
Part 1: Introduction to ArcGIS 9.3.1

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1. Introduction

This introductory tutorial is part one of the Essential ArcGIS Training Series 2 which is designed as a set of training workshops to get you started using a GIS effectively without spending years learning it. That being said, the workshop series will provide an intensive hands-on training in which you will learn how to do a GIS-based project from start to finish. The series consists of three workshops which are taught using ESRI’s GIS software, ArcGIS 9.3.1, with each training session lasting approximately 4 hours. Although the workshops in the series are designed to be worked on as part of one big project they can be done separately as short, stand-alone tutorials.

The overall objective of this training series is for you to learn how to use GIS for emergency preparedness planning. This first workshop will focus on creating/deriving, cleaning/preparing, and organizing in a geodatabase the type of data that are needed for emergency preparedness planning - an important part of the project workflow process that is often overlooked in most training courses. In addition, it’s important because when an emergency does occur you don’t want to have to go looking for data, let alone having to “clean” them before doing GIS analyses.

Outlined below is a simple guideline for starting a GIS-based project:

1. Decide on a GIS software and get training on it if needed.
2. Decide what data are needed (already available? Or need to create?).
3. Explore your data & clean them up as needed for your purpose.
5. Results: maps & other products.

In relationship to the above outline then the goals of this first workshop are:

1. to get you familiar with and trained in ArcGIS (using ArcCatalog, ArcMap, and ArcToolbox);
2. explore some GIS data and if needed, “prepare” them for use in GIS analyses;
3. learn how to make a map using ArcMap.

The structure of the tutorial is set up as follows: main sections are highlighted in blue followed by exercise sub-sections in orange. Step-by-step instructions for each exercise are numbered. Blue textboxes are notes or tips related to the exercises which you should read.

2. The ArcGIS software

ArcGIS is a scale-able desktop GIS software, consisting of a suite of three products: ArcView, ArcEditor, and ArcInfo each providing different levels of GIS functionalities.

ArcView is the most basic of the three products, meant for the general (non-GIS professional) audience. It includes the basic mapping and analysis tools along with simple editing and geoprocessing capabilities.

ArcEditor is the next intermediate level up and is generally used for editing and managing data. It includes the full functionality of ArcView in addition to advanced editing capabilities that is between ArcView and ArcInfo, such as the ability to edit features in a multiuser geodatabase.
**ArcInfo** is the highest level and is considered to be ESRI’s professional GIS product. It includes the full functionality of both ArcView and ArcEditor with more advanced geoprocessing and data conversion capabilities.

In addition to what these three base products offer, there are add-on products and extensions that can expand the capabilities of ArcGIS. Extensions allow specialized tasks such as raster geoprocessing and 3D analysis to be performed. More information on the ArcGIS products and extensions can be found on ESRI’s website (.esri.com).

Although differing in GIS functionalities, the three products all share the same core applications, user interface, and development environment. Within each product are three components: ArcCatalog, ArcMap, and ArcToolbox within which “GIS” work is done. Note ArcToolbox is integrated with ArcMap and ArcCatalog and can only be accessed through these applications.

*ArcCatalog* works like Windows Explorer. This is where you can browse and manage your data, including viewing, editing or creating documentation (i.e. metadata) for your data.

*ArcMap* is where you create, display, and interact with your maps. You can view, query, edit, and analyze your spatial data within a map environment. ArcMap provides an easy transition from viewing a map to editing its spatial features as well as providing a basis for understanding the relationship between your data.

*ArcToolbox* is a set of tools accessed through the ArcCatalog or ArcMap application. It contains tools for working with and manipulating your data. You can do advanced processing of your data, such as projection, conversions, and building topology. Wizards and tools provide step-by-step instructions via dialog boxes.

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### 3. Using ArcCatalog

ArcCatalog is an application for viewing and managing your spatial data. It resembles Windows Explorer, but is specifically designed to work with GIS data. In this regard ArcCatalog should always be used to delete, move, copy, or rename spatial data files.

**Exercise 1: Opening ArcCatalog and connecting to your data**

1. Open ArcCatalog from the desktop by double clicking on the icon  or go to Start >> Programs >> ArcGIS >> ArcCatalog.

   The ArcCatalog window opens with two frames. The left frame displays a list of all “mapped” drives on your computer – basically a list of all the folders and sub-folders on your computer. This is called the Catalog Tree or simply a directory tree. The right frame is called the Catalog Display and has tabs (Contents, Preview, Metadata) that let you explore the contents of the directory tree on the left side.
2. Connect to the series2 data folder if it’s not already “mapped.” Look in the directory tree to see if the folder C:\GIS_training_data\series2 is there. If you don’t see it, then create a direct connection to it by doing the following:

- Click the Connect to Folder button on the Standard toolbar.
- In the Connect to Folder window: Navigate to the C:\GIS_training_data \series2 folder >> OK. You should now see the folder in the Catalog Tree Panel.

Notes:
You only need to do this once. The next time you open ArcCatalog the directory you just mapped will be displayed in the catalog tree until you delete the connection or “unmap” it. To delete a folder connection, select the folder in the catalog tree then click Disconnect Folder Connection button.

If you have many connected directories you can organize them by renaming the connections to something more meaningful/logical. In the Catalog Tree, right click on the connected directory >> Rename. For example you can rename the mapped directory “C:\Documents and Settings\Stephanie\Desktop” to just “Desktop”.

3. Create yourself a working sub-folder in the C:\Students folder and connect to it.

- In the Catalog Tree Panel, navigate to the C:\Students folder >> Right click on the folder name >> New >> Folder.
- Rename the new folder to something of your choosing (e.g. C:\Students\Steph).
- Connect to your folder using the Connect to Folder button again.
You should now have two folders, the series2 data folder and your own working folder mapped in the Catalog Tree.

Exercise 2: Exploring data in ArcCatalog

In this exercise you will use ArcCatalog to explore some of the data in the series2 data folder including looking at metadata. Metadata is data about your data, and can come in many formats (e.g. separate text, html, or xml files or it can be included as part the spatial data in the header). Information such as coordinate system, data source, and resolution is contained in the metadata. For this exercise you will be looking at the metadata of the shapefile, coast_n83 as an example.

1. **The Contents tab**: view the contents of the series2 folder and sub-folders by selecting it in the Catalog Tree. The default tab in the Catalog Display panel is the Contents tab which shows the contents of the selected folder. Note each data file is represented by a data icon.

2. **The Preview tab**: select coast_n83.shp in series2\Boundaries folder then click the Preview tab. By default the Preview tab will always show the geography of the select data file. Attribute table associated with the data file can be viewed using the Preview menu options at the bottom of the Preview tab window.
4. The Metadata tab: view the metadata associated coast_n83.shp by clicking the Metadata tab. You should see three other tabs: Description, Spatial, and Attributes tabs that will provide more detailed information.

- The Description tab describes the data, which include an abstract, purpose, and status of the data.
- The Spatial tab gives information about the spatial reference of the data. Click this tab to view the coordinate system information.
The **Attribute tab** gives information about the table/attribute that is associated with the selected file. Click this tab to view field information such as field names and types.

5. Editing/creating metadata: “pretend” to edit/create metadata for the coast_n83 shapefile. This coastline shapefile was downloaded from the Hawaii Statewide GIS Program’s website, and already has associated metadata as a text file (see step 6).

- In the Metadata toolbar, click the Edit Metadata button.

- A metadata editor popup box appears with different tabs allowing you to edit or input certain information about the data. Text boxes noted in red are required inputs needed to meet the minimum metadata standard as indicated by the Federal Geographic Data Committee (FGDC metadata standard). Take a look at each of the tabs -- remember this is only for practice so you don’t actually have to fill in the required info.
6. Attaching and viewing an existing metadata text file as an enclosure. Use coast_n83.shp.

- On the Metadata toolbar, click the Metadata Properties button.
- Click the Enclosures tab >> Add.

- In the Add New Enclosure window: input the following parameters.
  - Xml Tag: accept default
  - Path: Browse to the C:\GIS_training_data\series2\Boundaries folder and select coast_n83.txt
  - Description: type a description if you want.
  - Click OK.

Notes:
For more information on the FGDC metadata standard, see the ArcGIS Desktop help section under Working with Metadata or the FGDC website at [http://www.fgdc.gov/](http://www.fgdc.gov/).
The text file enclosure should be added in the Enclosures tab. In the Enclosures tab, click Apply >> OK.

Note that back in the Metadata tab the enclosed file and description has been added.

To view the enclosed metadata text file, click the Metadata Properties button on the Metadata toolbar >> Enclosures tab >> Double click on the coast_n83.txt.

Notes:
Metadata in format such as text, HTML, XML, etc. can be imported. However, they have to be formatted properly in whatever metadata standard and style you’re using. Sometimes that may be more work than it’s worth; in which case adding them as enclosures is very useful.
Exercise 3: Organizing commonly used coordinate systems in Hawaii

This exercise is considered optional but highly recommended as navigating through the thousands of coordinate systems in ArcGIS to find the one you need can be time consuming. Organizing frequently used projection files in a folder of its own will provide easier access to them. Since you are in Hawaii – you will create a folder for two of the most commonly used coordinate systems in Hawaii. See the Hawaii Coordinate Systems page at the back of this document for a complete listing of projections used in Hawaii.

☐ 1. In the Catalog Tree Panel find the Coordinate Systems folder and expand it. You should see three sub-folders: Geographic Coordinate Systems, Projected Coordinate Systems, and Vertical Coordinate Systems.

☐ 2. Create a new folder for Hawaii coordinate systems. Right click on the Coordinate Systems folder >> New >> Folder.

☐ 3. Rename the new folder to “1Hawaii” (putting the 1 in front ensures that it will show up at the top of the folder listing).

☐ 4. Copy and paste the following projection files (.prj) into the 1Hawaii folder. PCS = Projected Coordinate Systems folder.

- PCS\UTM\NAD 1983\NAD 1983 UTM Zone 4N.prj
- PCS\State Plane\NAD 1983 HARN (Feet, Intl and US)\NAD 1983 HARN StatePlane Hawaii 3 FIPS 5103 Feet.prj

You should now have two projection files in your 1Hawaii folder.

Exercise 4: Creating a geodatabase in ArcCatalog

Before starting a GIS project you should create a geodatabase (GDB) to help you organize and manage your data. A GDB is a “container” for your spatial data. ArcGIS supports three types of GDBs – personal GDB, file GDB, and ArcSDE GDB (requires ArcSDE) – each is defined by their storage capacity. Spatial data in ArcGIS can be stored as either shapefiles or GDB feature classes. The shapefile is an older file format from previous versions of ArcGIS that is still supported with version 9.3.1 and is the simplest format for GIS data. Although you can use both file formats, it is recommended that you store your data as GDB feature classes as this is considered the “native” format for ArcGIS 9 and up. Plus a GDB is more portable and easier to manage then a bunch of files (e.g. a shapefile consists of at least 5 associated files). Also, keep in mind that some tools will
only work with feature classes stored in a GDB not shapefiles. In this exercise you will create an empty file GDB to store your data.

1. Create a file geodatabase. In the Catalog Tree Panel, navigate to your personal working folder (e.g. C:\Students\Steph). Right click on it >> New >> File Geodatabase.

2. Rename the new file GDB (e.g. eHonolulu.gdb). You will populate the GDB later with data.

Exercise 5: Creating datasets and features classes in a geodatabase

Spatial data in a geodatabase are stored as feature classes (i.e. points, lines, polygons). Feature classes in a GDB can be grouped into datasets. Feature classes within a dataset all must be in the same coordinate system – you will use the coordinate system that the Hawaii Statewide GIS Program uses, which is NAD83, UTM Z4. In this exercise, you will create feature datasets and then batch import shapefiles from the series2 data folder into your GDB. Raster and tabular data can also be created or imported into a GDB.

Exercise 5.1: Create empty feature datasets

1. Create an empty feature dataset in your GDB. Right click on your GDB >> New >> Feature Dataset.
2. In the New Feature Dataset window: input the following parameters.

- **Name:** call the feature dataset “boundaries”
- **Horizontal Coordinate System:** 1Hawaii\NAD 1983 UTM Zone 4N
- **Vertical Coordinate System:** None

   ![Coordinate System](image)

   Click Next and finish going through the wizard accepting the default options for XY Tolerance.

3. Follow steps 1 and 2 to create empty feature datasets corresponding to the sub-folders in the series2 folder (see list below).

   - Demographics
   - FEMAflood
   - Pubsaftey
   - Struct_fac
   - Transportation

When you are done, you should 6 empty feature datasets in your GDB.

Exercise 5.2: Importing data into feature datasets

1. Batch import shapefiles from the boundaries sub-folder of the series2 data folder into in the corresponding feature dataset in your GDB.

   - In the Catalog Tree, expand your GDB so that you can see the feature datasets. Right click on boundaries dataset >> Import >> Feature Class (multiple).
   - In the Feature Class to Geodatabase (multiple) window: input the following parameters.
Input Features: Browse to C:\GIS_traning_data\series2\Boundaries folder and select all the files in the boundaries folder (use Shift key to select multiple files) >> Click Add.

Setting the Environments options so all data imported in a common coordinate system and covers the same extent. Click the Environments button.

In the Environments window:
- Click on the General Settings to expand it.
- For Output Coordinate System: select As Specified Below then click the select coordinate system button to bring up the Spatial Reference Properties window. From this window, click the Select button >> navigate to 1Hawaii folder and add the projection file, NAD 1983 UTM Zone 4N.prj.
- For Extent: click the browse to folder button (you should automatically be in the Boundaries folder and select the NeighborhoodBoard.shp or the Zipcodes.shp.
- Click OK to set the Environments setting.

Back in the Feature Class to Geodatabase window: click OK.
You should now have the four imported shapefiles as feature classes in the boundaries dataset of your GDB.

2. Follow the above instructions to import the shapefiles from the sub-folders in the series2 data folder into their corresponding feature dataset in your GDB (use the images below for guidance).

- Demographics shapefiles to demographics feature dataset. Use the environments setting below.

- FEMAflood shapefiles to FEMAflood feature dataset.
- Pubsafety shapefiles to Pubsafety feature dataset.

- Structuresfac shapefiles to Struct_fac feature dataset.

- Transportation shapefiles to Transportation feature dataset.
Your feature datasets now should contains copies of the shapefiles as feature classes.

Exercise 6: Creating a raster catalog in a GDB

For emergency planning purposes it’s generally a good idea to have current, high resolution aerial photos or images of your area of interest. In the series2 data folder, there is a sub-folder called vol012ecw which contains 1ft resolution aerial images for Honolulu. The images are in compressed ECW format (ER Mapper). In this exercise you will create a raster catalog for these image tiles then change the settings for how the raster catalog is displayed.

Exercise 6.1: Create an empty raster catalog

1. Right click on your GDB >> New >> Raster Catalog.

2. In the Raster Catalog window: input the following parameters.

   - Output Location: accept default which is your GDB
   - Raster Catalog name: type in “aerial_1ft”
   - Coordinate System for Raster Column: use the Spatial Reference Properties button and select NAD_1983_UTM_Zone_4N for the 1Hawaii folder.
- Coordinate Systems for Geometry Column: NAD83 UTM Zone4
- Raster Management Type: select Unmanaged
- Accept all other default settings >> Click OK

Exercise 6.2: Load the raster catalog

1. Right click on the raster catalog (i.e. aerial_1ft) >> Load Data.

2. In the Load Data window: input the following parameters.
   - Input Rasters: browse to the C:\GIS_training_data\series2\vol012ecw folder and select all files
   - Output Geodatabase: accept default (which is your raster catalog)
   - Click OK.

Notes:
You could also use a script to create and load the raster catalog in one step; In ArcToolbox >> Samples >> Conversion >> Raster >> Workspace to New Raster Catalog.

We are creating an unmanaged raster catalog as we do not want the images to be stored/managed by the GDB as this will take too long to process (converting the compressed .ecw to ESRI grids).

For more information on raster catalog, search for the term in ArcGIS Desktop help.
3. Preview the raster catalog, aerial_1ft using the Preview tab. Notice that it shows the footprints or wireframes of the raster image tiles. When you have more than 9 images in a raster catalog, it will show the footprints instead of the actual images. This is done so faster display. Change this setting to show images instead of wireframes.

   - Click Tools menu >> Options >> Raster tab >> Raster Catalog Layer sub-tab >> Check the box next to do not show wireframe at all >> Apply >> OK.

   - Refresh the raster catalog. In the Catalog Tree, right click on aerial_1ft raster catalog >> Refresh. You should then see the raster images show up in the Preview tab.

5. Using ArcMap

ArcMap is the main application where you view spatial data, create maps and do most of the GIS analyses. When you open ArcMap, it either creates or opens a map document (an .mxd file) depending on the startup dialog option selected. A map document may contain one or more layers of geographic data (i.e. map layers) and various supporting map elements, such as a legend, labels, and a scale bar. Layers on a map are contained in data frames. For the purpose of learning the basic functions of ArcMap, you will create a map of Honolulu showing the locations of some public safety feature classes from your GDB.

[CTRL + S] use it or lose it! Save your work after every exercise. ArcMap 9.3.1 may crash unexpectedly.

Exercise 1: Launching ArcMap

1. Open ArcMap from the desktop or go to Start >> Programs >> ArcGIS >> ArcMap.

2. When ArcMap opens a startup dialog box will pop up giving you three options for opening an ArcMap session. Select a new empty map and click OK.

   The ArcMap window opens with two frames. The left panel is the table of contents (TOC panel) that lists all your map layers. The right panel is the map display area. Note your window may look slightly different as all the toolbars/controls are customizable and are tear-off and dockable anywhere.
Exercise 2: Setting the map document properties

When you add a layer to your map, ArcMap references the data source the layer is based on. When you save the map, the data references are stored with it. The next time you open your map document, ArcMap locates the data based on their path references. If you move or rename the data layers, ArcMap may not find the data. When you save a map document the data source references are either saved with relative or absolute pathnames - the default is with absolute pathnames. To avoid having a map document with missing data when moving files around and for portability, save your map documents with relative pathnames. The relative pathnames setting only works for data stored in a common disk drive (i.e. cannot span disk drives).

1. To change the map document properties, go to File menu >> Document Properties.

2. In the Document Properties window, type in any properties you want then click the Data Source Options button.

Notes:
The Layout Toolbar is only active when you are in Map Layout View. Your ArcMap may look different as well depending on how the interface was customized or set up by the last person who used the application.
3. In the Data Source Options window, select the option for storing relative pathnames to data sources. Also check the box to make relative paths the default for new map documents. Click OK.

4. Save the map document. Go to File menu >> Save or Save As. Save the map document in your personal working folder (e.g. C:\Students\Steph\eplan_hon_w1.mxd). Make sure Save as type is ArcMap Document not template.

Exercise 3: Adding data to a map

1. Add the raster catalog, aerial_1ft from your GDB to your map. Click the Add Data button on the Standard toolbar.

   Notes:
   Always use the Add Data button to add your data regardless of whether they are tables, vector shapefiles or raster images.

2. In the Add Data window:
Navigate to your GDB (e.g. C:\Students\Steph\eHonolulu.gdb) and add the raster catalog, aerial_1ft to your map.

Notes:
If you don’t see your folder, then use the Connect to Folder button to create a direct connection to it first.

When making a map, the first layer added should be the layer you are using as the basemap since the first layer added sets the map extent and coordinate system of the current data frame you’re working in – this is important in that if you add data layers with different coordinate systems then ArcMap will project them on the fly based on the coordinate system of the data frame so that your see the data layers in a common system.

□ 3. If you see the raster wireframes instead of actual images, then change the display settings for the raster catalog in ArcMap.

➢ In the TOC, right click on aerial_1ft >> Properties.
➢ In the Layer Properties window:
  o Click the Display tab
  o Under Wireframe Display: check the box to Never show wireframe
  o Click OK.

Notes:
You could also change the raster catalog settings through the Tools menu >> Options >> Raster tab >> Raster Catalog sub-tab >> Check the box do not show wireframes at all. This will change the setting for all future raster catalogs.

□ 4. Use the Add Data button again to add the feature class, coast_n83 from the boundaries dataset of your GDB to your map (e.g. C:\Students\Steph\eHonolulu.gdb\boundaries\coast_n83). Notice ArcMap returned to the location you last accessed when you added data.

Notes:
To change the option of returning to the last accessed folder, go to Tools menu >> Options >> General tab >> unchecked the appropriate box. This option can also be set for ArcCatalog as well by going to Tools >> Options >> General tab.

□ 5. Add the feature class, cdplc00_n83 from the demographics dataset of your GDB to your map (e.g. C:\Students\Steph\eHonolulu.gdb\demographics\cdplc00_n83).

□ 6. When you add a polygon data layer to ArcMap it is automatically displayed with a solid polygon symbol. To quickly change the symbology for how features of a layer are shown, do the following.
Change the symbology for the coast_n83 layer by clicking the square box underneath the layer name to access the Symbol Selector window. Select a symbol (e.g. Hollow) and change the color and size (e.g. outline width = 2) then click OK.

Do the same thing to change the symbology for the cdplc00_n83 so that the aerial photos are shown underneath.

Exercise 4: Exploring the data layers in Table of Contents (TOC) panel

Now that you have added some data layers to your map, you can start exploring them. The TOC panel lists all the data layers in your map. This is where you can turn layers on and off, access the layers’ properties as well as the properties of the data frames, and change the order in which layers are drawn. You can choose how the layers are viewed in the TOC with the Display, Source, or Selection tabs.

1. The Display tab: When you open ArcMap, the default view of the TOC is the Display tab. This tab shows the layers in each data frame with the layers sorted by drawing order. Below are some options for displaying and exploring the data frame and layers within the data frame.

   Change a layer’s drawing order by dragging and dropping it on top of or below another layer in the TOC.

   Turn layers on/off by checking the box next the layer name.

   Zoom to a layer’s map extent by right clicking on the layer name >> Zoom to Layer.

Notes:
Layers within a data frame are drawn from bottom to top; that is the bottom layer is drawn first, followed by the next layer all the way to the top layer. When you add data to ArcMap, it will intuitively stack the data layers for you in the following order from bottom up: raster, polygons, lines, points, annotation.
- View a layer’s properties by right clicking on the layer name >> Properties. Spend a few minutes exploring the different tabs in the Layer Properties window. When you are done, close it.
- View the data frame’s properties by right clicking on the data frame >> Properties. Spend a few minutes exploring the different tabs in the Data Frame Properties window. When you are done close it.

**Notes:**
A map can have many layers and many data frames. A data frame in bold indicates that it is active. Layers in a data frame can also be grouped into datasets. For example, you could have a dataset called Streets with two layers such as street centerline and street casing in it.

1. **The Source tab:** Click the Source tab to view the layers with their full pathnames. The Source tab shows the layers in each data frame with the layers organized by their data source folders or databases (i.e. where the layers are found). The Source tab view will also list tables that have been added to the map as data.

   ![Source Tab Example]

2. **The Selection tab.** Click the Selection tab to view all layers in the active data frame that are selectable. By default all layers added to a map is set as selectable. You can check which layers you want selectable or not.

   ![Selection Tab Example]

   **Notes:**
The Selection tab works like the Set Selectable Layers dialog box accessed from the Selection menu. Notice that the raster data is not listed as a selectable layer. The Selection tab is only valid for vector data.

**Exercise 5: Moving around the map using the Tools toolbar**

The Tools toolbar is used for moving around the map and also querying features on the map. Spend a few minutes using the buttons on the Tools toolbar to explore your data and map. Your toolbar may be docked somewhere on the interface or it could be floating.
1. The **Tools** toolbar can be used in both the data view and layout view. Some buttons are only active when certain types of data are present. Place the mouse pointer over a button to see its function described in the status bar.

2. **Spatial Bookmarks:** You can also create spatial bookmarks of areas of interest using the Bookmarks menu.

   - First zoom in to an area of interest on the map.
   - Go to Bookmarks menu >> Create. Type in a name for the bookmark.
   - Go to a different area of the map.
   - Go back to Bookmarks menu >> Click on your named bookmark to jump to it.
   - To make any changes to your bookmarks (i.e. edit, delete), go to Bookmarks menu >> Manage.
Exercise 6: Create a Honolulu city boundary layer

In this exercise you will create a Honolulu city boundary layer based on the census designated places layer (cdplc00_n83). Then you will clip the Honolulu city boundary with the coastline layer (coast_n83) so they will coincide.

Exercise 6.1: Create a Honolulu city boundary

☐ 1. In the TOC, click the Selection tab and uncheck the aerial_1ft and coast_n83 layers so that only the cdpl00_n83 layer is selectable.

☐ 2. On the Tools toolbar, click the Select Features button . In the map, click on the Honolulu polyon that contains the aerial photos (see image below).

☐ 3. In the TOC, click the Display tab >> Right click on cdpl00_n83 layer name >> Data >> Export Data.

☐ 4. In the Export Data window: input the following parameters.

  ➢ Export: Selected features
  ➢ Use the same coordiante system as: this layer’s source data
  ➢ Output shapefile or feature class: accept the default
  ➢ Click OK.
Say Yes to automatically add the exported data to your map.

Exercise 6.2: Clip Honolulu city boundary to coincide with coastline

1. Clip the exported data layer with the Oahu coastline by doing the following.

- First, display the ArcToolbox menu if not already shown by clicking the ArcToolbox button on the Standard toolbar
- In ArcToolbox >> Double click Analysis Tools >> Double click Clip
- In the Clip window: input the following parameters.
  - Input Features: select Export_Output from the drop down menu
  - Clip Features: select coast_n83 from the drop down menu
  - Output Feature Class: save as feature class “Honolulu” in the boundaries dataset of your GDB (e.g. C:\Students\Steph\eHonolulu.gdb\boundaries\Honolulu)
- Click OK
Notice that the new Honolulu city boundary layer is clipped to the coastline.

2. Delete the Export_Output and cdplc00_n83 layers from your TOC since you don’t need these anymore. Right click on each layername >> Remove.

Exercise 7: Mapping and symbolizing your data

When you add data to a map, ArcMap will add the data with a default symbol used to represent your data. You’ve already used the Symbol Selector window to change the symbology of features in a feature class. In this exercise you will explore the many more options in the Layer’s Properties window for symbolizing and mapping your data. Let’s say for example, you want to make a map of the downtown Honolulu area with features such as hospitals/clinics and fire, police, and EMS/ambulance stations displayed on top an aerial photo as the basemap.

1. Use the Add Data button to add in the hospitals, police, fire, and ambulance stations from the Pubsafety dataset of your GDB. Use the Shift or Ctrl key to select multiple files.

2. Add to your map the public street centerline feature class from the Transportation dataset of your GDB.

3. Add to your map the neighborhood board feature class from the boundaries dataset of your GDB.
4. Change the symbology for the fire station layer through the Layer Properties window. In the TOC, right click on the FireStations layer name >> Properties.

- In the Layer Properties window, click the Symbology tab.
- In the Symbology tab:
  - Click the square box with the dot symbol in it to access the Symbol Selector window.

- In the Symbol Selector window:
  - Click the More Symbols button to access a list of ESRI symbol sets
  - Click Civic from the list of symbol sets (All will show you everything)
  - Category: select Civic from the drop down menu

- Pick a symbol (e.g. fire truck or fire station symbol) and change the size if needed
- Click OK
- Back in the Symbology tab:
  - Under Legend, you can type in a label for the symbol (e.g. Fire Station)
  - Click OK
5. Change the symbology for the data layers below by following the same instructions as in the above step.

- Ambulance
- Hospital_clinics
- Police
- Public_Street_Centerline (you can use the Transportation symbol set from the More Symbols listing)
- NeighborhoodBoard (select a Hollow symbol so the aerial photo shows underneath)

6. Subset only the Downtown area from the NeighborhoodBoard layer using a Definition Query.

- Right click on the NeighborhoodBoard layer >> Properties.
- In the Layer Properties window: select the Definition Query tab.
- In the Definition Query tab: click the Query Builder button.
  - In the Query Builder window:
    - Double click “Town” (this will add the field to the query expression text box)
    - Click the Equal sign button
    - Click the Get Unique Values button
    - Double click “Downtown”
    - Click Verify button >> OK
Back in the Definition Query tab, click OK.

Notes:
The rest of the records that were not subset out as defined by the data definition query are not deleted. They are just hidden. To see all records/features again, just clear the Definition Query on the data (Query Builder button >> Clear).

7. Zoom to the extent of the Downtown area. Right click on NeighborhoodBoard layer >> Zoom to Layer.

Exercise 8: Creating a map layout and adding map elements in layout view

So far, you’ve been working with spatial data in the data view. To make a map, you need to be in a layout view. In this exercise you will make a map layout of the downtown Honolulu area with features such as hospitals/clinics and fire, police, and EMS/ambulance stations displayed on top an aerial photo as the basemap. You will also be adding map elements, such as a scale bar, legend, and north arrow to enhance your map as well as add a map inset showing an overview of the Hawaiian Islands. Use this exercise as a guide to help you explore some of the many map design/production tools and options available in ArcMap.

1. Switch to layout view. Go to View menu >> Layout View. Alternatively you could click the layout view button (white sheet of paper icon) in the bottom left hand corner of the map display area.

2. Spend a few minutes exploring the buttons on the Layout toolbar to see what they do. The Layout toolbar is only active in layout view.

Notes:
The Zoom to 100% button is extremely useful for viewing how your map looks at 100%, especially for sizing map elements.
3. Explore how the buttons on the Tools toolbar (toolbar used in Data View) works in the Layout View. Notice how the Tools toolbar works on the map data but the Layout toolbar works on the map layout. For example, the Zoom in button on the Tools toolbar zooms in on the data whereas the Zoom in button on the Layout toolbar zooms in on the map page.

4. Changing the page size and print setup. In the layout view >> Right click anywhere in the map layout >> Page and Print Setup.

In the Page and Print Setup window: select the appropriate settings for your map. If you have access to a printer, you can use the printer settings for your map and check the box next to “Use Printer Paper Settings”. Otherwise use the settings for Map Page Size.

5. Design your map in the Layout view. The first thing you probably want to do after changing the page and print set up is resize and/or move your map frame accordingly. To do this, click on the map frame to select it, then use the “handles” to resize/move it.

6. Add a map inset showing the Honolulu city boundary and the Downtown area on Oahau. To add a map inset you need to add another data frame by copying and pasting an existing data frame in the TOC or inserting a new data frame from the Insert menu.

Go to Insert menu >> Data Frame. A new data frame is added to the TOC and is set to be the current active frame (bold). Also notice a second data frame has been added to your map layout – default position is in the middle of the map page so often times it is on top on the main frame.

Notes:
Only one data frame can be currently worked on or be active in a multiple data frame map document. To activate a data frame from the TOC, right click on it >> Activate or by clicking on the interested data frame in the Layout view.

7. Move/resize the new data frame in the Layout view as needed.

8. Changing the names of the data frames.
- Rename the first data frame. Click on the data frame name to select it then click on it again to get a text cursor. Type in a name for your main data frame (e.g. Downtown Honolulu).
- Rename the second data frame (e.g. Oahu).

9. Add data to the map inset data frame (e.g. Oahu). For the map inset you just want to show a simple overview of Oahu with the Honolulu city boundary and downtown area showed on the inset.

- Make sure the Oahu data frame is active (bold). If not, right click on the data frame name >> Activate.
- Drag and drop from the first main data frame (e.g. Downtown Honolulu) to the second map inset data frame (e.g. Oahu) the following layers. Reorder the layers in the TOC if needed after you add them to the second data frame (coast = bottom, Honolulu middle, neighborhood = top).
  - Coast_n83
  - Honolulu
  - NeighborhoodBoard

10. Add a title to your map. There are two options for adding a title to your map. Choose an option.

- Option 1: Go to Insert menu >> Title. ArcMap will add in the title of your map document (e.g. eplan_hon_w1). Change the title as necessary. Use the Drawing toolbar to change the text properties as necessary.

- Option 2: Click the New Text button on the Drawing toolbar then click in the map layout where you want the text to be placed. Change the text properties before or after adding the title.

The Drawing toolbar is used to add graphic elements to your map.
11. Add a legend to the map using the main data frame (i.e. Downtown Honolulu) by doing the following:

- Go to Insert menu >> Legend.
- In the Legend window:
  - Remove coast_n83 from the list of Legend items. Under Legend Items, select coast_n83 then click the button with 1 arrow point to Map Layers.
  - Set the number of columns in your legend to 2.
  - Click Next and finish going through the wizard accepting all other default settings.

- Move/resize the legend in your map layout if needed.

Here is a sample Legend.

Legend

<table>
<thead>
<tr>
<th>Fire Station</th>
<th>Streets</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMG</td>
<td>Downtown</td>
</tr>
<tr>
<td>Hospitals</td>
<td>City Boundary</td>
</tr>
<tr>
<td>Police Station</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Items in the Legend are linked to their corresponding data layer in the TOC. For example, if you change the name of the data layer in the TOC it will be reflected in the Legend.

12. Add a scale bar to your map. Go to Insert menu >> Scale Bar.

- Choose a scale bar. Click the Properties button to change the properties of the scale bar if needed.
- Apply your settings.
- Move and resize the Scale Bar as necessary in your map layout.

☐ 13. Add a north arrow to your map. Go to Insert menu >> North Arrow.

- Choose a north arrow. Click the Properties button to change the properties of the north arrow if needed.
- Apply your settings.
- Move and resize the North Arrow as necessary in the layout.

☐ 14. Add an image (e.g. logo, picture) to your map. Go to Insert menu >> Picture.

- Navigate to C:\GIS_training_data\series1 folder and select UHlogo.jpg.
- Move and resize the Logo as necessary in the layout.

☐ 15. Add a grid to the main map frame (i.e. Downtown Honolulu).

- Make sure the data frame to which you are adding the grid is active.
- Right click on the data frame name >> Properties >> Grid tab.
- In the Grid tab:
  - Click the New Grid button
  - Use the wizard to choose your options and apply the settings to your map

Below is a sample map
Exercise 9: Saving the map layout as a template

Once you’ve designed your map, you can save it as a template for use in making other maps. Map templates are especially useful for making a series of maps.

1. To save your map as a map template, go to File menu >> Save As. Give the template a name and select Save as Type = ArcMap Template.

Notes:
To use a map template, click the Change Layout button on the Layout toolbar. In the Select Template window: select an ESRI made template from the General, Industry, USA, or World tab. To use your own customized template that you saved, click the MyTemplates tab; browse to your template and add it to your list of templates. For more information on map templates, search for the term in ArcGIS Desktop Help.

Exercise 10: Exporting a map

1. To save your map as an image file (e.g. jpeg, tiff, png, etc) or as a pdf, go to File menu >> Export Map. Choose the appropriate settings for the file type you want and save it.

2. Save your map document (or not) and close out of ArcMap.
## Hawaii Coordinate Systems

### Datums and Projections Commonly Used in Hawaii

<table>
<thead>
<tr>
<th>Organization</th>
<th>Datum (GCS)</th>
<th>Projection (PCS)</th>
<th>Map units</th>
<th>Coordinate System .prj file</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Census</td>
<td>Old Hawaiian</td>
<td>(geographic)</td>
<td>degrees</td>
<td>GCS\Oceans\Old Hawaiian</td>
</tr>
<tr>
<td>Federal USGS</td>
<td>NAD 1983</td>
<td>UTM 4N, 5N</td>
<td>meters</td>
<td>NAD 1983 UTM Zone 4N, or 5N</td>
</tr>
<tr>
<td>State of Hawaii (new)</td>
<td>NAD 1983</td>
<td>UTM 4N</td>
<td>meters</td>
<td>PCS\Utm\Nad 1983\NAD 1983 UTM Zone 4N</td>
</tr>
<tr>
<td>State of Hawaii (old)</td>
<td>Old Hawaiian</td>
<td>UTM 4N</td>
<td>meters</td>
<td>PCS\Utm\Other GCS\Old Hawaiian UTM Zone 4N</td>
</tr>
<tr>
<td>Hawaii County</td>
<td>NAD 1983</td>
<td>State Plane zone 1</td>
<td>feet</td>
<td>PCS\State Plane\NAD 1983 (Feet), NAD 1983 StatePlane Hawaii 1 FIPS 5101 (Feet)</td>
</tr>
<tr>
<td>Maui County</td>
<td>NAD 1983</td>
<td>State Plane zone 2</td>
<td>meters</td>
<td>PCS\State Plane\NAD 1983, NAD 1983 StatePlane Hawaii 2 FIPS 5102</td>
</tr>
<tr>
<td>C&amp;C Honolulu (old)</td>
<td>Old Hawaiian</td>
<td>State Plane zone 3</td>
<td>feet</td>
<td>PCS\State Plane\Other GCS, Old Hawaiian StatePlane Hawaii 3 FIPS 5103</td>
</tr>
<tr>
<td>Kauai County</td>
<td>NAD 1983</td>
<td>State Plane zone 4</td>
<td>meters</td>
<td>PCS\State Plane\NAD 1983, NAD 1983 StatePlane Hawaii 4 FIPS 5104</td>
</tr>
</tbody>
</table>

* NAD 1983 HARN is a refined, more accurate version of NAD 1983. The Honolulu City and County GIS will very soon (early 2005) be converting its data to this system.

** This file is in ArcGIS 9.0 only, but it can be copied and used in earlier versions.

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