USER'S DOCUMENTATION

PITT MEADOWS GEODATABASE V1.0

Basic Technical Manual

Written by Kim Liske and Carol Cheuk, March 2003

TABLE OF CONTENTS

INTRODUCTION

This manual contains technical information about the creation of Pitt Meadows Geodatabase. The developed Geodatabase is the first version and will require future implementations or revisions. This Geodatabase includes only data that can be linked to the cadastre feature layer. Information on the software is provided to give the administrator some background knowledge of how the Geodatabase was developed and tested.

SOFTWARE USED

The following are the software used for creating this Geodatabase v1.0.

- Operating System: Windows 2000
- ESRI ArcView GIS 3.1
- ESRI ARC/INFO Workstation 8.2
- ESRI ARCGIS 8.2
- MICROSOFT VISIO 2002

DATA CREATION, JUSTIFICATION AND STANDARDIZATION

The following are the steps that are used in formatting the data required for this geodatabase v1.0.

Data Projection

The projection of all data is UTM Zone 10 NAD 83 coordinate system. Data that do not conform to this projection are reprojected or moved manually using the EDIT option in ArcMap. For this geodatabase, only the water services had to be manually moved in ArcMap because of its unknown projected distortion.

Cadastre Annotations (Lot & Plan numbers) Creation using AML

Two AML Scripts are used in creating the cadastre annotations of lot and plan numbers: cad_annolot.aml and cad_annoplan.aml. These AML scripts were modified versions of annotation AML created by Darrin Grund at Land Reserve Commission. The scripts can only run on ARC/INFO workstation ARC Prompt platform. The scripts cannot run on ArcGIS Toolbox because Toolbox does not support commands from ARC/INFO ARCPLOT which is the backbone of this AML.

The procedure assumes that the cadastre coverage, cad_annolot.aml and cad_annoplan.aml are the only files in the working directory (workspace). By running the cad_annolot.aml, a new coverage named cad_anno with lot annotation subclass is created. This aml will then add plan annotation subclass to the cad_anno coverage by calling cad_annoplan.aml. To see the actual commands used in the AML, see APPENDIX 1 and 2 for ARC/INFO. To start the AMLs, go to the workspace where the AML is stored and type the following in ARC prompt:

Arc: **&run cad_annolot.aml**

The resulted cad_anno coverage will contain lot and plan annotations in different text sizes based on their corresponding parcel area size. This cad_anno coverage should be generated whenever there is an update on the cadastre data layer.

Cadastre UNIQUE ID Creation

The UNIQUE ID column for the cadastre data of this geodatabase v1.0 is created by joining the JUROL and PID attribute columns. This is done because if new cadastre parcels are added, the unique ID for each parcel can be created easily by joining the two columns. However, since not all parcels have PID or JUROL numbers in the current cadastre layer, the resulted performance is not as good, so it requires future revisions. This UNIQUE ID is finally not used for linkage in the geodatabase v1.0.

Adjusting cadastral boundaries of other data layers (i.e. crops)

Feature Data Layers that have shifted/distorted cadastral boundaries (i.e. crops) can be adjusted correctly using the new cadastre data boundaries following these steps:

1) Create an attribute column in the cadastre coverage that has unique numbers for each record. Another option is to use the ARC/INFO # or ARC/INFO ID column that should have unique value for each record. These two columns are generated automatically by ARC/INFO when the coverage is created.

2) Overlay the cadastre coverage (having unique numbers) with the data coverage that you wanted to adjust using the UNION ARC/INFO command. The resulted union coverage will have both attribute columns from cadastre and the original adjusting data layer. To do this, type the following in ARC/INFO ARC Prompt:

   Arc: **UNION cadastre crops union_cov 0.01 JOIN**

   The ARC/INFO usage for UNION command is:

   Arc: **UNION <in_cover> <union_cover> <out_cover> {fuzzy_tolerance} {JOIN | NOJOIN}**

   NOTE: ARC/INFO only allows coverage names with 13 characters, so give an <out_cover> name less than this character width. The <> brackets are required variables that you must define while variables in {} brackets are not required. If the {} variables are not typed, the default ARC/INFO values are used. In the given example, 0.01 tolerance (which equals 1cm) is used.

3) Remove the original boundaries of the adjusting data layer using the DISSOVE command. For example, in ARC Prompt:

   Arc: **DISSOLVE union_crops diss_crops cadastre-ID POLY**

   The ARC/INFO usage for DISSOLVE command is:

   Arc: **DISSOLVE <in_cover> <out_cover> <dissolve_item | #ALL> {POLY | LINE | NET | REGION.subclass}**

NOTE: dissolve_item is the column name of cadastre that you defined in step 1 that is used to perform this DISSOLVE function. The POLY | LINE | NET | REGION.subclass allows you to define the feature class for dissolving. In the above case, the feature class is POLY (Polygon).

4) Add the attribute columns of original adjusting data layer back to the new dissolved coverage through joining. This is required because the DISSOLVE COMMAND only adds the cadastre's dissolve_item attribute column to the resulted dissolved coverage. Since the original adjusting data layer don't have this cadastre's dissolve_item column, will need to use the union coverage to perform the joining. The join can be done using the JOINITEM command in ARC PROMPT:

Arc: **JOINITEM diss_crops union_crops diss_crops cadastre-ID**

The ARC/INFO usage for JOINITEM command is:

Arc: **JOINITEM <in_info_file> <join_info_file> <out_info_file> <relate_item> {start_item} {LINEAR | ORDERED | LINK}**

NOTE: relate_item is the item that you can join between the info files.

5) Manually add missing boundaries in the original adjusting data back to the new dissolve coverage. This is not required if the original data layer contains only cadastre boundaries. For the crops layer in this geodatabase, there are some sub-divided parcel boundaries in the North that require manual addition. The manual addition is done using ARCEDIT.

6) At last, rename the dissolve coverage properly using the RENAME command. For example:

Arc: **RENAME diss_crops crops**

The ARC/INFO usage for RENAME command is:

Arc: **RENAME <old_geo_dataset> <new_geo_dataset>**

Formatting JUROL/PCLLINKSID numbers

Many roll number attribute columns in various data layers (attribute and feature) have inconsistent attribute type or format when compared to the cadastre's JUROL or PCLLINKSID

(both are Pitt Meadows Jurisdiction roll numbers) attribute column. Some roll numbers use dashes, some have missing zeros or some are in integer format (but both JUROL and PCLLINKSID in cadastre are in string format). Furthermore, some data contain roll numbers for Maple Ridge. Therefore, the formatting process requires careful matching, so it cannot be automated. The following are two different procedures in formatting the roll numbers:

Formatting the roll numbers to match cadastre's JUROL format

1) Create a new attribute column called JUROL as string type.
2) Add the existing roll number values to the new JUROL column.
3) Make sure the roll numbers in the new JUROL column has "12319" as the first 5 digits where "12" represents Lower Mainland area and "319" represents Pitt Meadows Municipality. If the roll numbers don't have these numbers, add them.
4) Make sure the resulted roll number values have a character width of 12. If the width is < 12, this is likely because of missing zero after "12319". For example, JUROL number "123190008000".

Formatting the roll numbers to match cadastre's PCLLINKSID format

1) Create a new attribute column called PCLLINKSID as string type.
2) Add the existing roll number values to the new PCLLINKSID column.
3) Make sure the roll numbers in the new PCLLINKSID column have a decimal place before the last 3 digits of the roll number. If not, then add the decimal place.
4) Make sure the resulted roll number values have a character width of 8. If the width is < 8, this is like because missing zero as the first digit. For example, PCLLINKSID number "0366.001".

NOTE: For both formatting procedures, if the resulted roll numbers are in odd format, this is probably because they are Maple Ridge or other area's jurisdiction roll numbers.

Metadata Creation in ArcCatalog

Metadata for each data layer is created using the FGDC metadata editor in ArcCatalog. FGDC is the Federal Geographic Data Committee approved Standard for Digital Geospatial Metadata which is used by the Integrated Cadastral Initiative Society (ICIS). XML tags are used by ArcCatalog to store the keyed-in metadata information. The following are the general steps involved in editing/adding new metadata:

1) In ArcCatalog, click Tools and click Options.
2) Click the Metadata tab in the Options dialog box.
3) Click the Metadata Editor drop down arrow and click the FGDC editor if not currently selected.

4) Click OK.
5) Click the data layer (attribute or feature) whose metadata you want to add/edit in the Catalog tree on the left.
6) Click the Metadata tab.
7) Click the Edit Metadata button  on the Metadata toolbar.
8) Enter required metadata information using the editing dialog box. The following are the general metadata information keyed in for this geodatabase v1.0.

    - ✓ Data Contact Information
    - ✓ Data Description (Abstract, Purpose and keywords)
    - ✓ Data Disclaimer (Use Constraints)
    - ✓ Data Distribution Information
    - ✓ Data Revision
    - ✓ Data Source

    The above information are entered under Identification, Data Quality and Distribution tabs of the editing dialog box

9) Close the metadata editor when finished entering.

NOTE: Since most information is same among data layers such as Data Contact Information and Disclaimer, you can increase efficiency by importing an existed XML metadata. To accomplish this, click Import Metadata button  before doing steps 7 to 9. In the popped up Import Metadata dialog box, navigate to the existing XML metadata and select "FGDC CSDGM (XML)" and click OK.

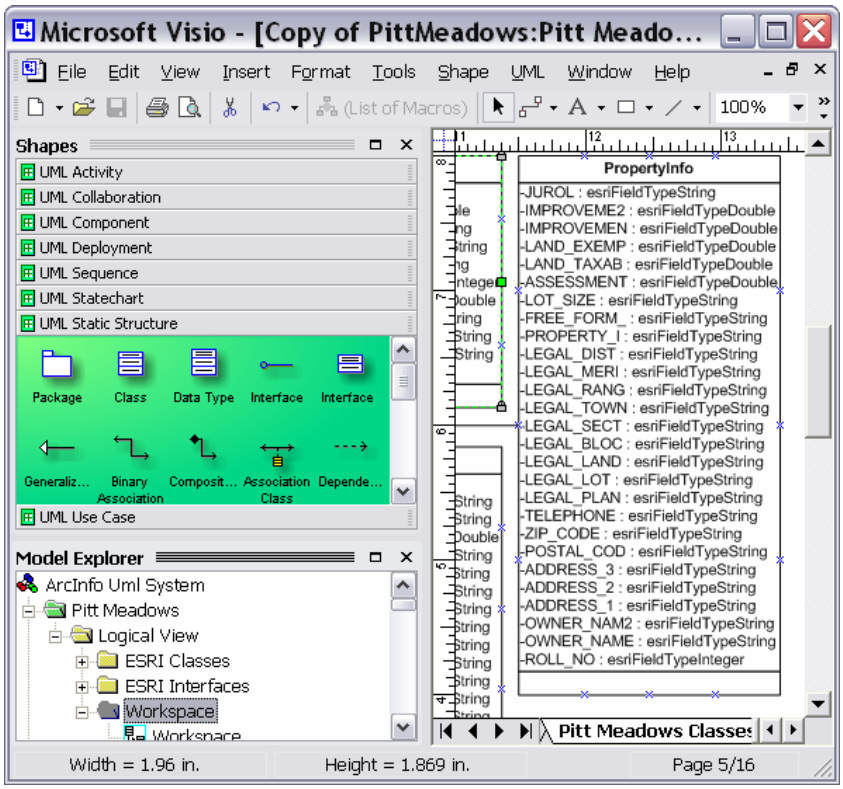
UML MODELLING

The following are the steps in creating the UML Model for geodatabase v1.0 using Microsoft Visio 2002.

STEP 1: Preparing the ESRI UML Model Template

Setting up the ESRI UML Model Template & Readying it for the Data Model

1) Open the ESRI ArcInfo UML Model (Visio 2002) template UML Model (Visio 2002) .vst in Microsoft Visio Professional 2002 to provide the ESRI framework for the data model
2) Save the template under the title PittMeadows
3) Because the data model is to be altered, change the name ArcInfo UML Model in the Model Explorer menu at the bottom left of the screen to PittMeadows by right-clicking it and selecting Rename



4) Insert a new package (def[n]: a container for elements, views (diagrams), and other packages) into which to begin the data model by navigating through the Model Explorer menu to Pitt Meadows > Workspace, right clicking on Workspace and going to New > Package
5) Name the new package PittMeadows Overview because it is to hold all of the classes contained in the Pitt Meadows data model.
6) Right click PittMeadows Overview and going to New > Static Structure Diagram to create a page for mapping out the general framework of the data model. Relationships between data classes will be discussed later as they were described on separate Static Structure Diagrams (viewed as pages) called Pitt Meadows Use Cases

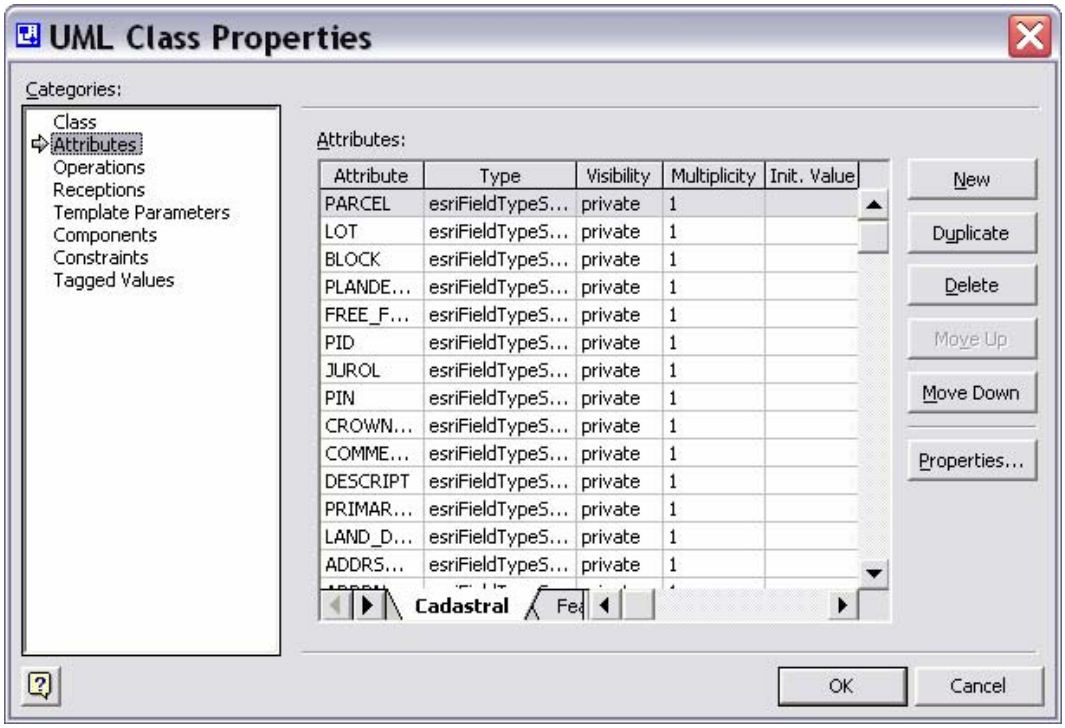
STEP 2: Establishing Feature and Object Classes

Adding Classes to the Data Model

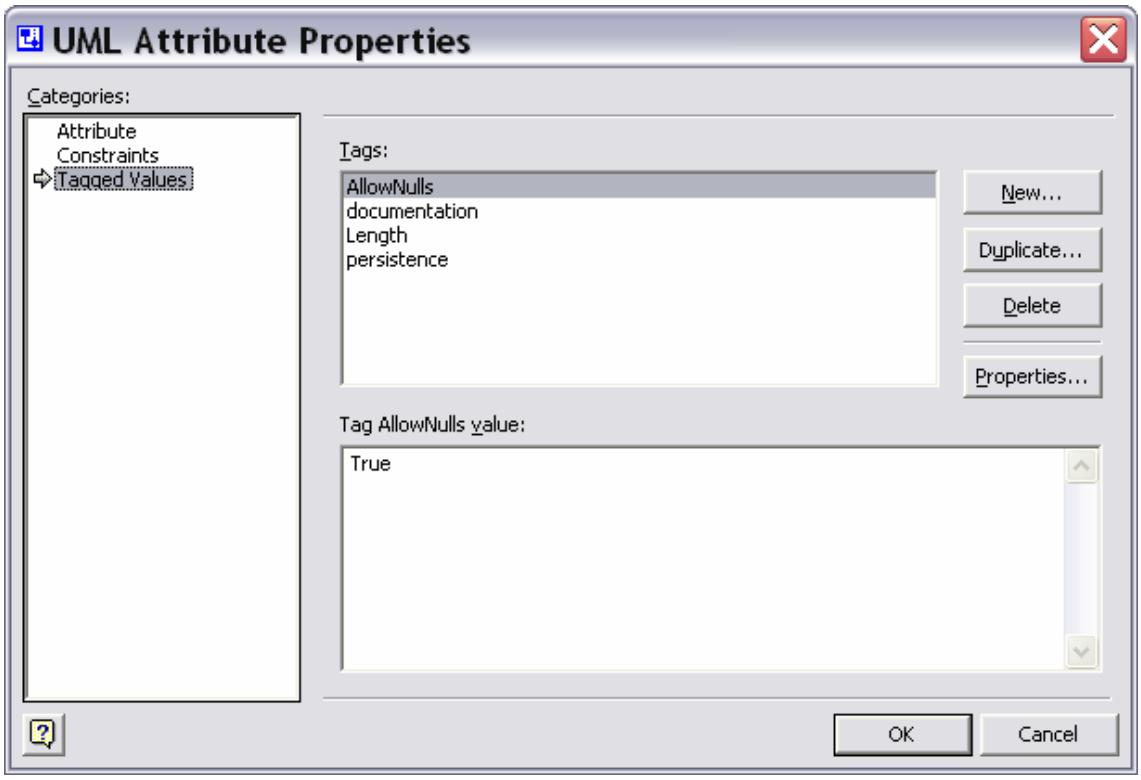
1) Stencils, when not present in the Shapes menu at the upper right hand side of the screen, can be added to the right hand side of the screen by going to File > Stencils and choosing the stencil class relevant to the data model
2) The stencils used for this data model can be found in File > Stencils > Software > UML Static Structure
3) Using the ESRI structure, create an ESRI Object Class and an ESRI Feature Class, both by navigating through ArcInfo UML System > Pitt Meadows > Logical View > ESRI Classes > Feature or Object in the Model Explorer menu and dragging the Feature and Object classes onto the PittMeadows Overview Static Structure Diagram
4) Generalize the Feature Class to the Object Class by dragging the generalization arrow stencil from the UML Static Structure Stencil menu and position the arrow ends on the nodes for each class with the arrow end towards the top of the hierarchy (the Object Class)
5) Attribute tables are created and generalized to the Object class while shape files are created and generalized to the Feature class. This is done by clicking and dragging the Class Stencil from the UML Static Structure Stencil menu

Setting Attributes and Tagged Values for Object Classes

1) Add attributes to the classes by double clicking the class on the PittMeadows Classes page and selecting Attributes in the left menu



2) To add an attribute click the New button and type the name of the attribute into the first empty field
    a. Select the attribute data type from the Type drop down menu. The attribute data type must be an esriFieldType
    b. To set the attribute , click the Properties button when the attribute is active
    c. Select Tagged Values in the left menu click the New button
    d. Enter the name of the tagged value into the upper box and its value into the lower box



i. Add Tagged Values:
    1. AllowNulls: True if attribute fields are allowed to be left empty, otherwise False. All are entered as True in the Pitt Meadows Data Model
    2. If data type is esriFieldTypeString or esriFieldTypeDate type Length: this is the width of the field
    3. If data type is esriFieldTypeInteger or SmallInteger type Precision: this is the width of the field. SmallInteger must have a width less than or equal to 9
    4. If the data type is esriFieldTypeDouble type Precision: this is the width of the field, then add another tagged value called Scale: this is the number of decimal places included in the width

Setting Attributes and Tagged Values for Feature Classes

1) Follow the steps in Setting Attributes and Tagged Values for Object Classes for Feature Classes along with the following:
2) Double click the Feature Class and select Tagged Values in the left hand menu
3) Click the New button to allow a new Tagged Value to be added
    a. Add Tagged Values:
        i. GeometryType: esriGeometryPoint, esriGeometryPolyline, or esriGeometryPolygon
        ii. HasM: True if the Feature class has a measured value associated with it, such as volume otherwise False. All are entered False in the Pitt Meadows Data Model.
        iii. HasZ: True if the Feature class has a z-value (elevation) associated with it, otherwise False. All are entered False in the Pitt Meadows Data Model.

Setting up Static Structure Diagrams for the Classes (used to hold relationships)

1. Add another package to the Workspace and name it PittMeadows Use Cases
2. For each class added into PittMeadows:
    a. Add a package to PittMeadows Use Cases and name it the Class name (ex. Septic)
    b. Add a Static Structure Diagram into the Package and also name it the Class name (ex. Septic)

STEP 3: Establishing Relationship Classes

1) Open the Static Structure Diagram for each class
2) ***Relationships are not set up in the Cadastral Static Structure Diagram because relationships involving Cadastral are defined on each of the other class's Static Structure Diagram
3) From the PittMeadows Overview menu drag the class to which the relationship is to become attached over to the Static Structure Diagram. This puts the class and all of its attributes onto the Static Structure Diagram (ex. Septic).
4) In the same fashion, add the classes to which the Cadastral layer is to be related. This only includes Cadastral in the Pitt Meadows Data Model
5) From the UML Static Structure Stencil menu in the Shapes menu drag the Binary Association Line to the Static Structure Diagram and attach its ends to a node on either class
6) Double click the Binary Association Line

a. Type in the name of the relationship. For example, SepticTo was used to illustrate that by concatenating the other class in the Static Structure Diagram (Cadastral) the relationship goes from SepticToCadastral.
b. In the Association Ends table
    i. Under End Name type in the relationship name, a colon, and the name of the first class (SepticTo:Septic)
    ii. Under Multiplicity select the multiplicity of the relationship from the drop-down menu (* (many) for all of the Classes except Cadastral, which is 1)
    iii. For the next row, the relationship name was typed along with a colon and Cadastral (SepticTo:Cadastral) and given Multiplicity of 1
c. Click Tagged Values in the right menu
    i. Add new Tagged Values:
        1. IsAttributed: True if there is a Relationship Class populated with attributes for many-to-many relationships, but False for all of the relationships in the PittMeadows data model
        2. OriginClass: the name of the class to be attached to Cadastral (ex. Septic)
        3. Notification: esriRelNotificationBackward, esriRelNotificationForward, esriRelNotificationBoth, or esriRelNotificationNone, but use esriRelNotificationForward for all of the relationships in the PittMeadows data model since the relationships are aimed from the origin class to Cadastral
        4. OriginPrimaryKey: the name of the attribute column to be linked as it exists in the origin class
        5. OriginForeignKey: the name of the attribute column to be linked as it exists in Cadastral

STEP 4: Exporting the UML Model to XMI (XML Metadata Interchange)

1) In Microsoft Visio, click Tools > Macros > Visio Extras > ESRI XMI Export
2) Give the data model a file name (ex. PittMeadows) and Save
3) Click OK when the Export Succeeded! box appears

STEP 5: Semantics Checker

1) In Microsoft Visio, click Tools > Macros > ESRI > Semantics_Checker
2) Enter the name of the XML document created in the last step
3) A list of errors in the data model is created
4) A clear Semantics Check must be passed before the data can be loaded into the data model

GEODATABASE CREATION

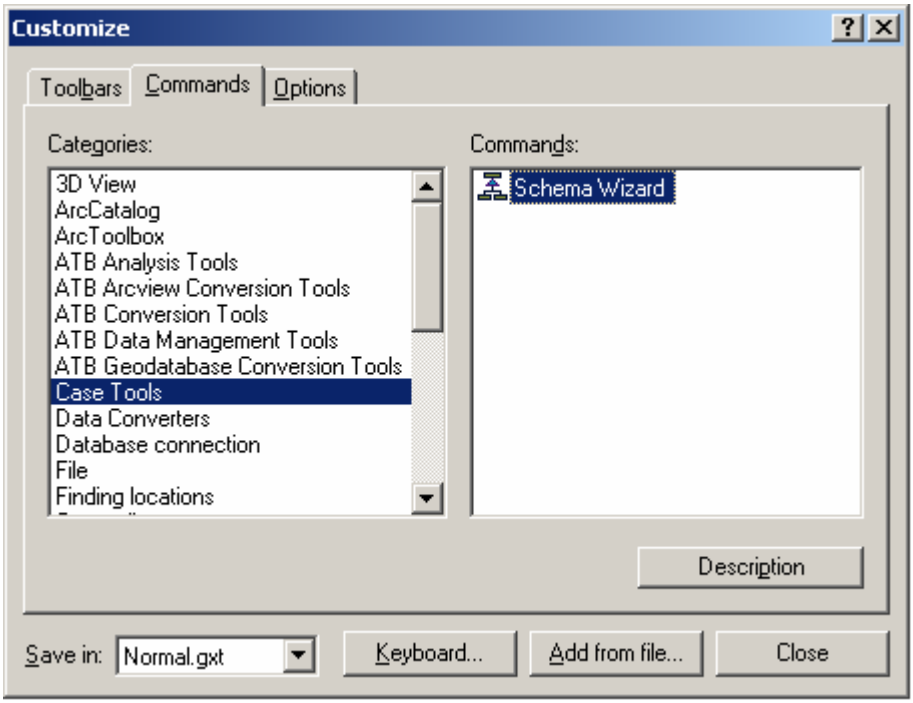
The following are the steps in creating the geodatabase v1.0 using ArcGIS ArcCatalog and ArcMap.

STEP 1: Installing the CASE Tools XMI Patch

In ArcGIS 8.2 version, the CASE Tools in ArcCatalog do not support XMI (XML Metadata Interchange) files. XMI is an Object Management Group (OMG) standard that specifies how to store an UML model in an XML file. With the CASE Tools XMI Update, ArcGIS can read models in XMI files as well as models stored in the Microsoft Repository. This patch can be downloaded from ESRI ONLINE SUPPORT CENTER at
http://arconline.esri.com/arconline/downloads/ao_/case_tools_xmi_update.cfm?id=185&pid=1
The steps involved in installing this patch are described detailing on the same webpage.

STEP 2: Adding the CASE Tools Wizard to ArcCatalog Toolbar

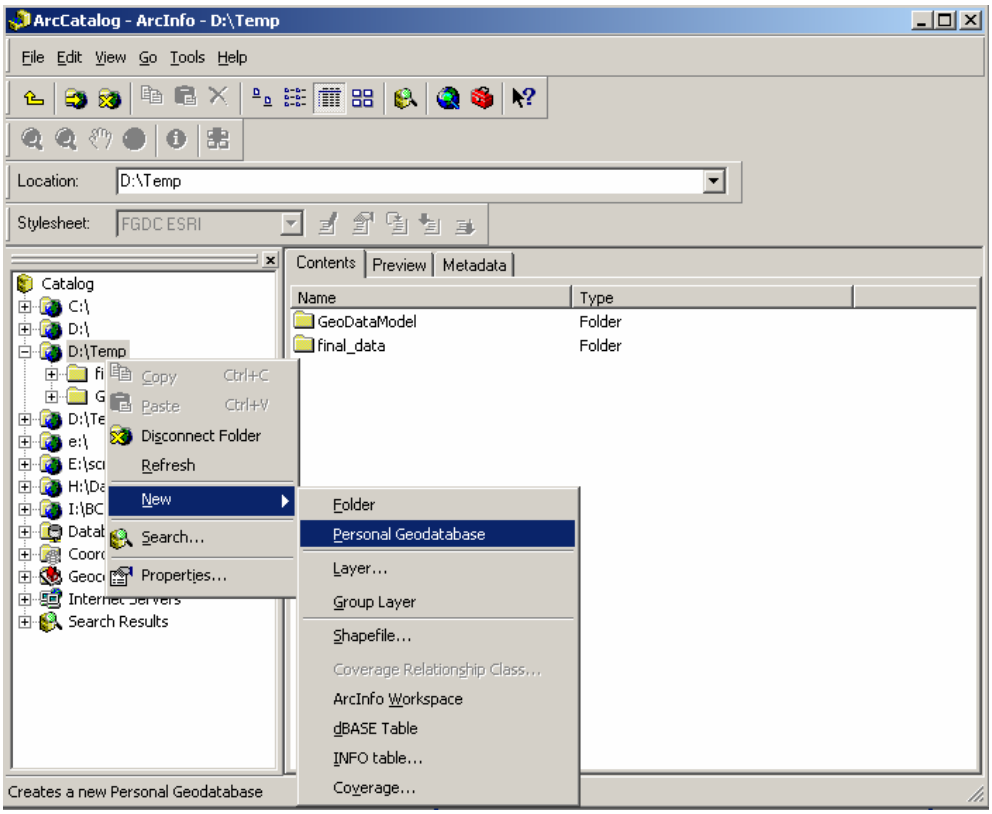
1) In ArcCatalog, click Tools and click Customize.
2) Click the commands tab in the Customize dialog box.



3) Click Case Tools.
4) Drag the Schema Wizard command from the Commands list and drop it such that the Case Tools button  appears on the Standard toolbar.
5) Click Close on the Customize dialog box.

STEP 3: Creating Empty Geodatabase

1) In the ArcCatalog tree on the left, right click on the location where you want to create the new personal geodatabase.
2) Click to New > Personal geodatabase as shown below:

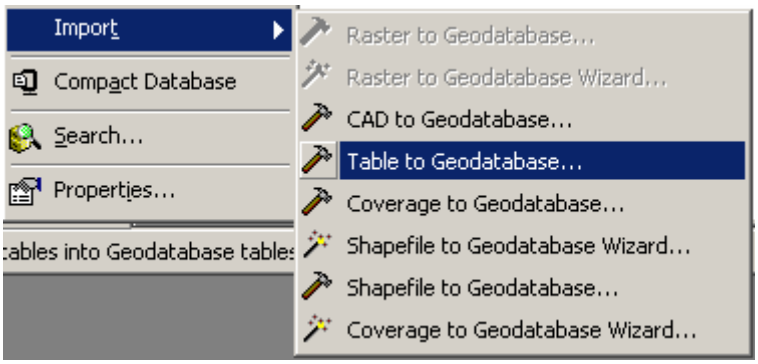


3) Type a new name for this personal geodatabase (i.e. pittmeadows)
4) Press Enter.

STEP 4: Load Attribute Tables to Geodatabase

The attribute tables are loaded before creating geodatabase schema because after the schema is created, ArcGIS does not have automatic functions for importing the attribute values. You can only add the attribute values manually or by writing ArcObjects scripts.

1) In the ArcCatalog tree, select the created personal geodatabase and right click.
2) Click Import > Table to Geodatabase.



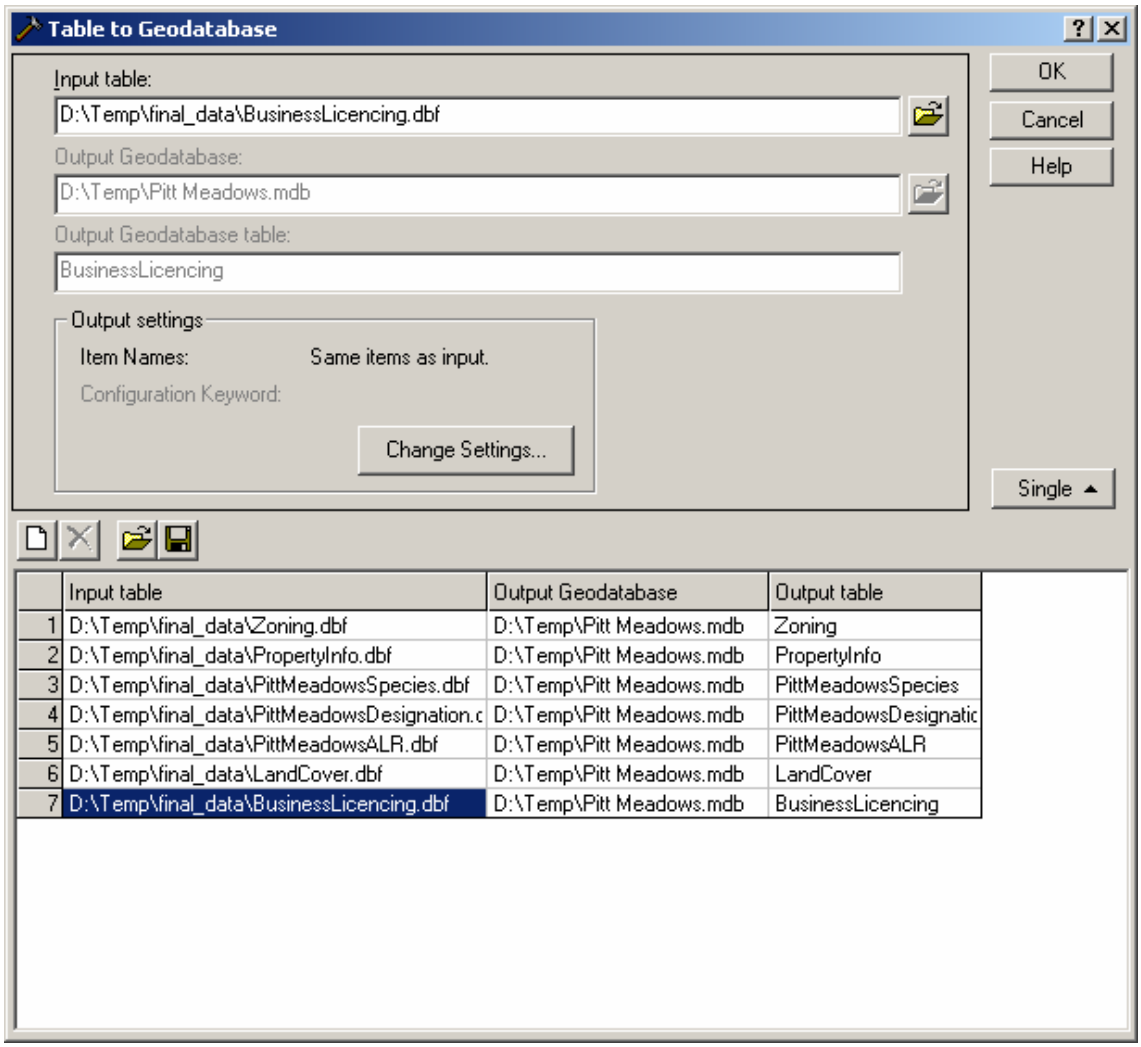
3) In the Table to Geodatabase dialog box, click the batch button 

button.

4) Click the directory button  and select the attribute tables (dbf, info or other formats) that you want to add. You can select multiple attribute tables in the same directory by selecting while holding down the SHIFT keyboard button.

5) If you need to add other attribute tables in other directories, click the add row  button and then repeat step 4.

6) When finishing adding all attribute tables, rename each "Output Geodatabase table" to the name that you set for this attribute table in the UML Model as shown below:



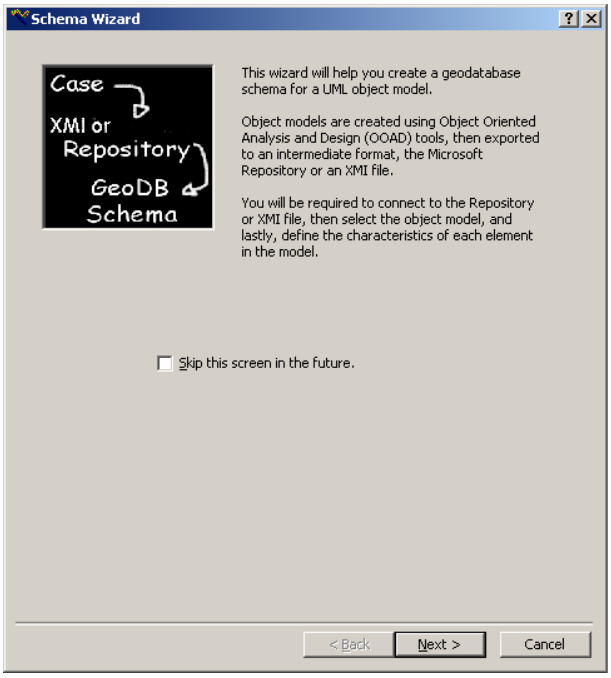
7) Click OK when finished.

STEP 5: Create Geodatabase Schema using CASE Tools and XMI file

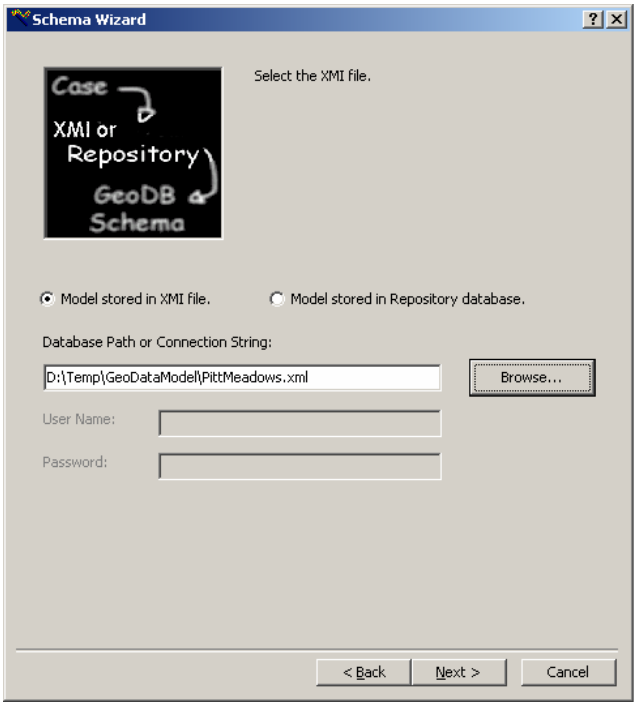
1) In the ArcCatalog tree, click the personal geodatabase.

2) Click the Schema Wizard button  to start the Case Schema Creation wizard.

3) A brief introduction to the wizard appears. Click Next.

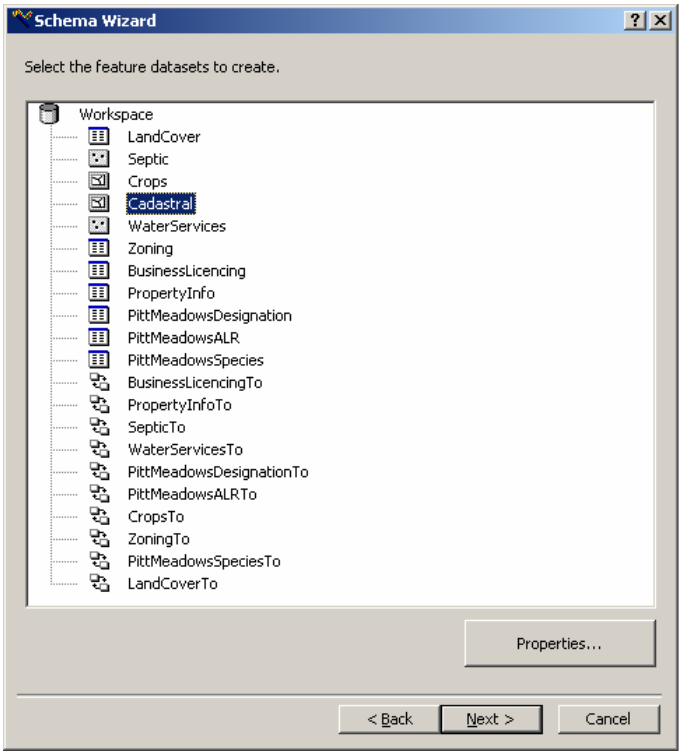


4) Click Model stored in XMI file in the Schema Wizard. Then Click Browse to navigate to the XMI file you created.



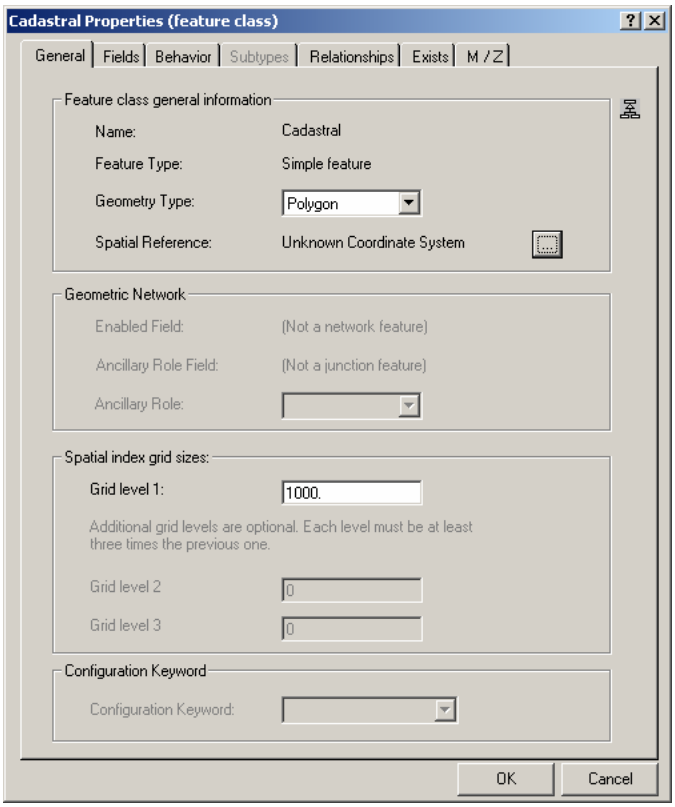
5) Click Next.

6) A tree view of the schema represented the UML model is displayed. This may take several minutes, depending on the size of your XMI file.

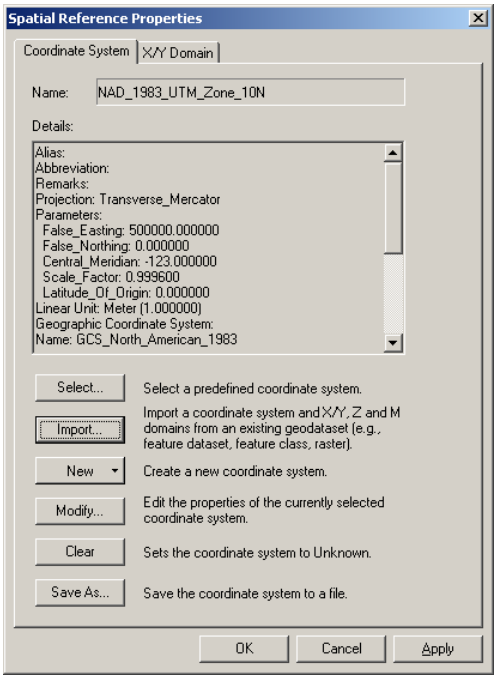


7) Select a Feature Data Layer and then Click Properties.

8) In the Feature Class dialog box, click the spatial reference button  .



9) Under the Coordinate System tab of the Spatial Reference Properties Dialog Box, click Import and navigate to the corresponding coverage data in UTM Zone 10 NAD83 Projection.

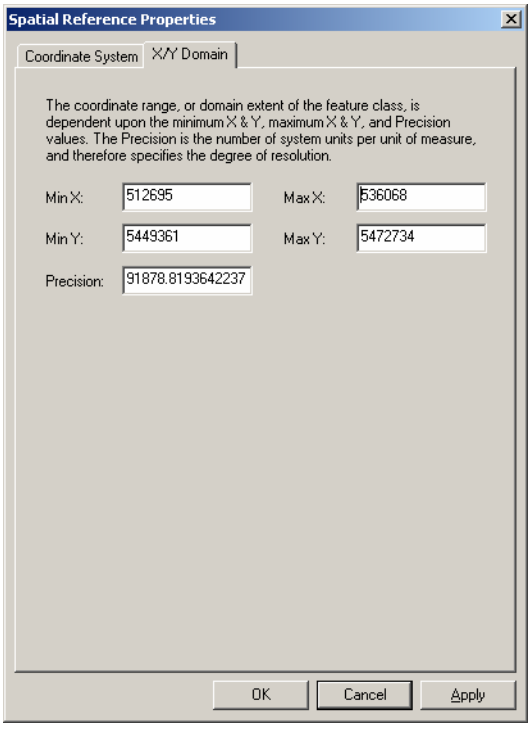


10) Click the X/Y Domain Tab. Enter the following values.

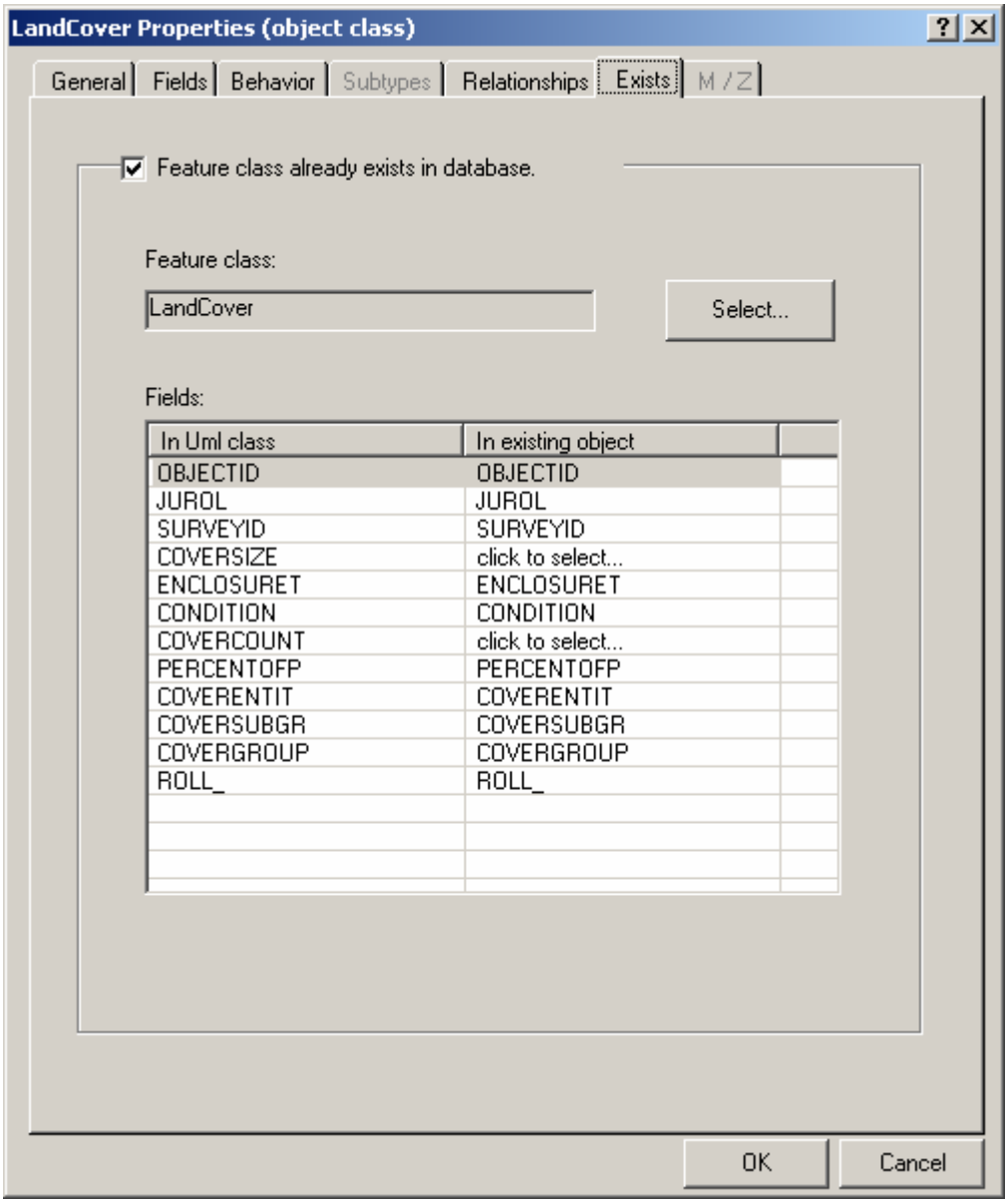
MinX: **512695** MaxX: **536068**

MinY: **5449361** MaxY: **5472734**

The above values are the coordinate values that are determined by arbitrarily drawing a rectangle box around the cadastre feature data layer. This rectangle box serves as the buffer spatial extent around the District of Pitt Meadows.



11) Click Apply and Click OK.
12) Repeat Steps 7 to 11 for all other feature data layers.
13) Select an Attribute Table and click Properties.
14) In the Attribute Table object class dialog box, click the Exists Tab.
15) Match any unmatched attribute columns in existing class (meaning existing attribute table columns loaded in the geodatabase from Step 3) to the defined attribute columns in UML class model as shown below. The unmatched ones are shown as "click to select…". The reasons why these attribute columns are not matching are because the attribute names were changed in the UML model either because they are SQL reserved words or because they are formatted to be compliant to ICI cadastre attribute columns (SEE APPENDIX 3 for details). NOTE: Make sure there is a check beside the Feature class already exists in database.

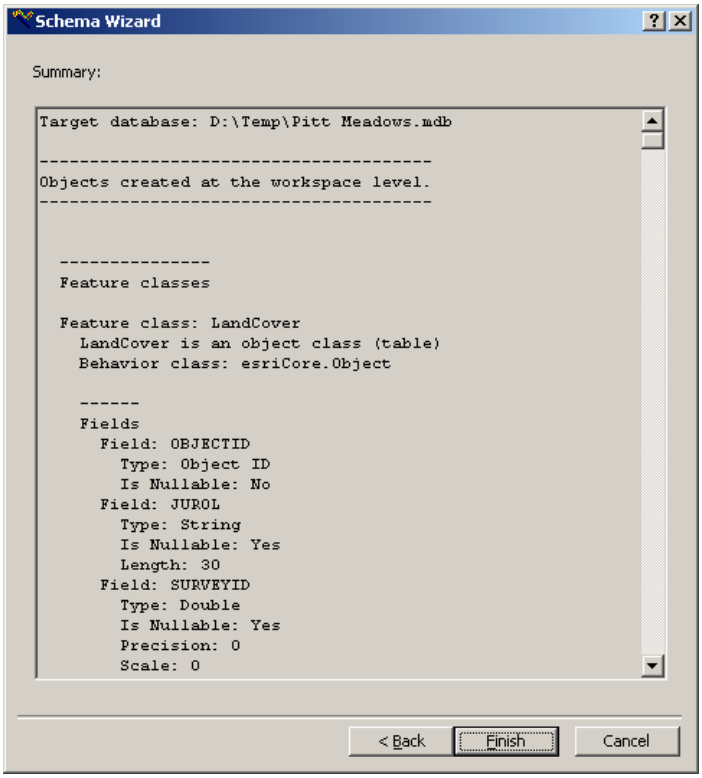


16) Click OK when finished matching.

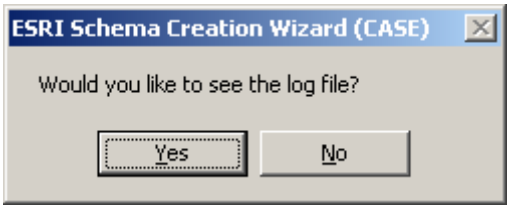
17) Repeat Steps 13 to 16 for all other attribute tables.

18) In the Schema Wizard dialog box as shown in Step 6, click Next.

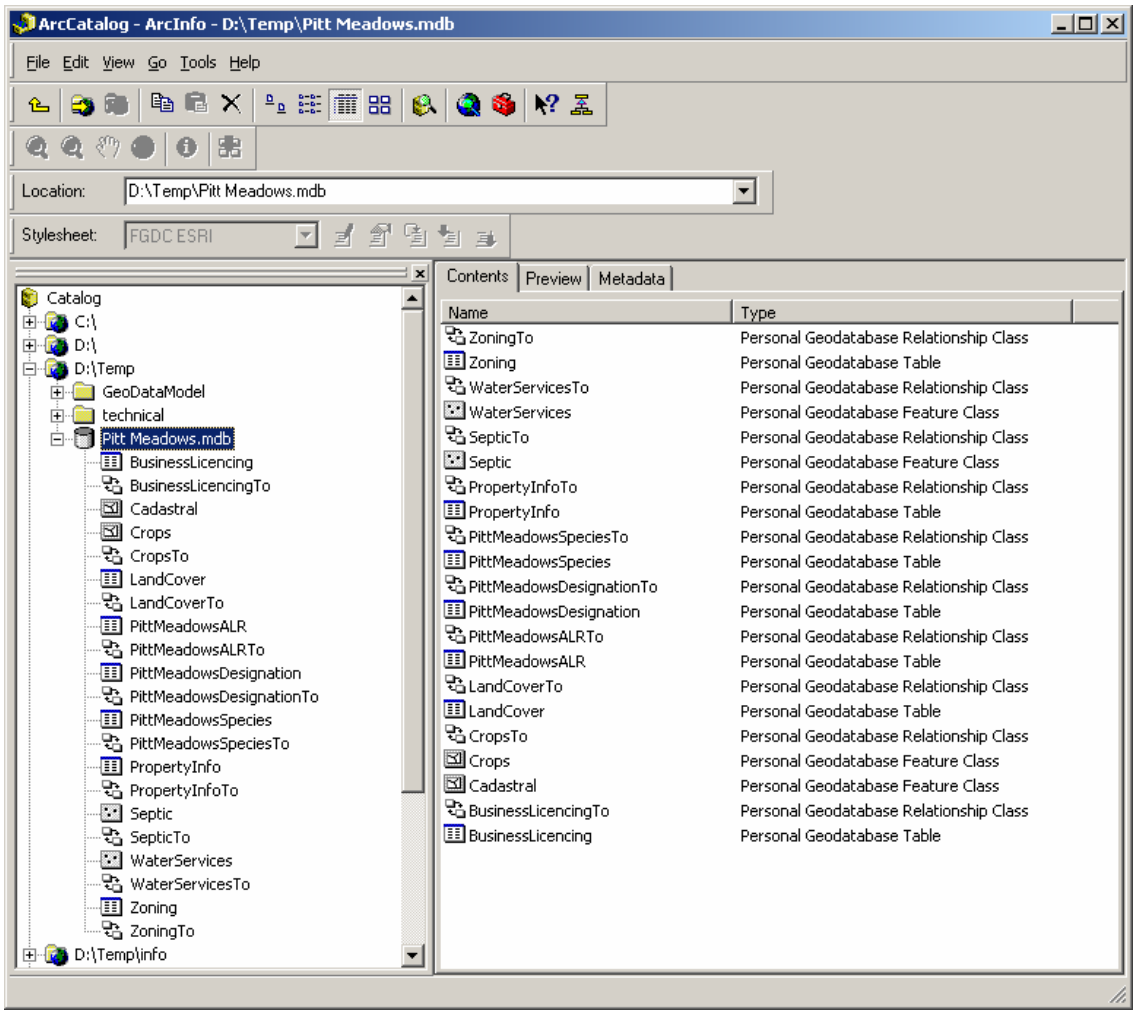
19) Click Finish in the new Schema Wizard dialog box.



20) Click Yes to see log file.

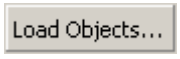


21) The geodatabase should appear similarly as follows in the ArcCatalog;



STEP 6: Load Feature Layers to Geodatabase in ArcMap

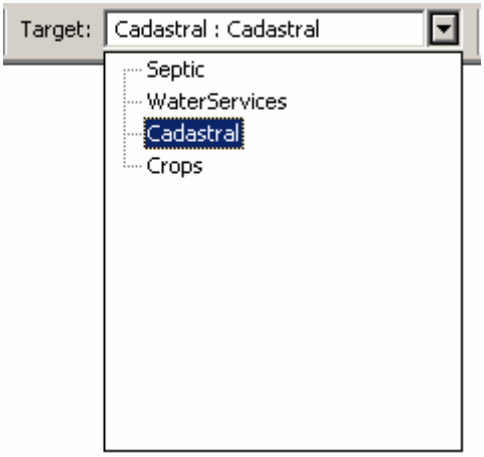
Instead of using the Simple data loader in ArcCatalog, the Data Loader in ArcMap is used to load data because Simple Data Loader only loads data without behaviour or relationship classes.

1) In ArcMap, Click Tools and click Customize.
2) Click the commands tab in the Customize dialog box.
3) Click Data Converters.
4) Drag the Load Objects command from the Commands list and drop it such that the Load Objects button 

appears on the Standard toolbar.
5) Click Close on the Customize dialog box.
6) Click on the Add data button  .
7) Navigate to the personal geodatabase and select all the feature data layers. You can select multiple layers by holding down the SHIFT KEY button of the keyboard.
8) If Editor toolbar is not shown in ArcMap, go to View and Click Toolbars and Click Editor.

9) Click the Editor button on the Editor Toolbar and Click Start Editing.

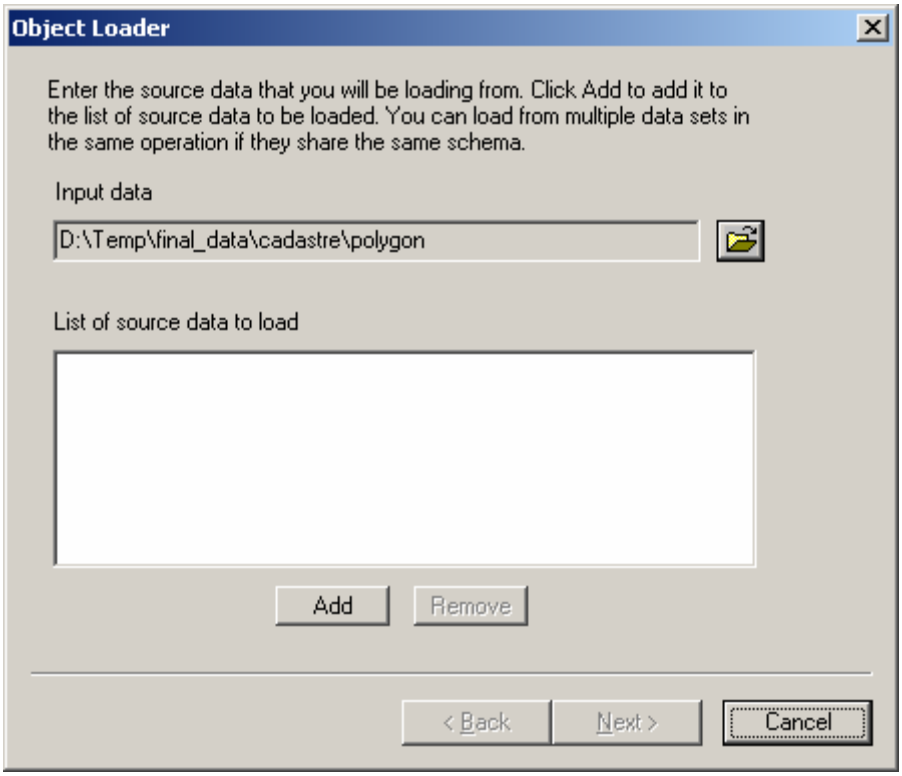
10) Click the Target button and select the Feature Data Layer that you want to Load Data.



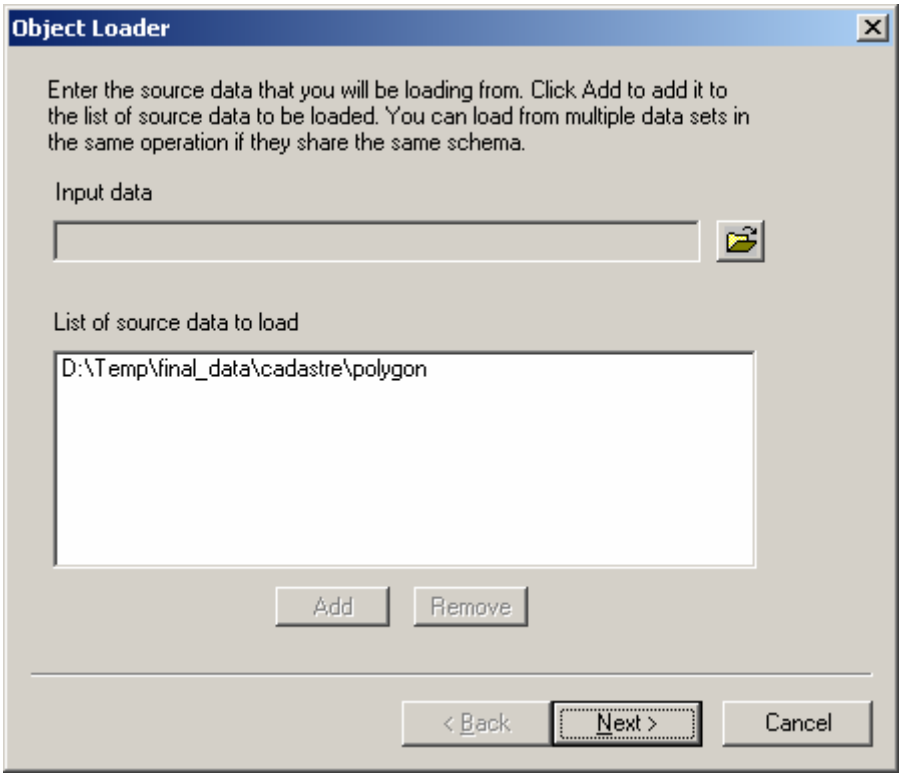
11) Click the Load Objects button 

.

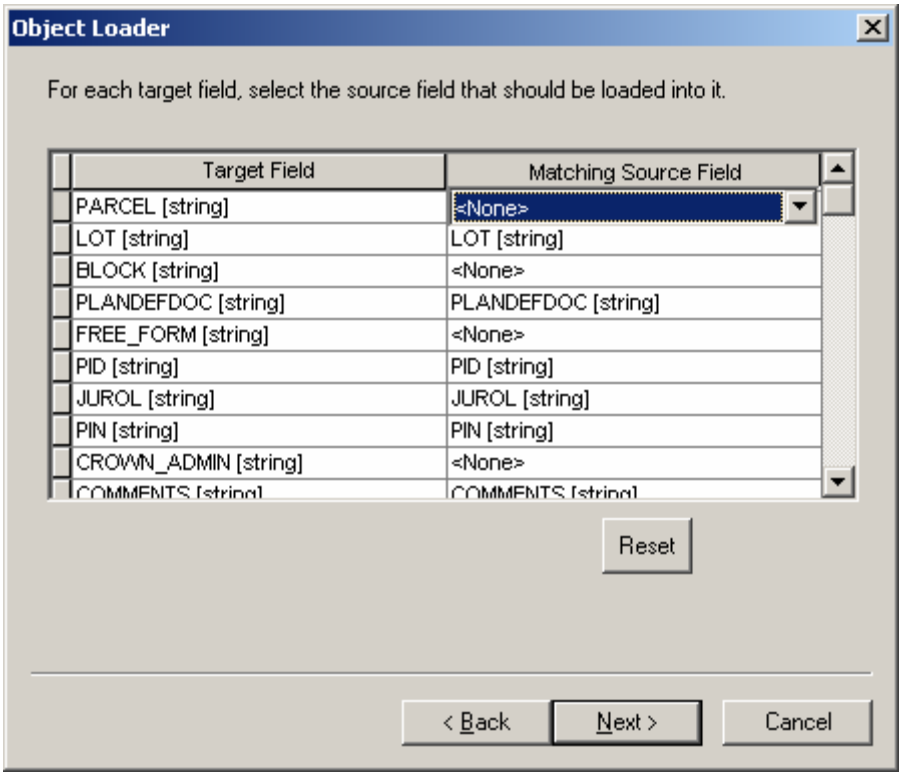
12) In the Object loader dialog box, click the directory button  and navigate to the corresponding feature coverage.



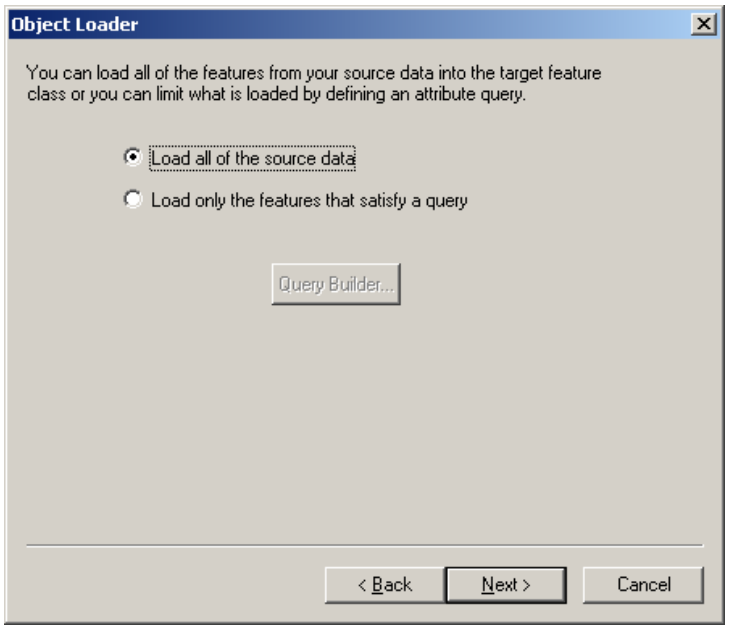
13) Click Add and Click Next.



14) Match the unmatched attribute columns in the object loader dialog box. Again, these attribute columns are not matching as the attribute names were changed in the UML model either because they are SQL reserved words or they are formatted to be compliant to ICI cadastre attribute columns (See APPENDIX 3 for details).

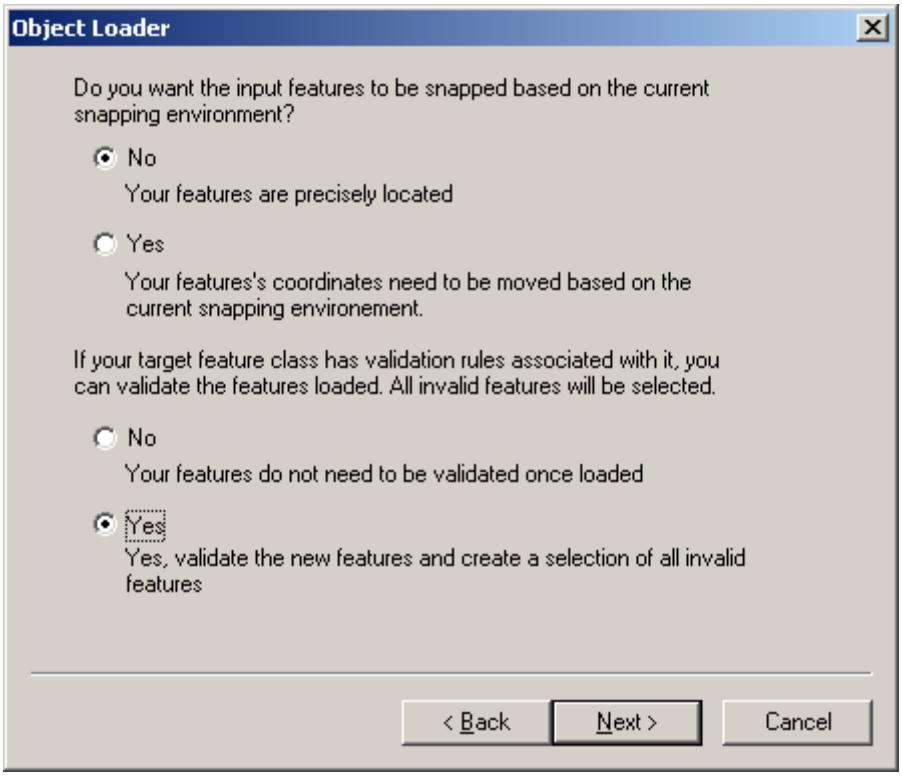


15) Select Load all of the source data and Click Next.

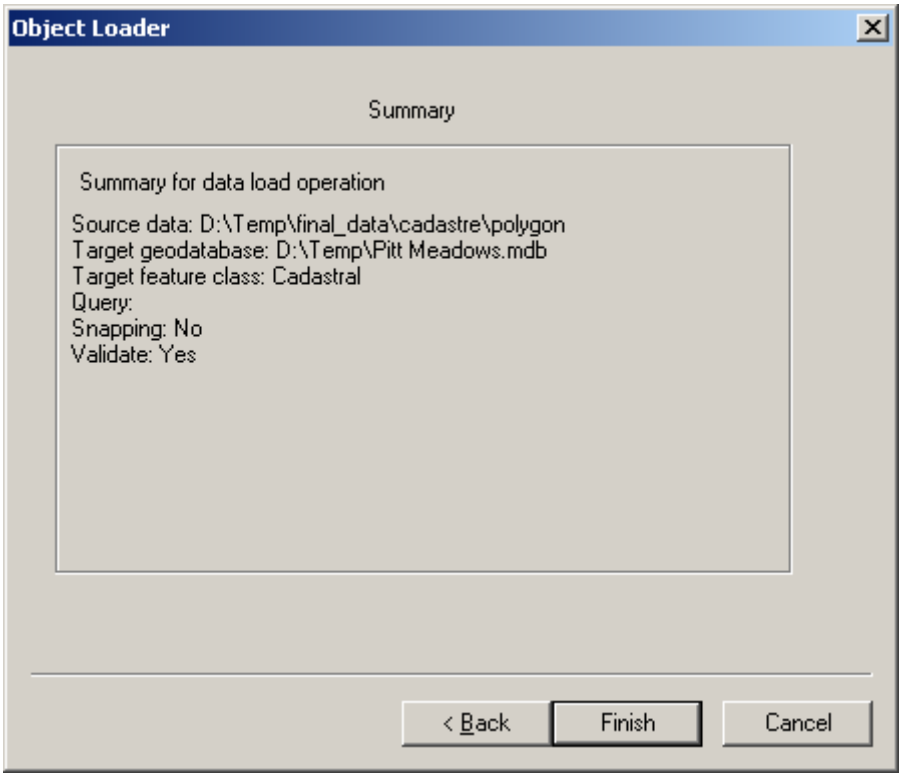


16) Click No to snap "Your features are precisely located" and Click Yes to "validate the new features and create a selection of all invalid features". Then Click Next.

Note: The snapping environment defines the spatial extent of the loading data. If the snapping is defined by its precise location, then the spatial extent will equal the original data's spatial extent. If the snapping is defined by current snapping environment, the spatial extent will equal the spatial extent of the geodatabase (defined in Step 10 of Create Geodatabase Schema using CASE Tools and XMI file).



17) Click Finish.



18) ArcMap will start loading the coverage's data into the feature class of the geodatabase. You can see the loading status on bottom left corner.

19) Click Editor and Save Edits.

20) Repeat Steps 10 to 20 for all other feature data layers.

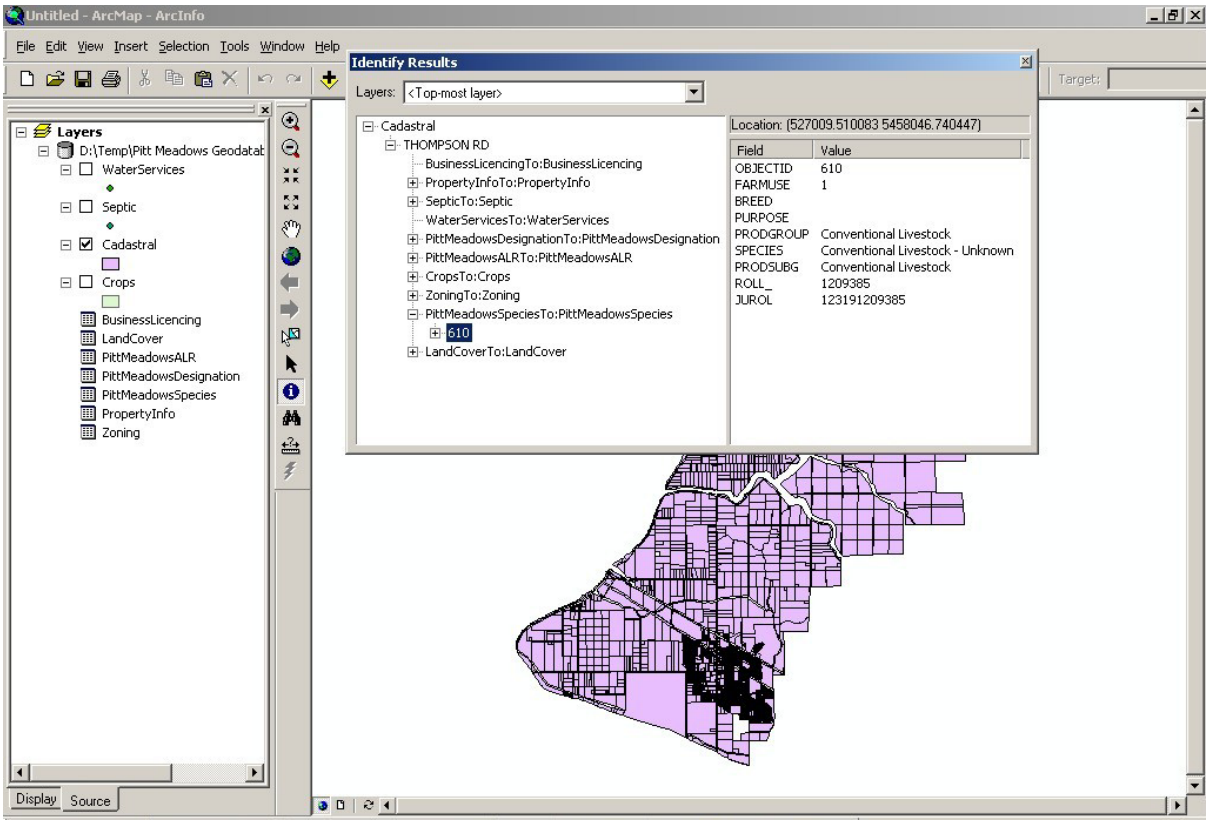
21) Click Editor and Stop Editing and Save all Changes when finish loading all data.

STEP 7: Check Relationships in ArcMap

1) In ArcMap, turn on the cadastre feature layer.

2) Click the identify button  and click on any parcel.

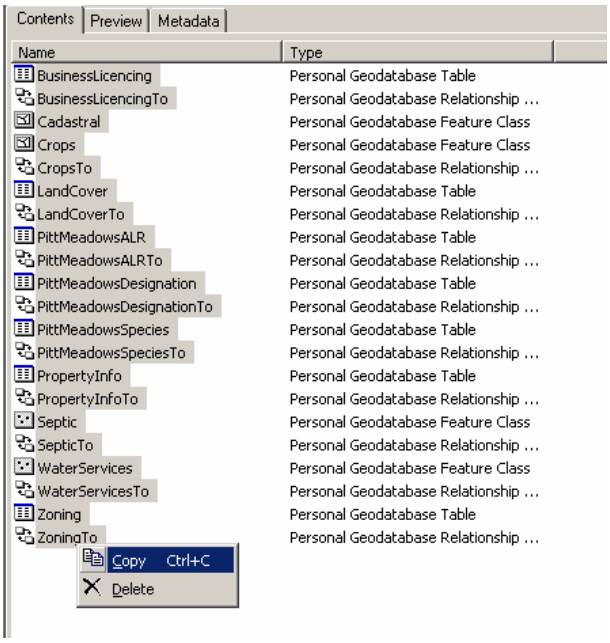
3) In the Identify dialog box, minus the + on the left as shown below. You should see all the data layers in your geodatabase. Those layers without + button means that there is no attribute information on the identified parcels.



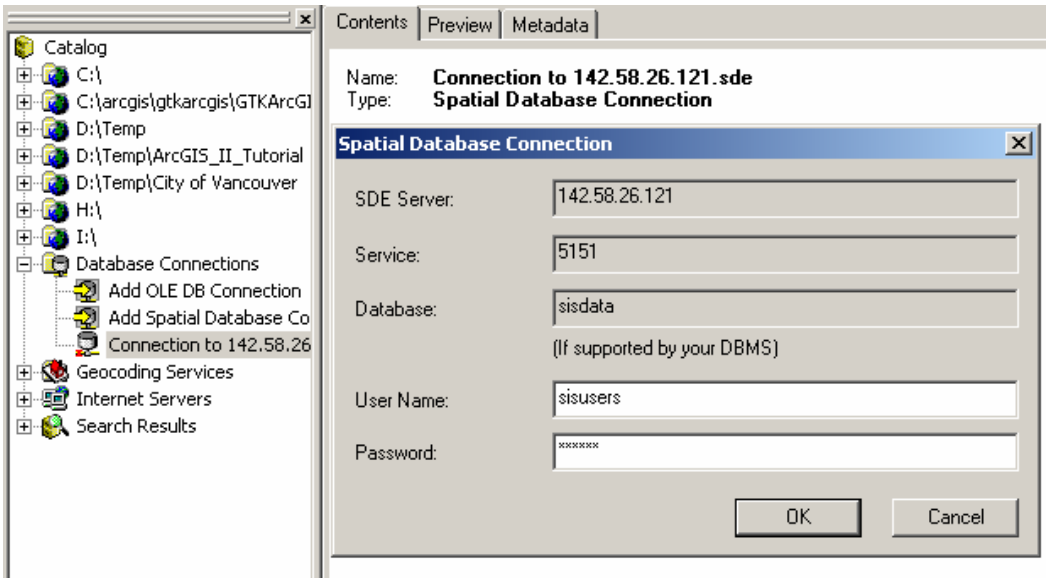
4) Repeat Steps 1 to 3 to check the relationships and related data in the geodatabase

STEP 8: Copy Personal Geodatabase to ArcSDE in ArcCatalog

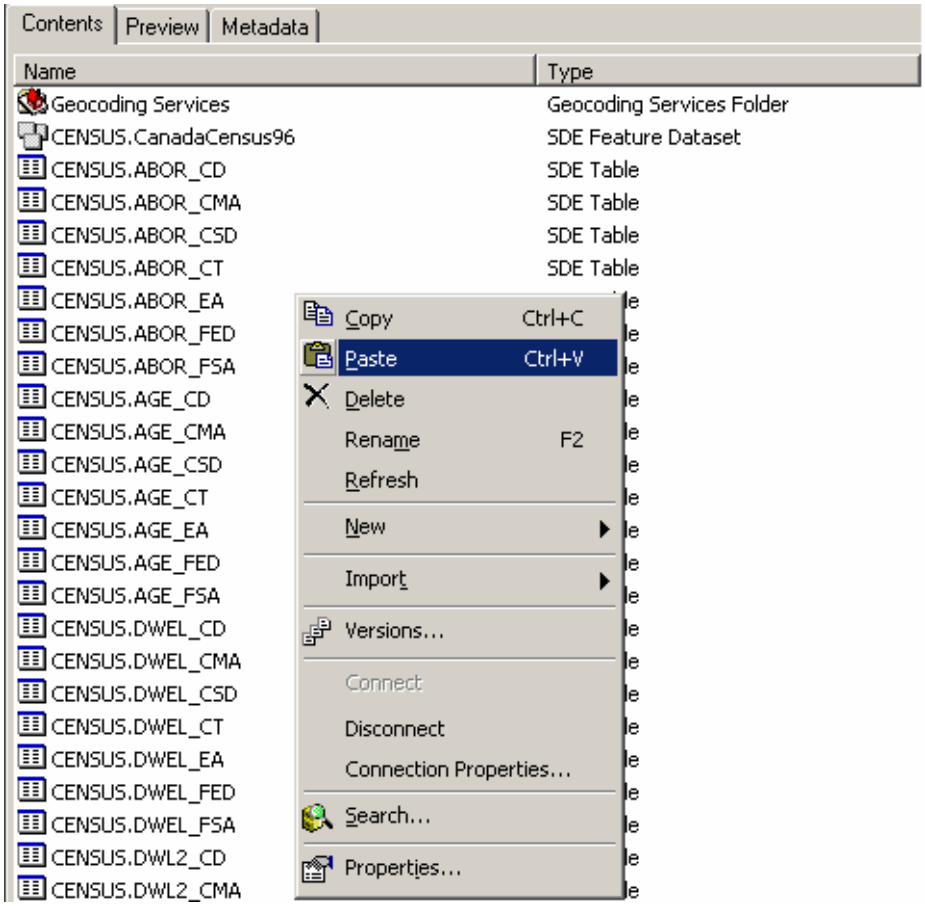
1) In ArcCatalog Tree, click on the personal geodatabase. Select all the layers (feature class, object/attribute class and relationship class) under Content Tab on the right. You can select all layers by holding down the SHIFT KEY.
2) Right click and click copy.



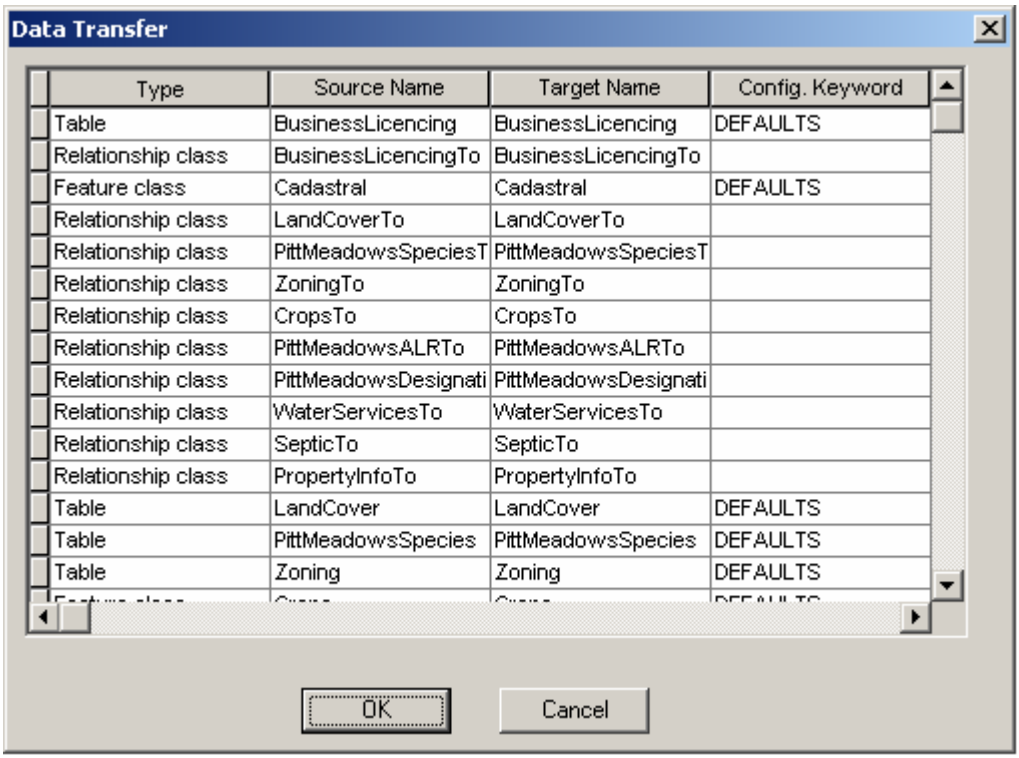
3) In ArcCatalog Tree, click Database Connections and select the ArcSDE database and Connect. If the ArcSDE database is not mapped yet, mapped it.



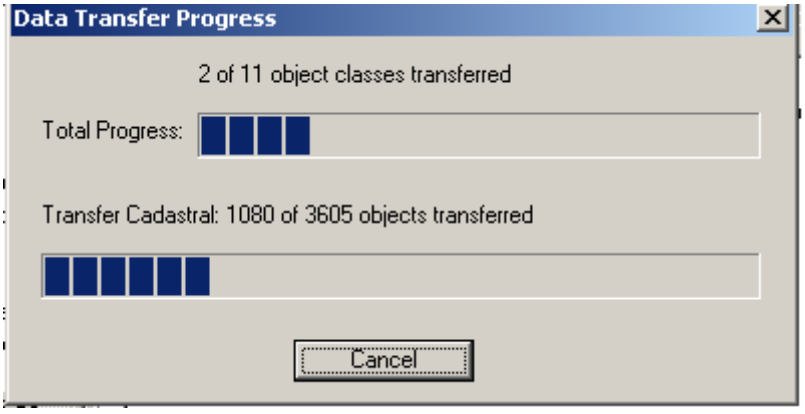
4) Under the Content Tab of the ArcSDE database, right click and click paste.



5) In the Data Transfer Dialog Box, Click OK.



6) A Data Transfer Progress Dialog box pops us to show the transferring process. This will paste all the data layers in your personal geodatabase to the ArcSDE geodatabase.



UNRESOLVED ISSUES & RECOMMENDATIONS

1) **Many-to-many relationships:**

Some feature layers and attribute tables were not included in the current project because they require populating values into an intermediary many-to-many relationship class table. These data values are necessary for linking the data layers (such as soils, capability, and OCP_Urban) to the cadastre. However the procedure for populating these values can only be accomplished either manually (adding row-by-row) or through an automated ArcObjects script. Such ArcObjects script is available in support ERSI online but apparently it populates values into a new relationship class table rather than populating existing relationship class table established through CASE Tools. As time constraints and lack of resources, it is impossible for the SFU students to explore further. For information about the mentioned methods (manual adding or automated script), see "Create a many to many relationship in a geodatabase" at support esri online at http://support.esri.com/Search/KbDocument.asp?dbid=21708.

Note: For data layers like soils and capability, they can be linked to cadastral feature layer by an overlaying procedure. This procedure uses the ARC/INFO INTERSECT command to create a new coverage with attribute values from both cadastre and soils/capability. The values in this table can then be uploaded to the many-to-many relationship class table for linking the layers. Note that the procedure requires using cadastre's UNIQUE ID for linking. For ocp_urban, it should be possibly link to cadastre by populating the many-to-many relationship class table with ocp definition and zoning codes.

2) **Cadastre's UNIQUE ID**

Further revision is required in developing the cadastre's UNIQUE ID. In the current geodatabase, attempts were made on creating this UNIQUE ID by joining the JUROL and PID. Since there are missing JUROL and PID numbers in the cadastre, this attempt was not too successful.

3) **Missing data:**

Many data layers were not loaded into this geodatabase due to lack of attributes. The following describes the problems of these layers in detail:

- Water Utility, Storm, and Sanitary sewer require geocoding. The District's engineering department has attributes for water utility, but we understand the only way to add these attributes into the GIS file is to do it manually.
- OCP_Rural could be updated so it contained all parcels in the rural area. Furthermore, its boundaries should be defined by parcels.

- The Roads layer could be linked to the Cadastral layer after missing addresses or house numbers are added, and the street names between the two layers has been standardized. After the above problems have been corrected, the Roads and Cadastral layers, can easily create an intermediate table to link these two layers, using the ARC/INFO ADDRESSMATCH command.

4) ICI compliant

In the future, newly collected attribute data for utility feature class layers (Storm, Sanitary and Water Utility) should be ICI compliant (with GPS).

5) ROLL numbers

Many roll numbers are missing in the rural areas of District of Pitt Meadows in the cadastre. This should be examined in the future to affirm if this is correct. Furthermore, new revised data layers like water services or pitt meadows septic system will require formatting the roll numbers before loading back to the geodatabase.

6) Linkage to other Database

Linking property information (obtained from AgFocus files) from current geodatabase to Vadim Finance Database should be explored in the future because it is beneficial to the business function of the District.

7) Metadata

More metadata should be collected wherever possible in the future.

8) Timestamp or Date Stamping Capability

Data model should be updated to include all existing cadastre versions with "date stamping" capabilities. This permits urban development analysis by looking at the changes in the parcels.

9) Identify Display User Interface

An identify display user interface should be created in ArcMap such that the related data can be displayed more efficiently and nicely when clicking on a parcel using the identify tool.
Note: The ArcMap's defaulted identify display dialog box is shown in Step 3: Check Relationships in ArcMap.

10) Inheritance in the Data Model

Inheritance between Data Model classes should be set up in the Visio model such that attributes including JUROL are inherited so that changes in the Cadastral class are inherited

to all other classes containing that attribute. Due to time constraints this was not accomplished by the SFU students.

11) Tagged Values Available to be Added

Class Domain may be set to allow only a specific range of values to be entered and Relationship Rules may also be created to control which classes may be linked to other classes. This was not accomplished by the SFU students due to time constraints.

CONCLUSION

Phases beyond the current model should consider integrating more feature classes. The District of Pitt Meadows' GIS department is encouraged to continue with its forward thinking GIS initiatives, and encouraged to partner again with SFU students in order to implement the various suggested future upgrades in a timely manner. In order to enable easy integration into the Geodatabase model, it is suggested that the District develop standards for data collection and AutoCad related files, and wherever possible to comply with ICI standards.

REFERENCES

Briggs, Ron. 2002. *Intro to Visio and UML Modelling.* UT Dallas.

MacDonald, Andrew. 1999-2001. *Building a Geodatabase*. ESRI, USA.

Microsoft Visio Online - http://www.microsoft.com/office/visio/default.asp

Environmental Systems Research Institute (ESRI). 2002. Building a Geodatabase with CASE Tools. ESRI USA.

Ministry of Sustainable Resource Management. 2002. *Integrated Cadastral Fabric (ICF) Standards and Specifications.*

Ministry of Sustainable Resource Management. *ICI Database*.

Support ESRI Online - http://support.esri.com

APPENDIX 1: CADASTRE_LOT.AML

```
/*CAD_ANNOLOT.AML
/*
/* Purpose: This AML creates an anno. coverage with LOT as subclass.
/*              It labels the Pitt meadows cadastre data parcels with
/*               LOT descriptions in the new anno coverage.
/*
/* ------------------------------------------------------------------
/* Usage: &run cadastre_annolot
/*
/*
/* Assumptions: assume cadastre data is in the same directory
/*                     assume only cadastre coverage, cadanno_plan.aml and
/*                     cadanno_lot.aml in the current directory (meaning no other files)
/*                     assume cadanno_plan.aml is in the same directory
/*
/* Note: - Calls the CAD_ANNOPLAN.AML to add PLAN
/*           annotation to CAD_ANNO coverage.
/*
/* Output: coverage called cad_anno in current folder
/*
/* ------------------------------------------------------------------
/* History: LRC (Land Reserve Commission) - 10-AUG-2001
/*                                    Created by Darrin Grund, Betty Ling
/*                                    for creating cadastre lot annotation
/*                                    of Capital Regional District
/* Modified: March-2003 Modified by Carol Cheuk for creating Pitt
/*                                Meadows Cadastre lot annotation
/*
/* ==================================================================

&IF [EXISTS    cad_anno -COVER] &then
        KILL    cad_anno all

/*set cadastre coverage name to .cover variable
&sv .cover = [listfile * -cover]

&IF [NULL %.cover%] &then &do
&type Missing coverage
&call usage
&return
&end

copy %.cover% cad_anno
centroidlabels cad_anno INSIDE
build cad_anno

/* ARCPLOT
arcplot

display 9999
mape cad_anno

polygonlines cad_anno 1

annocoverage cad_anno LOT

/*Create annotation for different area sizes
annolevel 1
reselect cad_anno poly AREA < 800
textset font
textsize 0.1 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 2
clearselect
```

```
reselect cad_anno poly AREA >= 800 and AREA < 1600
textset font
textsize 0.15 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 3
clearselect
reselect cad_anno poly AREA >= 1600 and AREA < 2400 and LOT NOT cn 'REM'
textset font
textsize 0.25 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 4
clearselect
reselect cad_anno poly AREA >= 2400 and AREA < 3200 and LOT NOT cn 'REM'
textset font
textsize 0.3 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 5
clearselect
reselect cad_anno poly AREA >= 3200 and AREA < 6400 and LOT NOT cn 'REM'
textset font
textsize 0.35 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 6
clearselect
reselect cad_anno poly AREA >= 6400 and AREA < 12800 and LOT NOT cn 'REM'
textset font
textsize 0.45 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 7
clearselect
reselect cad_anno poly AREA >= 12800 and AREA < 36000 and LOT NOT cn 'REM'
textset font
textsize 0.7 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc
```

```
annolevel 8
clearselect
reselect cad_anno poly AREA >= 36000 and AREA < 72000 and LOT NOT cn 'REM'
textset font
textsize 0.8 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 9
clearselect
reselect cad_anno poly AREA >= 1600 and AREA < 3200 and LOT CN 'REM'
textset font
textsize 0.15 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 10
clearselect
reselect cad_anno poly AREA >= 3200 and AREA < 12800 and LOT CN 'REM'
textset font
textsize 0.25 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 11
clearselect
reselect cad_anno poly AREA >= 12800 and AREA < 72000 and LOT CN 'REM'
textset font
textsize 0.45 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 12
clearselect
reselect cad_anno poly AREA >= 72000 and AREA < 144000
textset font
textsize 0.9 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 13
clearselect
reselect cad_anno poly AREA >= 144000 and AREA < 700000
textset font
textsize 1 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
```

```
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 14
clearselect
reselect cad_anno poly AREA >= 700000 and AREA < 2000000
textset font
textsize 2.5 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

annolevel 15
clearselect
reselect cad_anno poly AREA >= 2000000
textset font
textsize 3.5 pt
textcolor 'black'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno LOT # lc

clearselect
/* Quit out of ARCPLOT
q

/* ARC prompt
/* Create attribute table (.TAT) for the annotation subclass

build cad_anno anno.lot
addtext cad_anno lot

/* Calls ANNO_PLAN.AML to add PLAN descriptions on parcel(s)
&r cad_annoplan cad_anno

/* END OF CAD_ANNOLOT.AML
/* ================================================================
```

APPENDIX 2: CADASTRE_PLAN.AML

```
/*CAD_ANNOPLAN.AML
/*
/* Purpose: This AML adds PLAN annotation as new subclass to the cad_anno
/*              coverage.    It labels the Pitt meadows cadastre data parcels with
/*              PLAN descriptions in the existing cad_anno coverage.
/*
/* ------------------------------------------------------------------
/* Usage: automatically run after cad_annolot.aml
/*
/* Arguments: <none>
/*
/* Assumptions: assume cad_anno data is in the same directory
/*
/* Output: Plan annotation subclass in cad_anno coverage in current folder
/*
/* ------------------------------------------------------------------
/* History: LRC - 10-AUG-2001 Created by Darrin Grund, Betty Ling
/*                                      for creating cadastre PLAN annotation
/*                                      of Capital Regional District
/* Modified: March-2003 Modified by Carol Cheuk for creating Pitt
/*                                  Meadows Cadastre PLAN annotation
/*
/* ==================================================================
&goto skip
&args .cover

&IF [NULL %.cover%] &then &do
&type Missing coverage
&call usage
&return
&end

&label skip

&IF [EXISTS cad_anno2 -COVER] &then
        KILL cad_anno2 all

/* Dissolve the parcels
dissolve cadastre cad_anno2 PLANDEFDOC poly
build cad_anno2
centroidlabels cad_anno2 OUTSIDE /*INSIDE

/* ARCPLOT
ap
display 9999

mape cad_anno2
polygonlines cad_anno2 1

/* Add anno coverage to cad_anno2
annocoverage cad_anno PLANDEFDOC

annolevel 1
reselect cad_anno2 poly AREA < 1000
textset font
textsize 0.075 pt
textcolor 'gray'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno2 PLANDEFDOC # uc

annolevel 2
clearselect
reselect cad_anno2 poly AREA >= 1000 and AREA < 10000
textset font
textsize 0.15 pt
textcolor 'gray'
textfont 93726
textstyle simple
```

```
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno2 PLANDEFDOC # uc

annolevel 3
clearselect
reselect cad_anno2 poly AREA >= 10000 and AREA < 50000
textset font
textsize 0.5 pt
textcolor 'gray'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno2 PLANDEFDOC # uc

annolevel 4
clearselect
reselect cad_anno2 poly AREA >= 50000 and AREA < 100000
textset font
textsize 0.75 pt
textcolor 'gray'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno2 PLANDEFDOC # uc


annolevel 5
clearselect
reselect cad_anno2 poly AREA >= 100000 and AREA < 1000000
textset font
textsize 1.5 pt
textcolor 'gray'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno2 PLANDEFDOC # uc

annolevel 6
clearselect
reselect cad_anno2 poly AREA >= 1000000
textset font
textsize 2 pt
textcolor 'gray'
textfont 93726
textstyle simple
textquality proportional
textalignment center
textjustification cc
labeltext cad_anno2 PLANDEFDOC # uc


/* Quit out of ARCPLOT
q

/* ARC prompt
/* Create attribute table (.TAT) for the annotation subclass

build cad_anno2 anno.PLANDEFDOC
addtext cad_anno PLANDEFDOC

/* CLEAN-UP The temp coverage
KILL cad_anno2 all

&return

/* END OF CAD_ANNOPLAN.AML
/* ============================================================
```

APPENDIX 3: Changes Made to Original Table/Column/Length

OLD	NEW	LOCATION	DESCRIPTION	REASON
GISINTF	PROPERTYINFO	N/A	Table Name	Better describes the purpose of the table
CADASTRE	CADASTRAL	N/A	Table Name	ICI Compliance
PCL	PARCEL	Cadastral	Attribute Column Name	ICI Compliance
BLK	BLOCK	Cadastral	Attribute Column Name	ICI Compliance
CROWNADMIN	CROWN_ADMIN	Cadastral	Attribute Column Name	ICI Compliance
PRIMARY	PRIMARY_FIELD	Cadastral	Attribute Column Name	SQL Reserved Keyword
STREETNAME	ST_NAME	Cadastral	Attribute Column Name	ICI Compliance
STREETTYPE	STREET_TY	Cadastral	Attribute Column Name	ICI Compliance
PLACENAME	PLACE_NAME	Cadastral	Attribute Column Name	ICI Compliance
DATAOWNER	DATA_OWNER	Cadastral	Attribute Column Name	ICI Compliance
COMMENTS	LENGTH = 255	Cadastral	Attribute Column Length	Necessary for loading into ArcSDE
DESCRIPT	LENGTH = 255	Cadastral	Attribute Column Length	Necessary for loading into ArcSDE
PERCENT	DESIGNPERCENT	PittMeadows Designation	Attribute Column Name	SQL Reserved Keyword
COUNT	COVERCOUNT	LandCover	Attribute Column Name	SQL Reserved Keyword
SIZE	COVERSIZE	LandCover	Attribute Column Name	SQL Reserved Keyword
PAGECOUNT	PRECISION = 12, SCALE = 4	WaterServices	Attribute Column Precision & Scale	Cannot enter 0 as Scale for a Double data type

DATE_INST	PRECISION = 17, SCALE = 9	WaterServices	Attribute Column Precision & Scale	Cannot enter 0 as Scale for a Double data type
FARMUSE	DATA TYPE = SMALLINTEGER, PRECISION = 1	PittMeadows Designation	Attribute Column Data Type and Precision	Cannot have a Character string with the length of 1
IN_ALR & ALREDGE & PARTALR	DATA TYPE = SMALLINTEGER, PRECISION = 0	PittMeadows ALR	Attribute Column Data Type and Precision	Cannot have a Character string with the length of 1; since the column is empty it cannot be loaded with the data table in ArcCatalog without specifying an empty column precision
FARMUSE	DATA TYPE = SMALLINTEGER, PRECISION = 0	PMSpecies	Attribute Column Data Type and Precision	Cannot have a Character string with the length of 1; since the column is empty it cannot be loaded with the data table in ArcCatalog without specifying an empty column precision

***Width is used to determine the length and precision of integer, string, and data fields. For double fields, the display width and number of decimal places are entered as Precision and Scale, respectively. Any differences from these rules are documented above.

***Attribute columns with Numeric data type are entered as double because Numeric is not included in the esriFieldTypes

***Attribute columns with a specified number of decimal places in ArcInfo are entered with the data type Double, the Precision equal to the display width, and the Scale as the display width minus the column width.