

1.0 INTRODUCTION

One of the most significant functions of highway and planning management is the measurement of traffic volumes. Today we are experiencing a period of consistent traffic growth across North Carolina. With this increase in traffic flow, it is necessary to constantly improve and update transportation management systems. To this end, the North Carolina Department of Transportation (NCDOT) Traffic Survey Unit wishes to update its seasonal grouping assignments for over 58,000 traffic count stations throughout the state.

The updated seasonal grouping assignments are needed to prepare future-year traffic forecasts that are more credible and more useful in preparing financially feasible transportation plans. These traffic counts not only provide a method to accurately count annual average daily traffic, but they can also be used in other traffic analyses. Examples include peak hour estimates, traffic flow, capacity analysis, traffic engineering analysis, street and intersection design, and improved safety systems.

1.1 PROBLEM STATEMENT

The Division of Highways is required to conduct seasonal analysis of traffic volume data, vehicle classification, and vehicle weight data, a requirement established by the ISTEA '91 and the FHWA Traffic Monitoring Guide. The current seasonal grouping assignments of the traffic collection points needed to be updated to ensure accurate analysis. The current group assignments to the traffic count station locations were twenty years out of date.

The Traffic Survey Unit plans to establish a methodology in which it can assign each Portable Traffic Counter (PTC) station a seasonal group profile through a means of statistical and geographical analysis.

1.2 PROJECT GOALS

There were to be two major significant outcomes of this proposed work. The first significant outcome was to document a statistical method to estimate the correct seasonal profile of a roadway segment. The second outcome was to obtain a personal computer-based geographic information system application that will reduce the staff time required to check, validate and maintain seasonal group assignments for fifty-eight thousand PTC sites.

1.3 RESEARCH METHODOLOGY AND TASKS

- I. Develop a method by which readings of 7-14 days each should be taken at any average count site.
 - a. The method will identify the number of days per reading necessary to produce a statistically valid sample that will determine the best fit of the data to one of

the current seasonal profiles. We have enlisted the services of an NCSU statistician, Dr. Tom Johnson, to advise this phase of the project.

- b. A documented technical and literature research will be conducted to find the best method, software, and process to follow for this and subsequent tasks.
 - c. Create a report detailing the proposed method, and assist NCDOT in its implementation.
 - d. Deliverable for this task: Technical Report
- II. Develop an application to assign a "best guess" seasonal group to each site in the pilot area, based on the most recent data at that site.
- a. The "guess" method must consider the best fit of the periodic readings against the current snapshot of the current seasonal groupings.
 - b. The application will be designed to allow the use of new seasonal profiles when they are updated by NCDOT's Traffic Survey Unit.
 - c. The application will be run when a global reassignment of seasonal groupings is desired, or to calculate smaller groups of reassignments when new count data arrives from the field. Refinement of the assignments of individual stations will be accomplished with a separate application described in task #3.
 - d. Work will begin with the data from the 100 ATR sites, whose seasonal group assignment is known, as control data to refine this application. ITRE has enlisted the services of Dr. Tom Johnson to advise this phase of the project. His guidance will be necessary to develop the proper algorithm for fitting the station data to the seasonal profiles.
 - e. The application shall be designed to operate on Intel-based hardware under Microsoft Windows NT 4.0 operating system.
 - f. Deliverables for this task:
 - 1. Seasonal grouping assignment application
 - 2. Application documentation
 - 3. Data set delineating seasonal assignment grouping for each input traffic count station, in a format appropriate for supplying input to the application described in task #3.
- III. Develop an ArcView application to display roads, the 100 Automatic Traffic Recorder (ATR) sites, and the traffic count sites classified by the new "best

guess" grouping values. Many ArcView tools, such as those for zooming, panning, selecting, etc., will be incorporated.

- a. A provision will be made to display the current grouping (i.e., pre-"best guess" grouping).
- b. The program will also allow the incorporation of additional sites as new counts come in from the field, and are assigned seasonal groupings by the application described in task #2.
- c. The application will be used by a DOT analyst to change the assigned values based on the proximity of adjacent stations. The analyst will also be able to visually compare a displayed graph of the periodic collections at that point against the profile of the "best guess" (by default) and the profiles of the other six seasonal groupings (selectable).
- d. The user will also be able to examine the seasonal profile of the ATR(s) located in the county being examined and its seasonal history over a five-year period. The user will be able to view the data by county, by Region, by seasonal grouping, or by roadway.
- e. The application shall be flexible to allow both the increase and decrease of count stations during the year, as well as allow either the increase or decrease of seasonal groups on an annual basis.
- f. The application will be developed in conjunction with NCDOT Traffic Survey Unit personnel. Interface testing will be conducted, if desired, to ensure maximum functionality and flexibility in terms of its operation and use.
- g. The application shall be designed to operate on Intel-based hardware under Microsoft Windows 95/98. If not practical, alternate workstation configurations shall be recommended (however, this eventuality is not anticipated).
- h. ITRE will provide documentation for this application and train NCDOT personnel in the use of the application.
- i. Deliverables for this task:
 1. Interactive ArcView application
 2. Application documentation
 3. Application training

2.0 PROJECT OVERVIEW

2.1 OVERVIEW OF THE ROLES AND RECOMMENDATIONS OF THE DEPARTMENT OF STATISTICS

Dr. Tom Johnson, of the Department of Statistics at North Carolina State University, has examined the current counting methodology and data requirements of the Statewide Planning Branch. Through his analysis, he has developed recommendations as to the preferred data collection and analysis procedure for this project.

Dr. Johnson focused on the first proposal task: The development of a method by which traffic count readings should be taken at any short-term count site. Dr. Johnson researched the methods used within NCDOT to take short-term readings, the methods used by other states that responded to an e-mail query, and studied the short-term count data from 1991. He concluded that there could be no absolute number of readings at a short-term site that can be guaranteed to yield a sufficient sample by which to assign it a seasonal grouping. He recommends a baseline set of four to six readings be taken one year, and that data should be compared against previous years' readings to ascertain each site's variability. The next year's reading should then be planned based on each site's variability from the predicted volume based on the best seasonal group assignment, with sites exhibiting high variability requiring more than the baseline number of counts. A detailed report of Dr. Johnson's recommended activities to be taken in assigning groups is attached to this report as *Attachment A*.

Dr. Johnson also focused on the second proposed task: The development of an application to assign a "best guess" seasonal group to each site in the pilot area, based on the most recent data at that site.

The project proposal states that an application to assign a "best guess" seasonal group to each short-term site based on recent traffic volumes would be created. Originally, this process was intended to be an automated, or non-interactive batch mode process. However, a process that involved an interactive data-exploring interface was recommended and utilized. This framework supports informed engineering judgement for group assignment, and makes it easier for the analyst to investigate the integrity of the data. SAS's JMP Statistical Discovery software was selected by Dr. Johnson as the most appropriate statistical software to use for the analysis of the traffic count data. The text of the justification statement is attached to this report as *Attachment B*. The response to this report was only that a clarification be made of a minor point, so Dr. Johnson's recommendation of JMP was adopted as the platform of choice for the analysis.

The decision to recommend JMP was based on the software package's flexibility in allowing visualization of the data in multiple ways as well as its affordability. Other packages, while easier to program in batch mode, were reviewed and rejected because of their lack of flexibility and expense. One requirement of JMP is that assignments of a "best guess" to each traffic count station must be done using "cookbook" point-and-click interactive analysis. Dr. Johnson developed such a procedure, detailing the steps

necessary to produce the "best guesses" with supporting charts and tables for each station, using Pairwise Correlation analysis in JMP (*Attachment C*).

The results from the JMP analysis were stored as GIF format images. These images are retrievable in ArcView by an established hot link between the PTC site features and the files (see section 3.2 for the hot link procedures). Several trials were conducted for the process of capturing the output information, though none proved significantly more efficient over the other. A final approach to the capture was to use a template created in Unisys Corporation's Paint Shop Pro 4.1. The tutorial for capturing these images (*Supplement B*) uses a similar approach with Microsoft's Photo Shop.

2.2 OVERVIEW OF THE ROLE OF THE INSTITUTE FOR TRANSPORTATION RESEARCH AND EDUCATION

For the purposes of this project, ITRE began with the current seven seasonal grouping profiles. Our primary task then became the reassignment of the current seasonal groupings to each of the approximately 200 short-term counting stations along the US Highway 70 corridor in eastern North Carolina. Dr. Tom Johnston of the Department of Statistics at North Carolina State University examined the methodology and data requirements of the Statewide Planning Branch and developed recommendations to the preferred data collection and analysis procedure for the project.

Although we recommended the *best* seasonal grouping (using statistical correlation and their associated p-values), a group profile was also recorded if it fell within a 5% probability of the best grouping.

The third task of the proposal was under the purview of the Institute. ITRE developed an ArcView application to display roads, the 100 ATR sites, and the traffic count sites with the "best guess" grouping value displayed. The application was built in its 'beta' form to display the Statewide Primary Roads network, the 100 ATR count sites, railroads, water features, and NC County boundaries. The locations of the short-term count stations in the pilot corridor are also displayed. The user is able to select a PTC site and display an attribute table listing its current seasonal assignment, its new seasonal assignment based on the best "best guess" as determined by the analysis in Task 2, and all the "best guesses" determined by that analysis. The user is also able to display the seven Seasonal Profiles, and the graphs and charts produced by the statistical analysis in Task 2. Finally, the user is able to update the new seasonal assignment based on the results of the statistical analysis and its spatial proximity to other stations.

Another product of the program was the training of the project staff of both the basic concepts and applications of ArcView and the utilization of the beta version of the application. The former is a routine class taught by the GIS staff at ITRE. The following description of the two-day class is an excerpt from the training brochure for the GIS/GPS Program at ITRE:

Visualizing Data with ArcView

This two-day course teaches students how to use ArcView, the menu-driven geographic visualization and query program for the desktop. Students will learn to access and update geographic data sets, create and manipulate themes, geocode addresses, design map layouts, and generate hard copy maps. The course is designed for students who primarily wish to work with existing data sets as opposed to developing their own. In addition, the user-friendly interface is well suited for first time GIS users.

A second one-day seminar was held to train the project staff and analysts with the customized ArcView interface and the SAS JMP software. The two tutorials are supplemental to this report (*Supplement A* and *B*, respectively).

2.3 CREATING THE INTERACTIVE ARCVIEW APPLICATION

An alpha version of the ArcView application was developed during the fourth quarter of 1998. The application contained a view component with themes and associated tables depicting highways, county boundaries, railroads, surface water features, municipalities, labeled ATR sites, an interactive locator map, and several Avenue scripts associated with a customized Graphical User Interface (GUI). The documentation for using the interface was delivered as an attachment to the quarterly report on December 31, 1998 (*Attachment D*). Prior to the report, a meeting was held to present the core project group with the alpha version of the application and to solicit the group's feedback. The design notes suggested by the group were implemented to create the first beta version of the application (*Attachment E*). This was followed by a series of meetings and application demonstrations, each of which was followed by a list of change requests that were added to the program when possible.

The DOT wanted Microsoft Access[®] to be at the center of the application (not a .dbf table) since the ATR and PTC data was already stored in that format. However, unlike .dbf files, tables in Access can not be directly edited in ArcView. Thus, the primary focus of the program was to implement a procedure that allowed the analyst to select and edit records stored in an Access format (.mdb) file through an ArcView interface. The idea was to match the PTC site location features stored in an ArcView readable shapefile (complete for those sites along the US Highway 70 corridor) with the Access table (PTC inventory table) that contained the attribute information for those sites. This would allow the sites to be analyzed by their spatial nature and selected using the graphical selection tools supplied by the ArcView program. Once selected, edits would then need to be made to the table via a customized dialog box and a series of SQL commands. By joining the PTC inventory table to the PTC attribute table, we were able to classify the sites by pending group assignment and acceptance value, and by whether or not data was available for the site. This procedure is described in more detail in the section about the Classify field (section 3.1.1).

Other functions of the program called for an *on-the-fly* hot link between the PTC site features and their associated SAS JMP output images. In addition, the user needed to view the seven seasonal group profile images. The PTC stations needed to be classified

by their pending PGA status and whether or not they had been "accepted" by the analyst. Likewise, the ATR stations needed to be classified by their current seasonal profile group assignment. During the latter part of project development, a request to annotate the PTC stations was made, in addition to annotating the ATR stations.

Finally, careful thought had to go into guarding the program from user-error. Saving and other procedures that allow a user to manipulate the program interface and/or scripts are guarded by a password message box. For example, anyone who wishes to open the Customize dialog box or save the project must have the appropriate password. The database is also safeguarded from a user's attempt to access the PTC inventory database after the reset date through the ArcView program. A warning dialog displays during project startup once within thirty days of the reset date. Once expired, access to the program is only given to those who obtain the password.

Once all design recommendations were implemented, the final step was to upload the program onto the DOT Traffic Survey Unit's server. Once in place the shapefiles that were used for geographic landmarks (highways, railroads, surface waters, etc.) were deleted and replaced with those on their server. A step-by-step guide attached as *Attachment F* illustrates how the program was loaded onto the department's Windows NT-platform personal computer.

The following section describes the program functionality in more detail.

3.0 THE CUSTOMIZED ARCVIEW INTERFACE

Several versions of this program have undergone review by the program staff. Key personnel evaluated each version and comments and requests for change were noted. When possible, the requests were implemented resulting in a user-friendly GIS interface whose goal is to ultimately aid in the update and validation of existing seasonal roadway assignments and improve the accuracy of all traffic data being provided to the NCDOT, urban transportation agencies, and other transportation management systems.

3.1 THE FLOW OF DATA BETWEEN MS-ACCESS AND THE ARCVIEW INTERFACE

Recall that the program is focused around an MS-Access database table that contains attribute information about the PTC sites. The table is imported into the project via an Open DataBase Connectivity (ODBC) link between ArcView and MS-Access. To establish this connection, an ODBC driver (Microsoft Access Driver version 3.50.360200) was installed and named "seascov" using Microsoft's ODBC Administrator. Through ArcView's supplied SQL connection dialog box (Figure 3.1), records inside the table are queried and opened as *Table1*. The connection only needs to be established during the initial project upload. If the table does not exist at the project opening, a warning message is displayed and a password request is prompted.

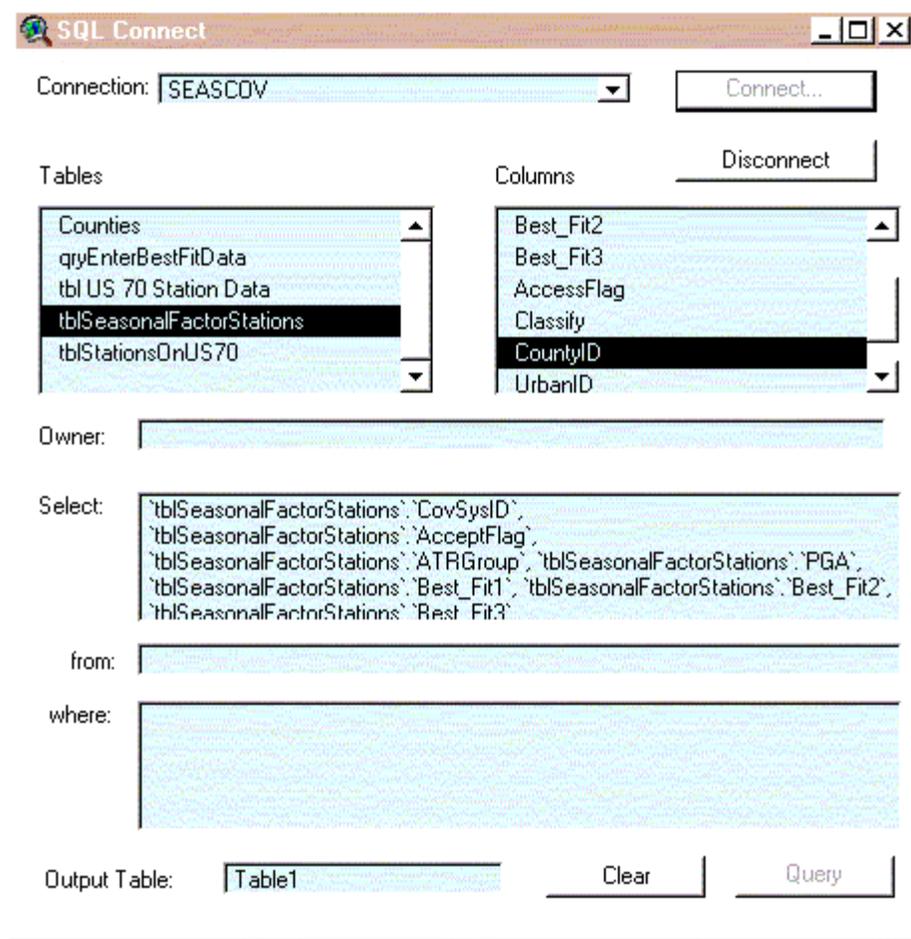


Figure 3.1: ArcView's SQL Dialog Box

Note that the database's logical and physical location is irrelevant for the purposes of the SQL connection. The pathname that holds the database is established in the ODBC configuration accessed through Microsoft's ODBC Administrator.

3.1.1 THE ACCESS PTC INVENTORY DATABASE TABLE

The items queried from the PTC inventory table become the attributes of *Table1*. Most have essential roles in the ArcView program; others are for reference. The following paragraphs describe each item and its role or roles in the program.

CovSysID. The values of this integer-type attribute are unique for each PTC site. The unique identifier establishes a means of selecting and joining records from and to *Table1*. It is crucial that the values for this attribute always remains unique in order for the program to work correctly.

The CovSysID field was created by the Traffic Survey Unit during the program creation. Prior to the creation of CovSysID, sites were identified by their CountyID and StationID fields, neither of which is unique by itself (StationID is not queried for *Table1*).

AcceptFlag. This integer-type attribute indicates that the user has or has not accepted the PGA value for a given record. The number will either be a zero (0) or an eight-digit number representing the date of acceptance in the format YYYYMMDD. When the value for a record's AcceptFlag field is zero, the PTC site the record represents has not been accepted.

ATRGroup. The ATRGroup field is a single binary byte integer that indicates the "current" seasonal profile group assignment. This historical information is included in the table as a source of information to aid in the analysts decision for updating the pending group assignment. Initially the values for the PGA field are calculated from the ATRGroup field, and changed only when new data exists for the site and the "best guess" profile differs from the ATRGroup's value.

PGA. The Pending Group Assignment (PGA) field values represent the seasonal profile group updates that are to be assigned to the PTC sites' ATRGroup during the yearly reset.

This field is the primary focus for the editing process. Initially, all site PGA values are the same as those of the ATRGroup assignment. If data is present for the site, then the SAS analysis is run and a "best guess" profile is found. Those sites whose best guess is different from their ATRGroup assignment will acquire that group number as their PGA. The analyst then has the option to change this assignment to any of the seven profiles. During the annual reset, the PGA assignments are used to calculate the new ATRGroup values. In turn, the outdated ATRGroup values are kept in the PTC inventory as historical fields.

Best_Fit1. The single-byte binary integer in this field indicates the seasonal profile for which the site's data best fits. This information is obtained during the SAS JMP analysis and is only present (greater than zero) when a site has new data that correlates within five percent with at least one of the seasonal profiles. When present this "best guess" assignment is calculated for the record's PGA.

Best_Fit2. Similar to Best_Fit1, the integer indicates the second-best correlation between the site's data and the seasonal profiles. The value is only greater than zero if more than one profile correlates within five percent.

Best_Fit3. The values for Best_Fit3 are similar to Best_Fit1 and Best_Fit2, but only occur when three or more profiles correlate to the site data within five percent. As with Best_Fit2, the data in Best_Fit3 is used only for aiding the analyst in his or her decision.

AccessFlag. The AccessFlag is a character-type attribute whose values are boolean in nature (either Y or N). When the AccessFlag is "raised", that is when the value is "Y", the site that the record represents obtains new data. When this occurs, the PGA value is the same as the best guess value in Best_Fit1.

Classify. This field was added during the latter part of the program creation. The values of Classify dictate how the PTC sites appear in the SGAA (Seasonal Group Assignment Application) View. Prior to the incorporation of this field, two PTC themes were needed in the View; one classified by the PGA to showing the current group assignment, and one by the AcceptFlag showing whether or not the station had been accepted. The latter had its features viewable as crosshairs whenever the AcceptFlag was greater than zero (whenever a date was present). When overlaid on top of the PGA-classified theme, the analyst would be able to note the stations current PGA assignment and acceptance status.

The problem with this method is that it required joining both PTC attribute tables to the imported PTC inventory table. This procedure took place each time the tables were refreshed, a process unavoidable in order to display the features in the SGAA View with their appropriate values. Part of the solution to this problem was to create a new field, Classify, that allowed the PTC sites to be classified into 5 possible categories:

1. Sites that have new data but have not been accepted,
2. Sites that have new data and have been accepted,
3. Sites that have no new data and have not been accepted,
4. Sites that have no new data but have been accepted, and
5. Sites that are not assigned.

The Classify field is calculated for each record in the Update PGA dialog box each time edits are applied. In all, there are 29 unique possibilities for Classify; 7 for each of the first four categories and one for the last. The calculations are set as a series of *if...then* statements in Avenue that run when edits are applied to the PTC inventory table. The following is an excerpt from that script (refer to script documentation in *Supplement C: Script Documentation*):

From MyDialog.Lbt_Apply.Click

Where `anAccessVal` is the value for AccessFlag,
`anAcceptVal` is the value for AcceptFlag,
`aPGAValNum` is the value for PGA,

```

if (anAccessVal = "0") then
  if (anAcceptVal = "0") then
    aNegPGAVal = (aPGAValNum * -1).AsString
    UpdateClass = "UPDATE tblSeasonalFactorStations SET
                  tblSeasonalFactorStations.Classify ="
                  ++aNegPGAVal++ "WHERE" ++anExpression++ ";"
    theSQLCon.ExecuteSQL(UpdateClass)
  else
    aNegPGAVal = (aPGAValNum * -100).AsString
    UpdateClass = "UPDATE tblSeasonalFactorStations SET
                  tblSeasonalFactorStations.Classify ="
                  ++aNegPGAVal++ "WHERE" ++anExpression++ ";"
    theSQLCon.ExecuteSQL(UpdateClass)
  end
else
  if (anAcceptVal = "0") then
    UpdateClass = "UPDATE tblSeasonalFactorStations SET

```

```

tblSeasonalFactorStations.Classify ="
++aPGAVal++ "WHERE" ++anExpression++ ";"
theSQLCon.ExecutesQL(UpdateClass)
else
aPGAVal = (aPGAValNum * 100).AsString
UpdateClass = "UPDATE tblSeasonalFactorStations SET
tblSeasonalFactorStations.Classify ="
++aPGAVal++ "WHERE" ++anExpression++ ";"
theSQLCon.ExecutesQL(UpdateClass)
end
end

```

The resulting 29 unique values that the Classify field can obtain are:

1 thru 7 by 1	(accessflag is 1, acceptflag is 0)
-1 thru -7 by 1	(accessflag is 0, acceptflag is 0)
100 thru 700 by 100	(accessflag is > 0, acceptflag is 1)
-100 thru -700 by 100	(accessflag is > 0, acceptflag is 0)

CountyID. The values indicate to which county each site is affiliated. The values of this field were used in conjunction with those of the StationID to create values for CovSysID. This field is also used during the initial selection of *Table 1*'s records by county during the project startup. The next section describes this process in more detail.

3.1.2 SELECTING PTC SITES BY COUNTY: CREATING *QTABLE*

The first beta version of the program joined *Table 1* to two PTC attribute tables. Recall that *Table 1* table was imported into ArcView, and both the attribute tables and *Table 1* are large (around 58 thousand records each). When executed, a refresh on the PTC theme or attribute table queries and re-imports *Table 1* and all associated joins are reestablished. This made the editing process inefficient, taking up to fifteen minutes to execute.

The first step to reducing the editing time was to reduce the number of joins. Deleting one of the attribute tables by adding a new field, Classify, to the PTC inventory did this (see section 3.1.1). Now only one join was needed, cutting the time almost in half.

The second step proved more significant. By prompting the user to select which county or counties with whom he or she needed to work, *Table 1* could be queried to create a much smaller query table. This could be done because the area that an analyst observes is usually smaller than a single county. The smaller table, named *qtable*, contains the records for each county selected by the user, and all of the attributes and values for those records. The table is joined to the PTC theme attribute table, and during a refresh, only this VTab is rejoined. Furthermore, no SQL connection has to be reestablished. This again reduces the editing time, this time by factor of over 400, taking less than one second per record to execute.

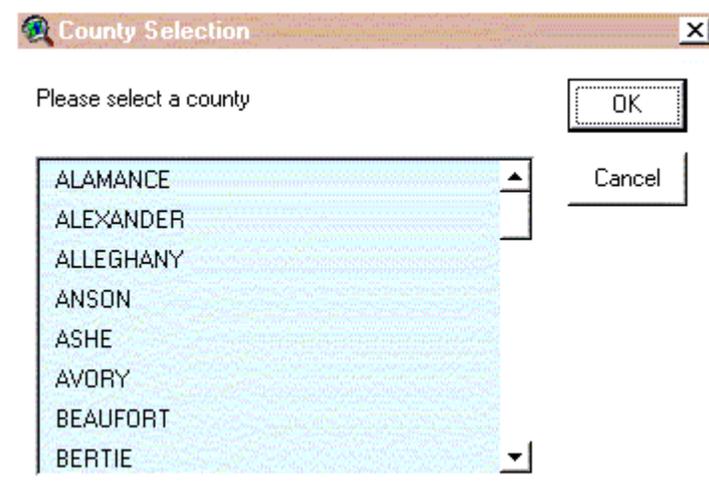


Figure 3.2: County Selection Query Dialog Box

Since *Table1* is not refreshed during the editing process, the values of its records do not reflect changes that have taken place. However, *Table1* is only needed to query *qtable*, so it is only important that the values be correct at project startup.

3.1.3 EDITING THE PTC INVENTORY TABLE: THE PGA UPDATE DIALOG BOX

The PGA Update dialog box is the vehicle by which records in the PTC inventory table in MS-Access can be viewed and edited from the ArcView platform.

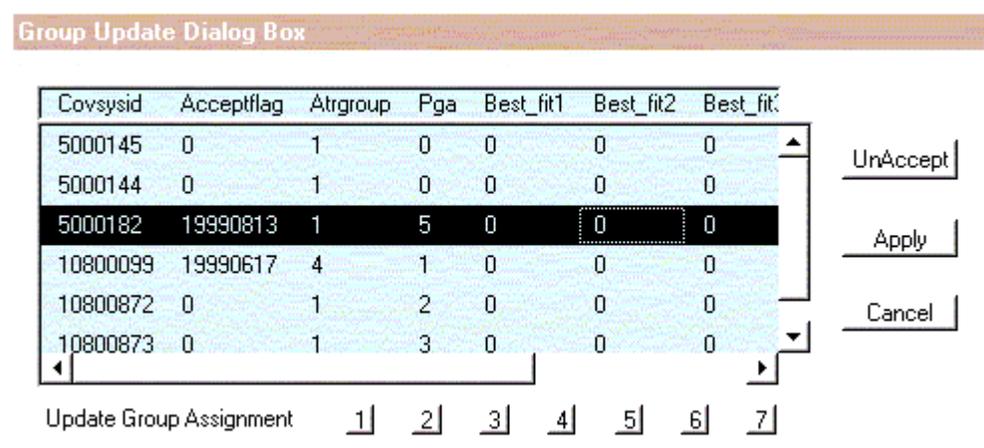


Figure 3.3: PGA Update Dialog Box

The dialog box was created using ArcView's Dialog Designer extension, an interface that allows the creation of controls and the association of their properties with scripts, text, or files. Examples of controls are buttons, check boxes, list boxes, and control panels. The

PGA Update dialog box is composed of eleven label buttons, one list box, one text label, and the dialog.

Dialog control settings for the PGA Update dialog box:

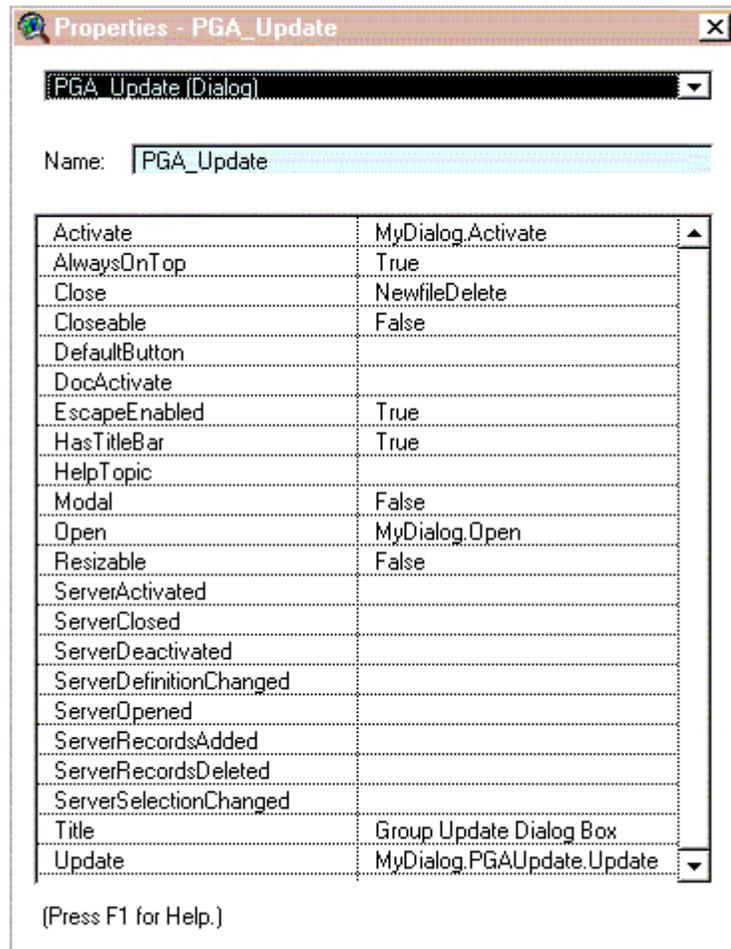


Figure 3.4: PGA Update dialog box dialog control properties

- ◆ AlwaysOnTop -- when TRUE, the dialog box always promotes to the top of the ArcView window.
- ◆ Close -- associates as script that executes whenever the dialog box is closed
- ◆ Closeable -- indicates whether or not a dialog can be closed using the window frame controls. The controls are disabled when the Closeable property is FALSE.
- ◆ EscapeEnabled -- When TRUE, allows the user to dismiss the dialog box by pressing the ESCAPE key.

- ◆ HasTitleBar -- determines whether or not the dialog window will have a title bar. The frame will be titled with the text set in the Title property if HasTitleBar is TRUE.
- ◆ Modal -- prevents the user from working with any function in ArcView other than the dialog if TRUE.
- ◆ Open -- the script that runs whenever the dialog is opened.
- ◆ Resizable -- allows the user to resize the dialog box if set to TRUE.

List box property settings for the PGA Update dialog box:

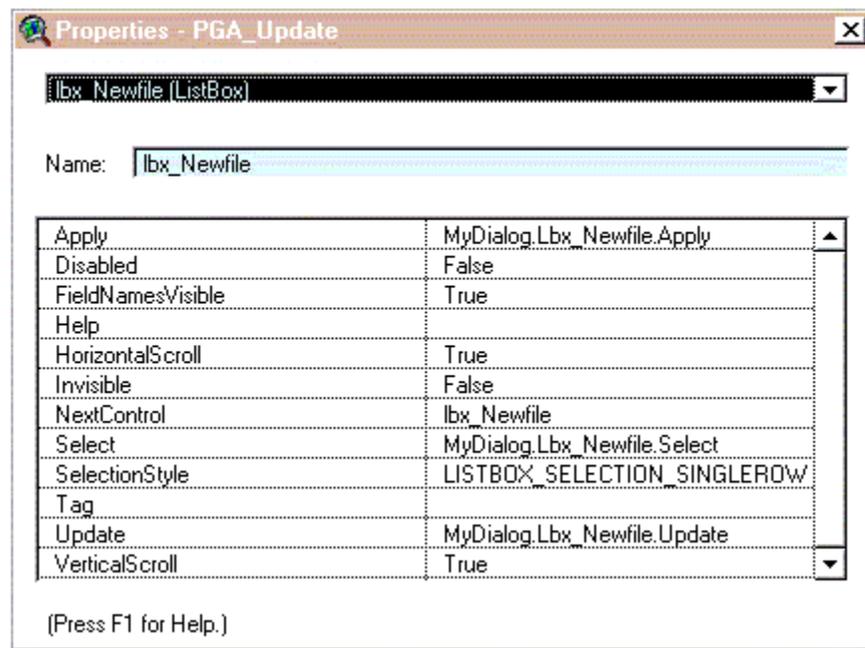


Figure 3.5: PGA Update dialog box list box properties

- ◆ Apply -- the script that executes when an *apply* event occurs. In the case of lbox_Newfile, the apply event occurs whenever a record inside the listbox is double-clicked.
- ◆ Disabled -- determines whether or not the listbox will be disabled. The listbox is disabled if this property is set to FALSE. Controls that are disabled are typically enabled when their Update script is run.
- ◆ FieldNamesVisible -- when the list box control is derived from a VTab, the field names will appear above the listbox if the FieldNamesVisible is set to TRUE.

- ◆ HorizontalScroll -- determines whether or not there will be a horizontal scroll bar in the list box. If FALSE, no horizontal scroll bar will appear and the elements inside the list box are sized to fit.
- ◆ Invisible -- sets the control invisible if TRUE. Controls that are invisible are typically set visible by the SetVisible request inside their Update script.
- ◆ NextControl -- specifies the control that will receive keyboard focus when the TAB key is pressed.
- ◆ Select -- name of the script that executes when a record is selected in the list box.
- ◆ SelectionStyle -- an enumeration that defines what type of selection is made from the list box. Lbx_Newfile is set to select a single row.
- ◆ Vertical Scroll -- determines whether or not there will be a vertical scroll bar in the list box. If FALSE, no vertical scroll bar will appear and the elements inside the list box are sized to fit.

Label button properties for the PGA Update dialog box:

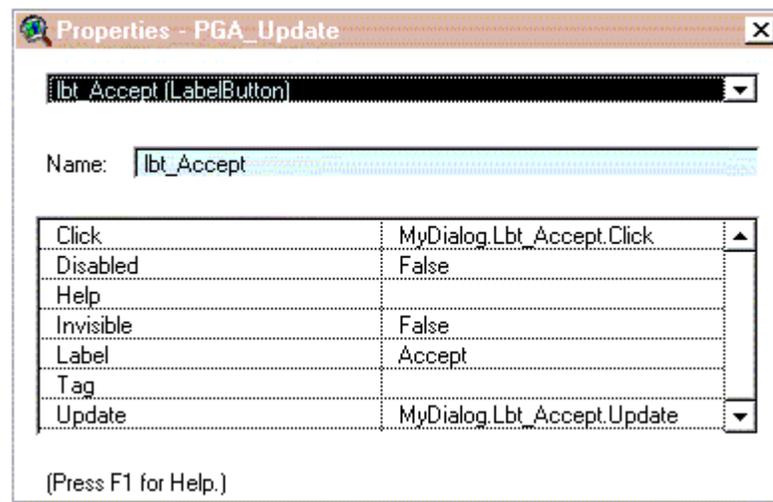


Figure 3.6: PGA Update dialog box Accept label button properties

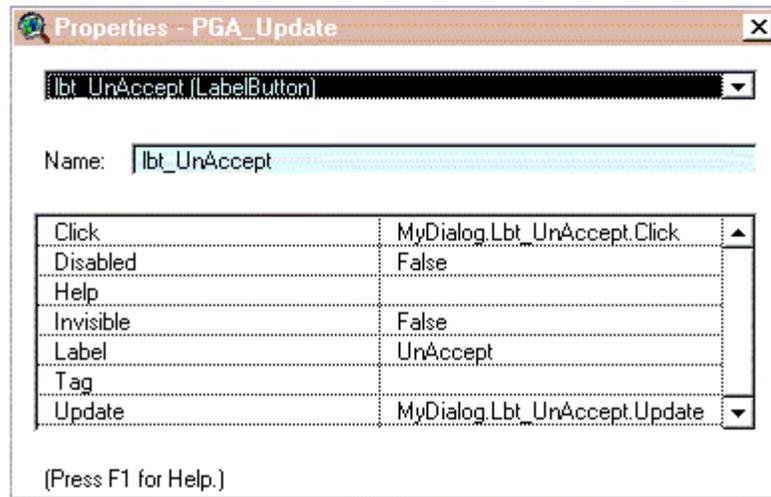


Figure 3.7: PGA Update dialog box Unaccept label button properties

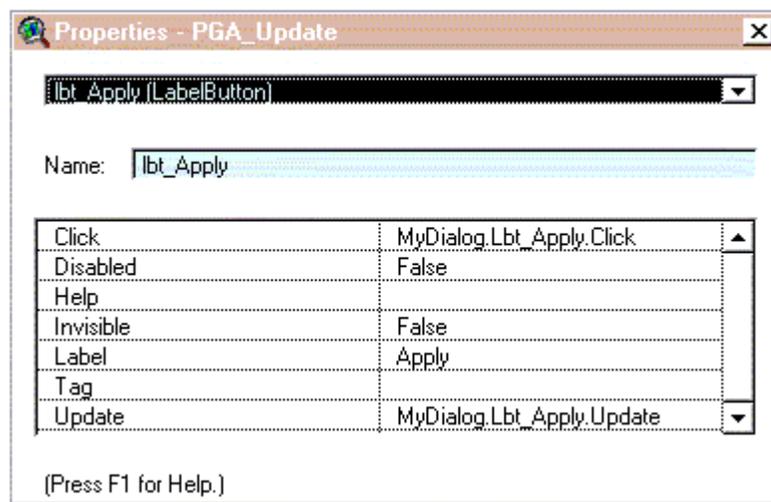


Figure 3.8: PGA Update dialog box Apply label button properties

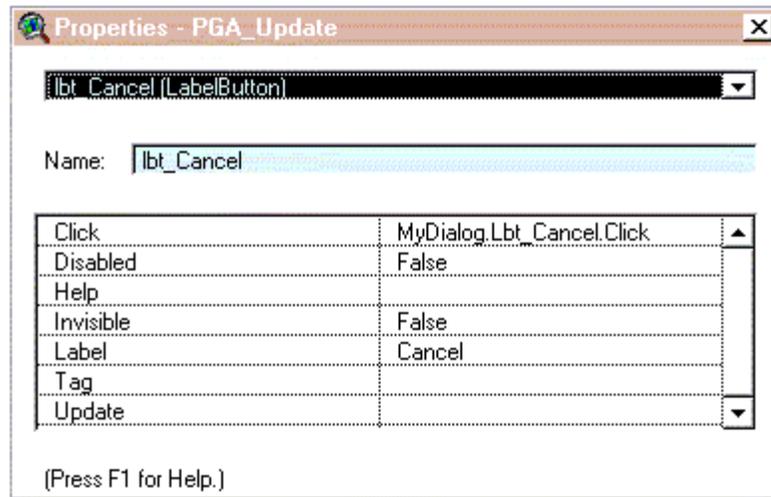


Figure 3.9: PGA Update dialog box Cancel label button properties

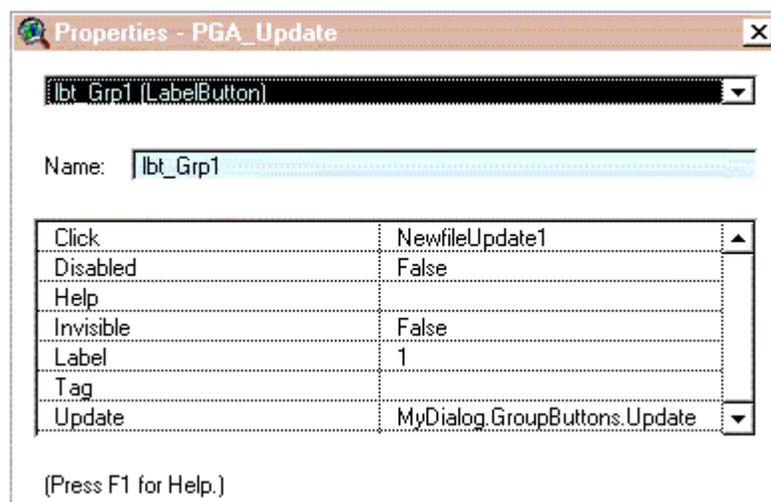


Figure 3.10: PGA Update dialog box Group 1 update label button properties*

* The *Update Group Assignment* label button properties are similar for all seven buttons. The Label field values for the seven buttons are 1, 2, 3, 4, 5, 6, and 7. These labels reflect the values that are calculated into the selected record's PGA when the button is clicked. The Click properties are associated with the NewfileUpdate'x' scripts, where 'x' is equal to the label text (i.e. the Click script for label 2 is NewfileUpdate2).

- ◆ Click -- name of the script that executes whenever the label button is selected or "clicked".
- ◆ Disabled -- indicates whether or not the control is disabled. By default, Disabled is FALSE. When set to TRUE, the button is "greyed" out.

- ◆ Invisible -- sets the control invisible if TRUE. Controls that are invisible are typically set visible by the SetVisible request inside their Update script.
- ◆ Label -- the text that appears on the label button
- ◆ Update -- the script that runs whenever an Update event occurs. Update events occur whenever a broadcast is sent to the listener component. For this program, the listener and broadcaster controls are set in the script MyDialog.Open.

Once a site or group of sites is selected, either by spatial or logical means, the dialog box can be opened from either the View or Table GUI by clicking the Open PGA Update Dialog Box button located on the GUI button bar.

 Open PGA Update Dialog Box button

This executes a script associated with the dialog's open property, which, among other things, creates a temporary table called *newfile* whose VTab is imported from the selected records of the PTC attribute table. These records are used to populate the list box in the PGA Update dialog. *Newfile* only exists as long as the dialog box is open; when the dialog is closed the values from *newfile* are used to edit the PTC inventory table and *qtable*.

While open, the dialog box gives the user access to various controls that will aid in editing the PTC inventory table. The following paragraphs describe each control and its function in detail.

List box (Lbx_Newfile). The list box values (fields and records) are loaded from *newfile*. The records can be selected one-at-a-time, which sends a broadcast to the Accept and Unaccept label button controls. This runs their update scripts that dictate which button will appear on the dialog box. If the AcceptFlag field for the record is zero (0), then the Accept button will appear. Otherwise, the Unaccept button is activated.

While open, the list box displays the updated records of *newfile* as they are edited. No edits are actually made to the PTC inventory table or *qtable* until the Apply button is pressed. When double-clicked, a record's PGA value is automatically calculated to be equal to its Best_Fit1 value, and the AcceptFlag is calculated to reflect the current date.

Accept and UnAccept label buttons (Lbt_Accept, Lbt_UnAccept). Only one of these buttons are available at a time. Initially both are inactive, but when a record inside the list box is selected, either the Accept or UnAccept buttons becomes available. The two buttons are overlaid on top of one another and act as a toggle. If the selected record's AcceptFlag value is zero (0), then the Accept button is activated. Else, the UnAccept button is promoted to the top, hiding the Accept button, and it becomes active.

When clicked, the Accept label button executes the script MyDialog.Lbt_Accept.Click which calculates the current date as an integer for the selected record's AcceptFlag field. At this point, the Accept button becomes inactive, and the UnAccept button promotes to the top of the dialog and is activated.

If the UnAccept button is clicked, the selected record's AcceptFlag value is recalculated to zero (0) and the Accept button promotes and becomes active.

Apply label button (Lbt_Apply). No edits are made to the PTC inventory or *qtable* until the Apply button is clicked. When executed, the associated script writes the edited records from *newfile* to the PTC inventory table in Access via a series of SQL commands. The edits are also made to *qtable* so that the changes are visible in the PTC theme (recall that *qtable*'s Classify field dictates how the PTC sites are symbolized in the SGAA view).

Once the tables are edited, the temporary table *newfile* is deleted and the dialog box closes.

Cancel label button (Lbt_Cancel). The cancel button dismisses the dialog box without making any edit changes to the PTC inventory table or *qtable*.

Update PGA Group buttons (labeled 1 through 7). These buttons calculate the list box's selected record's PGA field. Numbered '1' through '7', the labels indicate what value is calculated into the field. These calculations are made to the table *newfile*, which in turn is used to update the PTC inventory Access table when the Apply button is clicked. In addition to calculating the PGA, whenever an update group button is clicked the AcceptFlag is also calculated reflecting the current date.

3.1.4 ACCEPTING SITE PGA VALUES FROM THE VIEW GUI

The program provides the user a means of calculating the AcceptFlag for a selected site or sites without opening the PGA Update dialog box. The analyst is able to determine what the PGA value is for a site by noting its symbology in the SGAA View. If the value is acceptable, the user can select the site (or sites) and calculate the AcceptFlag for both the PTC inventory table and *qtable* by clicking the Accept PGA button located on the View GUI button bar.

A Accept PGA button

3.2 HOT LINKS FOR SITE SAS JMP OUTPUT IMAGES

Another function of the program enables the user to view the seasonal profile graphs and each station's SAS JMP output. The former was done by associating the images to a drop down menu item in the View GUI (see section 3.3). An established hot link between the PTC sites and their individual images provided the latter. An *on-the-fly* method is used to establish the hot link between the features in the view and their associated image. This

system creates the link whenever a site is selected with the appropriate hot link button located on the View GUI tool bar.

Site SAS Analysis Image Hot link button

The images are stored in a subdirectory named 'htimages'. These files are named with the following convention:

Station(CovSysID).gif

Where '(CovSysID)' is the site's unique identifier. When a site is clicked, the tool's associated script creates a relative path and filename, locates the GIF, and displays the image in an image window. The filename is created by concatenating the CovSysID of the chosen site with the prefix 'station' and suffix '.gif'. The following is an excerpt of the script MyView.Hot link (refer to *Suppliment A: Script Documentation*):

Where theField is CovSysID

```

...
    theVal = t.ReturnValueString(theField.GetName, rec)
    if (not (theVal.IsNull)) then
        theVal = "c:\seasonal\htimages\station"+theVal+".gif"
        if (File.Exists(theVal.AsFileName)) then
            i = ImageWin.Make(theVal.AsFileName, theVal)
            i.SetScaled(false)
            i.Open
            i.Resize(650,700)
            i.MoveTo(375,50)
        else
            MsgBox.Warning("File "+theVal+" not found.,"Hot Link")
        end
    end
end
...

```

This procedure eliminated the need to store an image path and filename inside the PTC attribute table. The advantage is a smaller table and an easier approach to moving the images. Also, no editing of records in the table is needed when images are created for the PTC sites.

3.3 SEASONAL PROFILE IMAGES

The ATR Graphs button was added to the View GUI button bar after a suggestion was made by a member of the program staff. The button opens a single image that contains all seven seasonal profiles.

ATR Graphs button

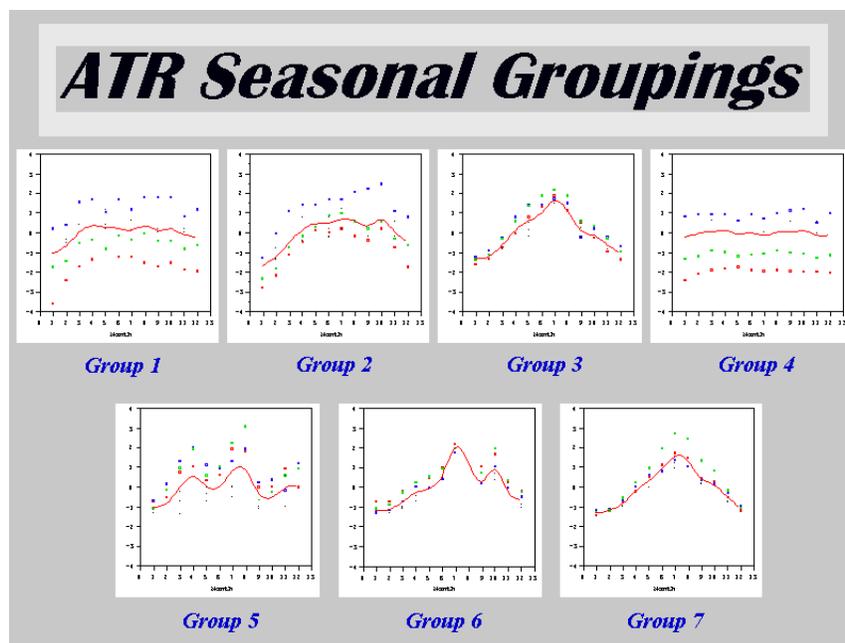


Figure 3.11: Seasonal Profiles for Groups 1 through 7

Each profile can be viewed independently as well. A menu button was added to the View GUI and named "ATR Groups." This menu contains seven menu choices, each named after the profile image they launch (e.g. Group 1, Group 2, Group 3, etc.).

3.4 VISUAL GUIDANCE: INTERACTIVE LOCATOR MAP AND ANNOTATION

The ability for the analyst to keep track of where he or she is while working in the ArcView interface is essential to optimizing efficiency in editing the PTC inventory table. Annotation, or labeling, is necessary to providing the ability to identify a feature or features on a map or view. Also, a locator map provides an effective way in which a user can quickly find the area he or she is working. Both of these concepts were implemented in this customized ArcView program.

Annotation for the ATR sites was originally produced manually and stored as attached graphics in the ATR theme. However, the creation of these graphics proved to be a long process. It was decided by the project staff to use the auto-labeling mechanism supplied by ArcView. Although the aesthetics are crude, the flexibility and speed of auto-labeling features is a more effective method. Also, the program's auto-labeler can be used to label the features of a theme with any of its values in the theme's attribute table.

Another feature added to the program labels the PTC stations in the SGAA View when the PGA Update dialog box is open. The function was requested by the program staff after the initial trial of the beta program. While working inside the PGA dialog box, difficulty arose when the analyst tried to visually link the features with their records in

the list box. By annotating the PTC sites with values from an attribute table's field (set to CovSysID by default), the analyst can easily recognize a feature in the SGAA view with its associated record inside the dialog box. When the dialog is dismissed, the labels are selected and deleted. This is a quick process, since only the PTC features within the view's extent are labeled.

By clicking the Locator Map button (located in the View GUI button bar), the user can open an *interactive* locator map view.

 Locator Map button

This view is composed of one theme depicting North Carolina's county boundaries, several zoom buttons and tools, and two custom buttons. When open, the locator view displays the county boundaries of North Carolina and a rectangle graphic showing the extent of the SGAA View. The map is interactive in that the user can resize or move the graphic to change the extent in the SGAA View by clicking and dragging the box by one of its handles and clicking the Change SGAA View Extent button.

 Change SGAA View Extent button

Another option to the user is to return to the SGAA View without changing the extent. This can be accomplished by clicking the customized Back to SGAA View button.

 Back to SGAA View button