

**HOBBY CENTER FOR PUBLIC POLICY/  
PROTOTYPE FUSION AND MODELING, LLC**

**LiabilityView 1.0 Manual**

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## INTRODUCTION

Prototype, Fusion, and Modeling, LLC (PFM) was invited by the Hobby Center for Public Policy (HCPP) to take part in the 2014 Greater Houston Partnership (GHP) Leadership Forum. PFM's role was to assist the HCPP team by creating a dynamic, interactive, three-dimensional visualization of key economic variables related to pension liabilities across the greater Houston area. As a result, PFM created the LiabilityView software to meet those requirements.

Using principles found in the Department of Defense 5000 Series Directive for Concept Exploration [1], the LiabilityView software was developed both as an analysis tool and presentation aid. The tool has very low system requirements. It will run on machines with Microsoft Windows operating systems dating back to the year 2002. Its interface was designed to be understandable to both computer experts and novices alike. The target audience for the application ranges from government officials to the general public.

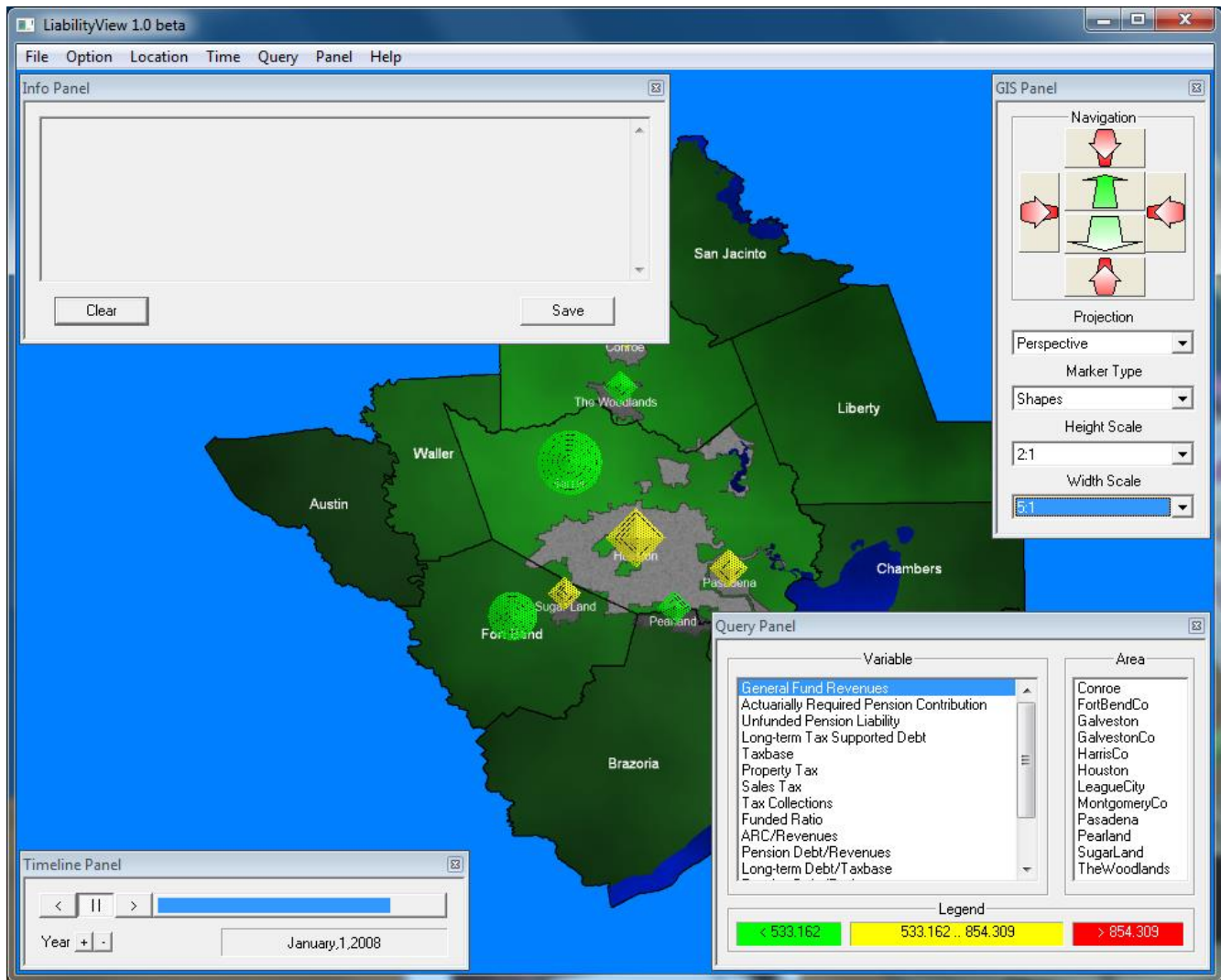
The LiabilityView software includes a database of 3,456 data items for the cities and counties studied. The data items were selected because they contained information deemed to be highly relevant to the issue of pension liabilities by members of the study team with expertise on the topic. The database is stored in a flat file format to preserve the "human readable" nature of the records. Data items that are in the current liability database range in time from 2000 to 2012 – with forecast data from 2013 to 2017. The software can readily incorporate any new additional data points occurring between January 1, 1990 and December 30, 2021.

Data, not directly generated by PFM, was obtained by a team assembled by HCPP. The source data was provided directly on the internet by the cities and counties themselves. Data for the GIS component of the software was obtained from the Harris County Public Infrastructure Department [2].

## MAIN WINDOW

The *Main Window* is the primary display area for the LiabilityView application. An image of the *Main Window*, with all of its default contents, is shown in Figure 1 below. A key feature of the *Main Window* is the interactive map. The map presents the major features of the 10-county Houston metropolitan statistical area (MSA). Although it appears similar to a traditional two-dimensional map, it is actually a three-dimensional geometric model. Because of the three-dimensional capabilities, LiabilityView supports a variety of features not possible with traditional flat-map software.

Figure 1 LiabilityView Main Window



## Navigating the LiabilityView Main Window

There are three primary methods of interacting with the LiabilityView program:

- *Mouse Commands*
- *Pop-up Panels*
- *Menu Bar*

*Mouse Commands* used in LiabilityView are typical of those found in other, well-known, software packages. These commands include: Clicking the mouse buttons, clicking mouse buttons with keyboard keys pressed, and dragging the mouse. Dragging the mouse involves moving the mouse with one of the mouse buttons held down.

*Pop-up Panels* are sub-windows that appear inside of the *Main Window*. They can be relocated or hidden from view by the user. These panels serve a multitude of purposes. They can: Change the way the map looks, determine which data items are displayed on the map, adjust the timeline to show data items between specific dates, and present detailed numerical information to users that require it.

The *Menu Bar* appears in the upper left-hand side of the *Main Window*, directly under the title bar. Items under each menu heading can be revealed by clicking the left mouse button on the heading. To pick a revealed item, click it with the left mouse button.

## Map Viewing

Map viewing is accomplished through the use of a “virtual camera” which, in many ways, is analogous to a film or video camera. Associated with the camera is a “focal point” at which it always looks. When the application starts, the focal point is at the center of the map. The camera can be positioned and oriented through four primary camera controls as follows:

1. *Aiming* changes the location of the focal point. To aim the camera, place the mouse over the desired location marker on the map. Next, click the right mouse button with the control key pressed. The focal point will automatically update to the new location marker.
2. *Zooming* allows the camera to move closer to, or further away from, the focal point. To adjust the zoom (range), drag the mouse forwards and backwards with the right mouse button pressed and the shift key held down. The mouse wheel can also be used for zooming.
3. *Panning* allows the camera to rotate horizontally (azimuth) about the focal point. To pan the camera, drag the mouse to the left and right with the right mouse button pressed.
4. *Tilting* lets the camera rotate vertically (elevation) about the focal point. To tilt the camera, drag the mouse forwards and backwards with the right mouse button pressed.

## Location Markers

Located near each city or county on the map is a three-dimensional marker, analogous to those seen in two-dimensional bar charts. The markers, collectively, represent all study areas and are spatially distributed across the Houston MSA. The height of each marker is determined by the magnitude of the currently selected variable being displayed. The width of each marker is generally related to the population of the area (which is used in per-capita calculations). Each marker has one or more tick-marks along its sides. These marks indicate the value of the currently selected variable, which is scaled logarithmically [3] so that all markers can be succinctly displayed on the map.

## Selection

Users can also get detailed information about liability data in an area via *Selection*. To make a *Selection*, point the mouse at the top of a marker on the map. Then, click the left mouse button while pressing the control key on the keyboard. Markers are the smallest selectable area on the map.

## Quick Reference Guide

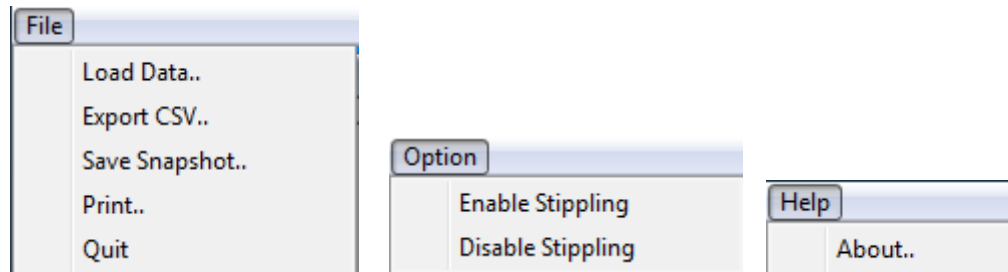
To access a quick-reference guide for viewing and selection controls, choose *About* from the *Help* menu.

## MENUS

### FILE, OPTION, AND HELP MENUS

The *File Menu* allows the user to perform liability database input and output related tasks. Figure 2 has an image of the *File Menu* which has five items:

Figure 2 File Menu, Option Menu, and Help Menu



#### Load Data

Selecting *Load Data* brings up an *Open File* dialog box that allows the user to select a liability database to load. The default file, “10-county.csv”, can be found in the “data” directory of the standard distribution folder. This file is text based and in a human readable format that can be imported into a variety of spreadsheet packages.

#### Export CSV

*Export CSV* allows the user to save a Comma Separated Value (CSV) file containing a human readable report of all areas for a specific user query. That query is based on the currently selected liability variable and the currently chosen date in the timeline.

#### Save Snapshot

The user can capture the current contents of the *Main Window* to a Windows Bitmap image file (BMP) by selecting *Save Snapshot*. In addition to saving the map, all open panels are saved in the capture as well. A panel not needed in the output image file can be closed and hidden from display. The saved bitmap image can be printed, shared via e-mail, or used with other software for further processing/analysis.

#### Print

The *Print* menu item captures exactly the same information as *Save Snapshot* but sends the image directly to a printer instead of to a file. The software will automatically scale the image to the printer resolution. In most cases, however, printing in landscape mode results in a better quality hardcopy.

#### Quit

The program can be terminated at any time via the *Quit* menu item.

## Option Menu

The *Option Menu* allows a user to enable or disable stippling. Stippling makes area markers semi-transparent. Disabling stippling can speed up LiabilityView on computers with less powerful display hardware, but can also make city and county labels harder to read.

## Help Menu

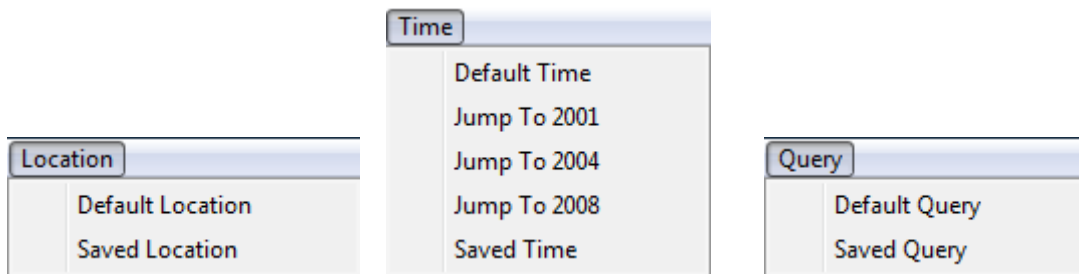
The *Help Menu* provides a means for the user to get further assistance. Select *About* for a brief reminder of mouse-based viewing commands or for contact information if further technical support is required.



## LOCATION, TIME, AND QUERY MENUS

Figure 3 is an illustration of the *Location Menu*, *Time Menu*, and *Query Menu*. The intent of the three menus is primarily to provide support for a user who is using the tool as a presentation platform. The idea is to have several events of interest ready to be called upon in rapid succession, assisting in situations where a presenter must provide a great deal of information in a short time.

Figure 3 Location Menu, Time Menu, and Query Menu



### Location Menu

The *Location Menu* allows a user to set the “virtual camera” focal point to a predefined location on the map. Selecting *Default Location* restores the view to the center of the Houston MSA. *Saved Location* is a temporary placeholder for the first user-defined location (currently undefined).

### Time Menu

The *Time Menu* gives a user the ability to skip forwards or backwards to preset dates in the timeline. Choosing *Default Time* resets the current time to the first date supported by the software. *Jump to 2001*, *Jump to 2004*, and *Jump to 2008*, set the timeline to January 1<sup>st</sup> of the years 2001, 2004, and 2008 respectively. *Saved Time* is a temporary placeholder for the next user-defined time (currently undefined).

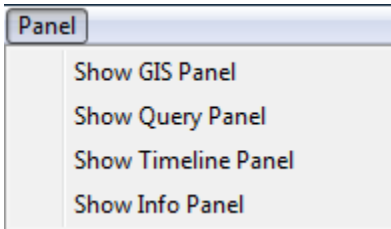
### Query Menu

The *Query Menu* allows a user to rapidly set the fields of the *Query Panel* to a predetermined query. Picking *Default Query* sets each of the fields in the *Query Panel* to their default state, which is the state the panel is in when the software is first launched from the windows desktop. *Saved Query* is a temporary placeholder for the first user-defined query (currently undefined).

## PANEL MENU

The *Panel Menu* allows the user to show panels that are currently hidden from view. Figure 4 is an image of the *Panel Menu* which has four items.

Figure 4 Panel Menu



By default, all panels except for the *Info Panel* are visible when the program starts. To hide a panel, click the small box (☒) in the upper right hand corner of the panel.

### Show GIS Panel

To reopen the *GIS Panel*, select *Show GIS Panel* from the *Panel Menu*.

### Show Query Panel

To reopen the *Query Panel*, select *Show Query Panel* from the *Panel Menu*.

### Show Timeline Panel

To reopen the *Timeline Panel*, select *Show Timeline Panel* from the *Panel Menu*.

### Show Info Panel

To reopen the *Info Panel*, select *Show Info Panel* from the *Panel Menu*, or make a *Selection* with the mouse.

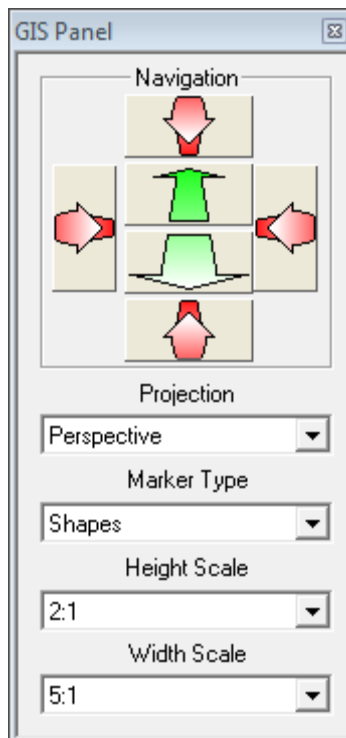
Each panel can be moved around inside the *Main Window*. In many cases, panels must be moved to uncover parts of the map they obscure. To drag a panel, place the mouse over the panel name and move the mouse while holding down the left mouse button. For a layout that works well, place the *GIS Panel* in the upper right, the *Query Panel* in the lower right, and the *Timeline Panel* in the lower left of the *Main Window*. Panels will remember their positions when hidden.

## PANELS

### GIS PANEL

The *GIS Panel* allows the user to modify the map displayed in the main window. Figure 5 is an image of the *GIS panel* which consists of four major components: The *Navigation Group*, the *Projection Drop-Down Menu Button*, the *Marker Type Drop-Down Menu Button*, and the *Height scale/Width scale Drop-Down Menu Buttons*. By default, the panel is configured to show a perspective projection with a 2:1 height scale/width scale using shapes (cones and pyramids) as markers.

Figure 5 GIS Panel



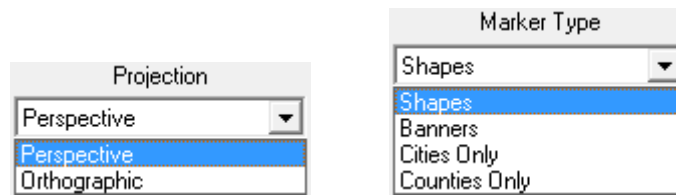
#### Navigation Group

As seen above, the *Navigation Group* allows the user to pan or zoom the view of the map without using mouse dragging or the corresponding key combinations. The red arrows perform “pirouette” rotation in the horizontal and vertical plane while the green arrows move the user closer to, or farther away from, the focal point on the map. For repeated zooming or panning, press and hold the left mouse button over the appropriate arrow.

#### Projection Drop-Down Menu Button

The *Projection Drop-Down Menu Button*, shown in Figure 6, allows the user to select between perspective and orthographic projections. Perspective projection provides a 3-dimensional view with distant parts of the map appearing smaller and further away. Orthographic projection yields a traditional top-view, or planimetric, 2-D map display. Panning is only available when perspective projection is used.

Figure 6 Projection and Marker Type drop-down menu buttons



### Marker Type Drop-Down Menu Button

The *Marker Type Drop-Down Menu Button* allows the user to choose the type of symbol displayed at each area on the map. The drop-down menu button has four options: *Shapes*, *Banners*, *Cities Only*, and *Counties Only*.

### Shapes Marker Type

The *Shapes* marker type uses cones (for Counties) and pyramids (for Cities) to depict the value of the currently selected liability variable at the location of each area studied. The height of the shape represents the log-scaled magnitude of the selected liability variable. The width of the shape generally indicates the log-scaled magnitude of the population in that area (for per capita calculations). The color of the shape provides a quick estimate of how low, or high, the value of an area is compared to its neighboring areas. The scheme is based on a “traffic light” model with green used for lower values, red for higher values, and yellow for values in-between.

### Banners Marker Type

The *Banners* marker type uses rectangular flags (for Counties) and triangular flags (for Cities) to depict the value of the currently selected liability variable at the location of each area studied. The height of the flag pole represents the log-scaled magnitude of the selected liability variable. The length of the flag generally indicates the log-scaled magnitude of the population in that area. The color of the flag is determined by the same traffic light model used in the *Shapes* marker type. The position of the flag on the flag pole gives a more detailed view of how the liability variable changes temporally. It is handy in situations where there is not enough of a magnitude difference, over time, to register a color change on the flag. If the flag is lower on the pole then the liability variable is lower in magnitude and if it is higher up the pole the opposite is true.

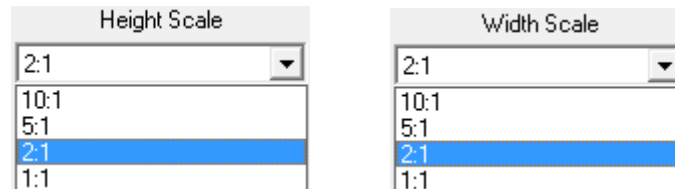
### Cities Only/Counties Only Marker Types

The *Cities Only* and *Counties Only* marker types are identical to the *Shapes* marker type but with only one type of area depicted on the map – either cities or counties.

## Height Scale/Width Scale Drop-Down Menu Buttons

Figure 7 shows the *Height Scale* and *Width Scale Drop-Down Menu Buttons*. The two drop-down menu buttons are used in combination to make the markers on the map larger or smaller. Their purpose is to increase the visibility of areas on the map under differing viewing conditions.

Figure 7 Height Scale/Width Scale Drop-Down Menu Buttons



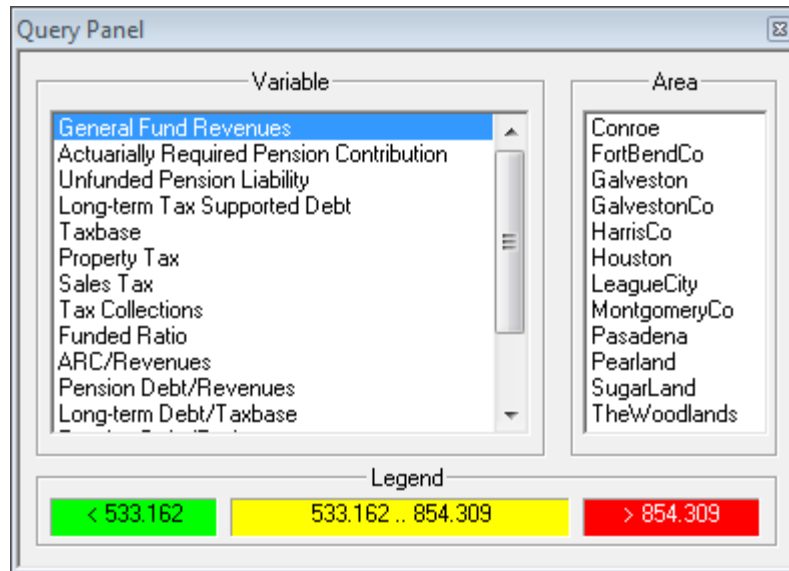
### Scale ratio

Four scale ratios are provided: *1:1*, *2:1*, *5:1*, and *10:1*. A scale of *10:1* tells the software to draw the markers ten times larger than normal. The default value in both cases is *2:1*, and a value of *1:1* implies a reduction in the default size of the markers.

## QUERY PANEL

The *Query Panel* provides the user with options for selecting which liability variables are displayed on the map. An image of the *Query panel* is illustrated in Figure 8. The *Query Panel* has three major sections: The *Variable Group*, the *Area Group*, and the *Legend Group*.

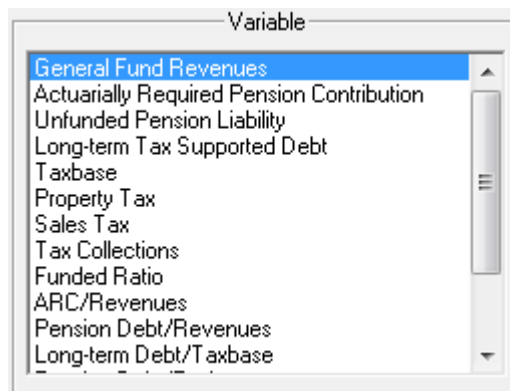
Figure 8 Query Panel



### The Variable Group

The *Variable Group*, shown in Figure 9, allows the user to select specific liability variables to view on the map. The size and color of each city or county marker will change relative to the magnitude of the selected variable and the date chosen in the timeline. There are currently 16 different variables a user can select. More can be added at a later time, if necessary. The scroll bar at the right-hand side of the *Variable Group* can be used to expose variables not currently visible in the window.

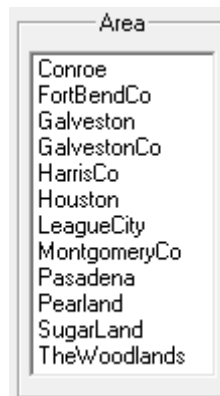
Figure 9 Variable group



## The Area Group

The *Area Group*, shown in Figure 10, lets the user select one of the, currently 12, cities or counties for the software to display detailed information about. Upon selecting an area in the *Area Group*, the map will center on the marker for the desired area. At the same time, the *Info Panel* will open (if it is not currently open) and specific numbers regarding the query will be printed for the user to inspect. Simultaneously, the other areas on the map will be “ghosted” – or made partially transparent-- to allow the user to get a clearer view of the target’s marker.

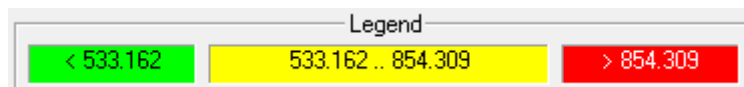
Figure 10 Area group



## The Legend Group

The *Legend Group*, shown in Figure 11, provides information related to the range of data values on display to the user. Its primary purpose is to provide “quick look numbers” showing how each area is performing relative to the others. Variables that are not specifically stated to be ratios in the *Variable Group* will be colored based on their per capita values. This allows the traffic light model used in the legend to assist the user in making apples-to-apples comparisons between the different markers displayed on the map.

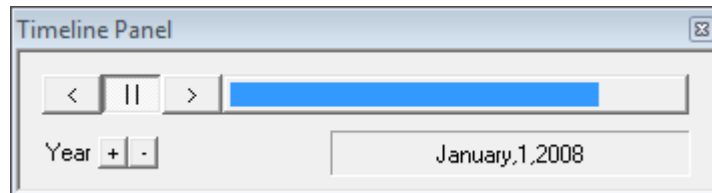
Figure 11 Legend group



## TIMELINE PANEL

The *Timeline Panel* allows users to dynamically display liability data for a specific point in time on the map. This time is known as the “current time”. By default, the current time is set to the first time present in the database. Figure 12 is an image of the *Timeline Panel*, which has three primary areas of interest: The *Date Display*, the *Tape Deck*, and *Fine-Tuning Controls*.

Figure 12 Timeline Panel



### Date Display

The *Date Display* is visible in the lower right-hand corner of the *Timeline Panel*. It shows the current date the software is using to select liability data for each area displayed on the map. It has the following format: month, day, and year.

The current date is updated by user interaction with the mouse, *Tape Deck* or *Fine-Tuning Controls*. The *Date Display* will rollover if the user attempts to set it to anything beyond December 31, 2021. It will also roll-under if the user attempts to set it earlier than January 1, 1990.

The user can control forward and reverse playback with the mouse. Dragging the mouse to the left, with the left mouse button down in the main window, controls reverse playback. To drive the timeline forward, drag the mouse to the right in the main window with the left mouse button down.

### Tape Deck

The *Tape Deck* derives its name from its similarity to an audio/video cassette player. It consists of a set of three *Radio-Buttons* and a *Timeline Indicator* bar.

### Radio Buttons

The three *Radio-Buttons* are mutually exclusive and selecting one will de-select either of the other two. By default, the *Pause Button* (||) is selected indicating that playback of liability data is halted. Click the *Forward Button* (▶) to automatically step forward from the current time. Click the *Reverse Button* (◀) to automatically step backwards from the current time.

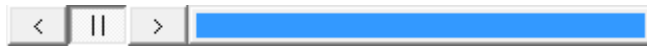
### Timeline Indicator Bar

The *Timeline Indicator Bar* depicts, for the user, where in the timeline the current date falls. The user has reached the end of the actual data when the blue bar extends all of the way



across its gray container, as shown in Figure 13. Advancing the timeline forward from that point shows data that was generated via forecasting.

Figure 13 Timeline Indicator Bar



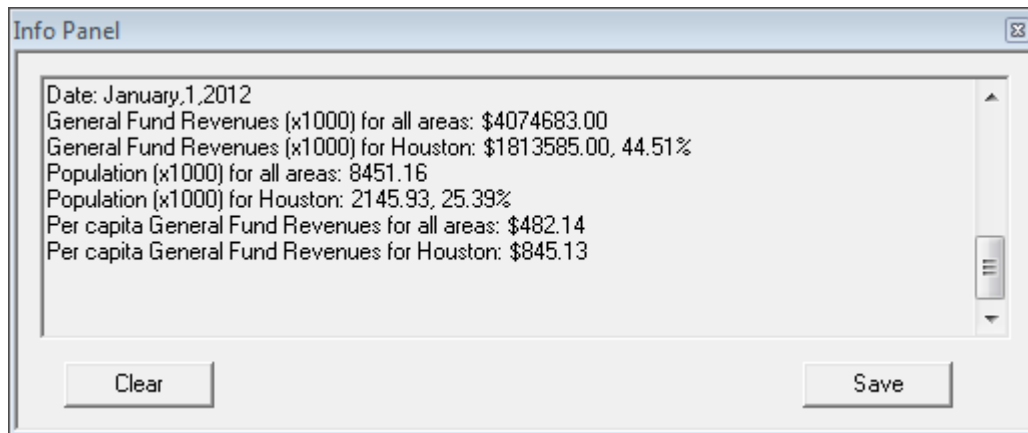
### Fine-Tuning Controls

The *Fine-Tuning Controls* are provided so that users can make very specific adjustments to the timeline. They include the *Increment Button* (+), and the *Decrement Button* (-). To move the year forward by one unit, click on the *Increment Button*. To move it backwards by one unit, click on the *Decrement Button*.

## INFO PANEL

The *Info Panel* provides detailed information about each selection made by the user. If the panel is not visible when the user makes the selection, it will automatically be displayed. Figure 14 illustrates an image of the panel which has three components: The *Text Area*, the *Clear Button*, and the *Save Button*. Information displayed in the *Text Area* depends on the date chosen in the *Timeline Panel* and the specific query options enabled in the *Query Panel*.

Figure 14 Info Panel



### Text Area

For each selection, and current liability variable, a set of lines are printed into the *Text Area*:

1. A line specifying the current date of the query.
2. Lines specifying the aggregate value of all areas studied
3. Lines specifying the selected area along with its percentage of the aggregate total.
4. A line specifying the per capita value (or ratio for ratio variables) for all areas studied
5. A line specifying the selected area per capita value (or ratio for ratio variables)

Data from multiple selections are recorded in the *Text Area* in the order the selections were made. When the visible portion fills with text, previous data will scroll out of view. A scrollbar will then appear on the right-hand side of the *Text Area*.

To see results from previous selections, drag the scrollbar upwards with the mouse or use the arrow at the top of the scrollbar. Dragging the scrollbar downwards, or clicking the arrow on the bottom of the scrollbar, will bring data from more recent selections back into view. Making another selection will always cause the *Text Area* to jump back to the most recently printed information.

## Clear Button

The *Clear Button* removes all selection information from the *Text Area*, returning it to its default state.

## Save Button

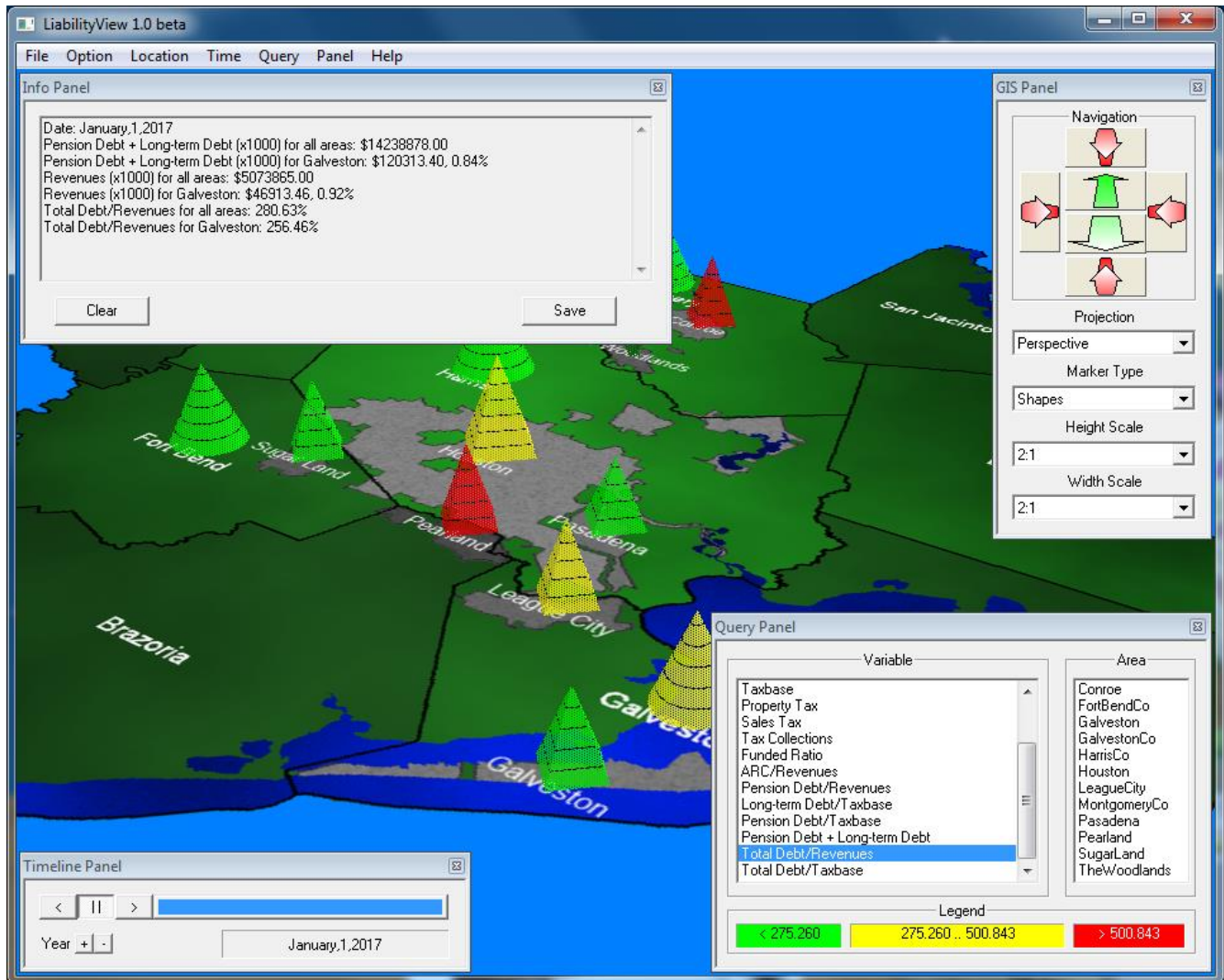
The *Save Button* allows a user to save information currently recorded in the *Text Area* to a file on disk. Both buttons can be used, in combination, to create a simple data file of area liability details. This file can be printed, shared via e-mail, or used with other software for further processing/analysis.

**EXAMPLE**

Below is an example that is provided to illustrate some of the concepts and graphical user interface components previously described in detail. As can be seen in Figure 15:

- The user has taken a 3-point perspective view centered on Pasadena.
- The current query looks at “Total Debt/Revenues” for each area.
- Red markers indicate areas whose debt is > 500% of their revenues and green markers are for areas with debt < 275% of revenue.
- The current date under consideration is 2017, which uses forecast data.
- Galveston has been selected and specific details relating to its Total Debt/Revenue are printed in the *Info Panel*.

Figure 15 Example of output from LiabilityView software



## WEB REFERENCES

[1] Department of Defense 5000 series Directive,  
<https://dap.dau.mil/aphome/das/Pages/Default.aspx>

[2] Harris County Public Infrastructure Department,  
<http://www.eng.hctx.net/gis.htm>

[3] Logarithmic Scaling,  
[http://en.wikipedia.org/wiki/Logarithmic\\_scale](http://en.wikipedia.org/wiki/Logarithmic_scale)