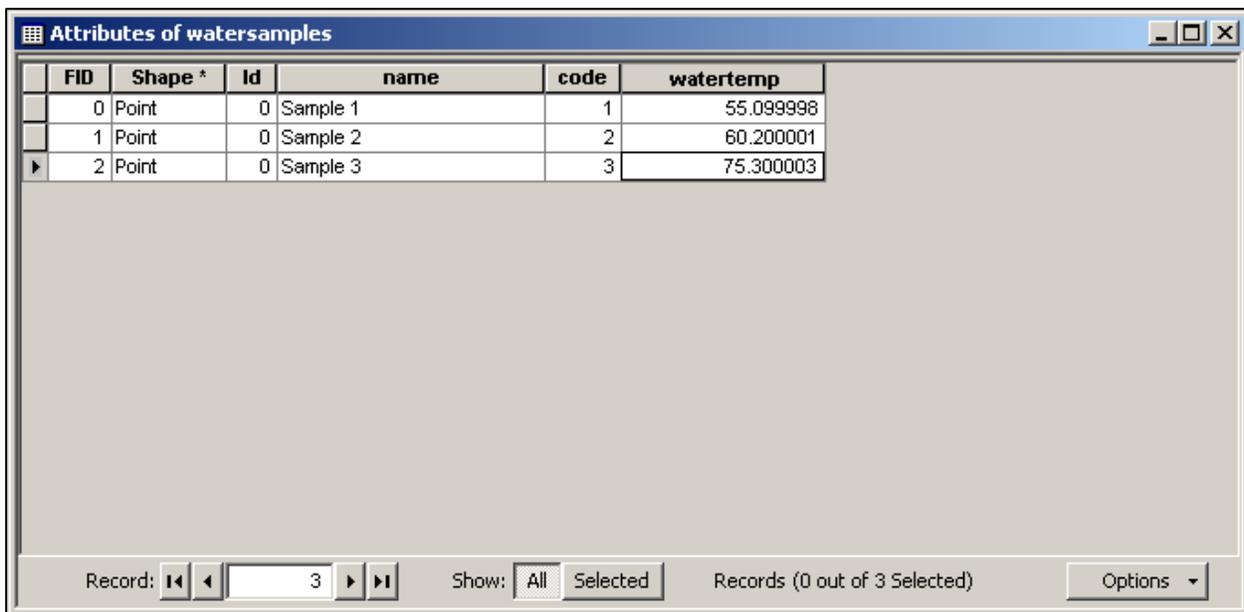
Watch the Jings in the Week 10 folder that explain how this works!

Now the Add Field dialog box opens and allows you to add fields to your attribute table.



Now you need to enter the Name and the Type of the new field you are adding to the attribute table.

- Name** Name of the field in the attribute table (= the column heading)
Simple, no blanks, no weird characters, all lowercase
- Type**
- Short Integer Use for small, even numbers (no decimal places)
Example: 1, 2, 34, 102, 887, etc.
 - Long Integer Use for large, even numbers (no decimal places)
Example: 997234, 12654897, etc.
 - Float Use for small numbers with decimal places
Example: 52.23, 187.234, 0.23, etc.
 - Double As Float, but with lot's of decimal places
Example: 1.9875209765, 457.9999992352
 - Text Use for text (i.e. letters)
Example: sample location, person who took the sample, owner, etc.
 - Date Use when entering a date



In the example above I added three fields to the attribute table and entered the attribute information.

- name A short text field for the sample name which is used later as a label in the map and the legend
- code A short integer field to give each sample a unique identification number.
This field is used later in the symbology to determine the color or symbol.
- watertemp In this example I entered the water temperature measured at each sample site.
This field can be used to show the color of the symbols as a function of the water temperature (= choropleth map).