# A Manual of Methods to Plan for Public Access to Florida's Coastal Waterways

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## Introduction

This manual presents a spatial approach for evaluating and selecting suitable sites for marinas and ramps in order to meet projected demand for public boating facilities within a specified area, such as a county. The process outlined in the manual will result in a planning instrument that specifies the type, quantity, and location of public boating facilities needed to meet projected demand. The goal is to provide planners and resource managers with a mechanism to balance growth and development of boating access facilities, with protection and management of coastal resources, while minimizing environmental impacts on sensitive marine habitats. Specific planning objectives include:

1. Determination of the current capacity of publicly accessible ramps and marinas within the study area;
2. Evaluation of current usage patterns at publicly accessible ramps and marinas;
3. Projection of future demand for publicly accessible ramps and marinas;
4. Comparison between the current and future demand for and supply of publicly accessible ramps and marinas;
5. Suitability analysis of potential sites to place new marinas and ramps and/or expand existing ones to meet anticipated boater demands.

The analytical methods presented in the manual are based on work conducted by the Florida Sea Grant College Program and others; references for relevant publications are cited at the end of the document. The methodological elements presented include boater demand projections and the application of suitability criteria to determine which sites are best for expanding existing facilities and/or developing new ones. An area-wide analysis compares the present and future stock of shore-side boating facilities with current distributions of boating trip origins and on-the-water routes and activity patterns.

The site suitability analysis is based on an evaluation of landside and waterside information. The landside data is parcel-based and is derived from existing datasets or interpretation of aerial imagery, which is then ground-truthed. Landside information consists of data such as zoning, current use, docks, road access, sewer, and potable water. Waterside data is obtained from various sources and at various scales, and includes attributes pertaining to salt-water access, water depth adjacent to parcel location, sea grass, wetland, and protected species.

## Determining Current Capacity of Existing Boating Access Facilities

The first procedural step is to determine the location and capacity of those boating access facilities in the study area open to the public. County personnel usually have this information or they will be able to provide a fairly complete list of ramps and marina wet and dry facilities within their jurisdiction. Other sources of information include publications (boater guides) produced by jurisdictions (e.g., a county) or the State (for example, the FWC Fish and Wildlife Research Institute). Internet searches can also provide relevant information. Another potential information source regarding facilities is the comprehensive statewide inventory of all publicly accessible boating facilities being conducted by the FWC Boating and Waterway Section and scheduled for completion in 2007 (www.floridaconservation.org/boating). Lastly, interpretation of aerial imagery or site visits to boat access facilities may be necessary to verify information, such as capacity: available parking or the number of slips and/or ramp lanes. An example of the spatial distribution of public boat ramps is shown for Sarasota County in Figure 1.


**Figure 1. Sarasota County Public Ramps.**

## Determining Current Usage Patterns at Existing Boating Access Facilities

Once all relevant boating access facilities within the study area are accounted for and mapped, a sampling schedule is devised for visiting boat ramps in order to identify patrons. Ideally, the schedule will extend over one year to allow for determination of seasonal fluctuations in usage and on-the-water recreational patterns and activities. The number and distribution of sample dates should be such that sufficient numbers of surveys from patrons are returned for each of the seasons or time periods that are to be characterized. Based on average return rates of 20 to 25 percent that were achieved during four prior implementations of a mail survey sent to patrons of boat facilities in Florida,[1] a sample frame of approximately 2,000 unique patrons for each time period is needed to receive ±400 completed surveys.[2] This is the sample size that is required to adequately profile patrons—given the estimated size of boater populations that can be expected to use facilities within any particular Florida county;[3] the calculation is based on a tolerable error of ± 0.05 and a confidence level of 95 percent.

Past studies demonstrate that many patrons of boating access facilities reside outside the county in which the facility is located. Nonetheless, accounting for the total population of registered boaters in surrounding counties will not increase the sample size above 400 using a tolerable error of ± 0.05 and a confidence level of 95 percent.

**Sampling Schedule:** Several methods can be used to estimate the relative distribution of ramp usage that occurs throughout the year, thereby enabling the construction of a schedule of weekends and weekdays on which to sample ramps during the course of a year. Preferably, prior boating activity studies will exist that can provide insights on temporal and seasonal boating patterns for the study area or for other similar boating regions. The references section of this manual contains examples of such studies that were conducted in the following counties: Brevard, Collier, Duval, Indian River, Palm Beach, St. Lucie, and Volusia. Similar studies for other counties likely exist and can be found by searching the gray literature or by contacting county or municipal personnel directly.

In the absence of information that is specific to the study area, more generalized information may be used to provide an estimate of seasonal boating patterns. A 2005 statewide survey of 1,140 Florida boaters indicated that peak boating activity occurs during the months of May, June, July, and August and accounts for 41 percent of yearly activity (Figure 2). According to survey results, approximately 10 percent of all boating excursions occur during each of the peak months (11 percent in July). This general trend is corroborated by the percentages of trips reportedly taken by Tampa Bay, Sarasota County, and Greater Charlotte Harbor boaters over the course of a year as shown in Figure 3. Site visits to area ramps on average weekdays and weekends can provide an estimate of differential usage patterns during the week versus on weekends.

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[1] Sidman and Flamm, 2001; Sidman, Fik, and Sargent, 2004; Sidman, Swett, Fik, Fann, Fann, and Sargent, 2005; Sidman, Swett, Fik, Fann, and Sargent, 2006.

[2] Information obtained during the four prior implementations of the mail survey indicates that "power" users—those persons who boat most frequently—are the ones who are more likely to return the survey.

[3] In 2005, the number of registered vessels in Florida ranged from 824 in Union County to nearly 59,000 in Miami-Dade County; these numbers represent all vessels and, therefore, include boats that do no use ramps or marinas. The sample size for each of these populations, assuming a tolerable error of ± 0.05 and a confidence level of 95 percent, is 262 for Union County and 382 for Miami-Dade.

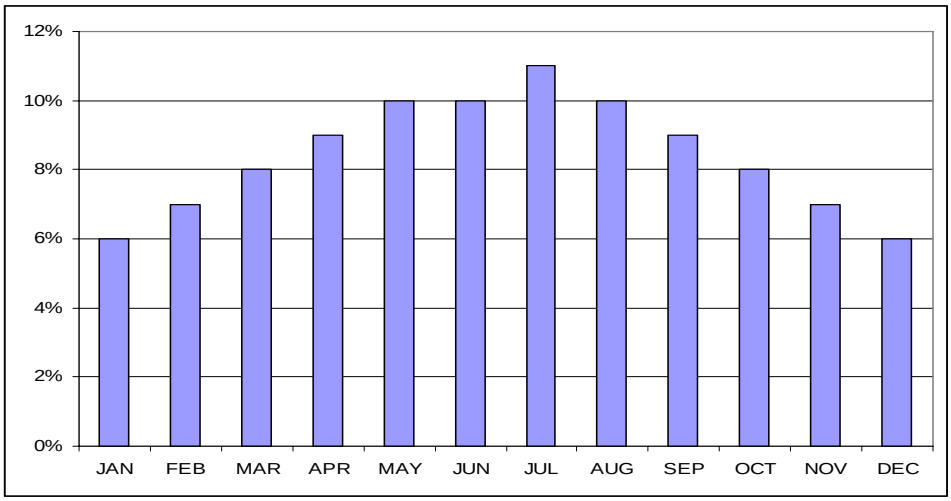


**Figure 2.** Relative monthly distribution of boating activity during a one year period (Swett, Fann, DeLaney 2005).

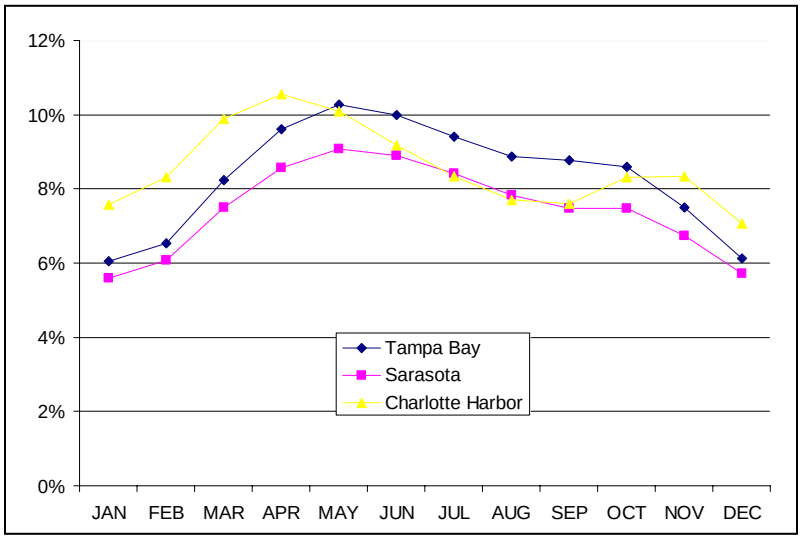


**Figure 2.** Relative monthly distribution of boating activity during a one year period for Tampa Bay, Sarasota County, and Charlotte Harbor.

The sampling schedule should be designed to estimate the number of survey days required to obtain a minimum of 2,000 unique trailer and/or auto tag numbers for each season / time period, while allowing for an estimated 20 percent of trailer and auto tag numbers that will not match listings in the Department of Highway Safety and Motor Vehicle registration database (VTRS). Appendix 1 demonstrates a method used to derive a sampling schedule for Brevard County.

**Sample Design:** The sampling scheme is designed to profile populations that access study area waterways via publicly accessible boat ramps and marina wet and dry slips. As previously mentioned, the sample size required to profile each of the three boater groups is a function of the desired confidence interval and confidence level. Given a total population of finite size, N, a tolerable error amount, e, and a desired confidence level as specified by the normal random

variate, Z, the required sample size, n, for estimating a population proportion, p, is determined by: (see footnote 4 for an example calculation of sample size using the following formulas[4])

$$n_o = \frac{Z^2 p(1-p)}{e^2}$$

$$n = \frac{n_o}{1 + \frac{(n_o - 1)}{N}}$$

Population estimates for marina wet slip and dry storage facilities can be determined from the total wet slip and dry storage capacities within the study area, which can be obtained from interviews with facility managers or, in some instances, by counting slips using aerial photography. The ramp user population can be estimated by analyzing information contained in the VTRS according to the following criteria

1. Vessel registrations for the target county or the estimated boating region.[5]
2. Vessel type equal to "open motorboat" or "cabin motorboat."
3. Vessel length greater than 8 feet and less than 26 feet.

The estimated *sample required* for each water-access type can be determined based on a tolerable error of ± 0.05 and a confidence level of 95 percent (z = 1.96). The *estimated questionnaires required* is a function of a *return rate multiplier* that assumes a 20 percent return rate based on return rates from previous surveys of southwest Florida boaters (Antonini et al., 1994; Antonini et al., 2000; Sidman and Flamm, 2001; Sidman, et al., 2004).

**Sample Selection:** Automobile and boat trailer registration numbers collected at area boat ramps and vessel bow numbers collected at marinas are used to obtain names and mailing addresses from the State's VTRS database. The registration information is used to identify the names and mailing addresses for patrons of boat ramps and marina wet slip and dry storage facilities. In addition, the name and mailing address for owners of observed documented vessels can be obtained from the United States Coast Guard (USCG) documented vessel database (www.st.nmfs.gov/st1/commercial/landings/cg_vessel2.html). The prescribed sample size is then drawn from the resulting information.

**Survey Instrument:** An understanding of the origins and destinations of boat traffic is fundamental to planning the expansion of shore facilities. A mail survey is an established method for acquiring spatial and behavioral information from boating communities and is the recommended method to be used for determining current waterway access patterns (West 1982;

[4] For example, assuming a population (N) of 59,000 registered boats in Miami-Dade County, a desired confidence level of 95% (Z = 1.96) and tolerable error of 5% (e = 0.05), and a proportion of 50 percent (p = .5), the sample size for Miami-Dade County (n) would be 382.

[5] The population of boaters that use a particular county's boating access facilities likely extends beyond those vessels that are registered in the county; previous studies shows that many patrons come from surrounding counties. Unfortunately, a priori to visits to area ramps, the geographic extent of the "market or service area" is unknown.

Falk, Graefe, Drogin, Confer, and Chandler 1992; Antonini, Zobler, Sheftall, Stevely, and Sidman, 1994; Antonini, West, Sidman, and Swett, 2000). The FWCC and FSG have successfully implemented mail surveys in as series of recreational boating characterization studies conducted for several of Florida's boating regions. The survey instrument used for those studies consisted of a two-sided 22 X 34 inch questionnaire that folded in quarters to 8.5 X 11 inches (see Appendix 2 for an example survey instrument). One side of the questionnaire consists of a scale map of the boating region of interest and the reverse side consists of 27 questions divided into the following topical areas:

1. Description of primary vessels owned and operated
2. Description of last two recreational boating trips
3. Description of favorite boating destinations and activities
4. Description of survey respondent
5. Open questions to identify perceived problems and needs

The questionnaire asks survey recipients to (1) mark the start and end point of their last two recreational boating trips on a map, (2) draw their travel routes, (3) identify their favorite boating destinations along those routes, and (4) annotate the map with abbreviations for the primary activities in which they engage while at each destination. Respondents also indicate on the map any places that they consider to be congested. Complementary questions allow recipients to characterize their last two trips according to vessel types, departure dates and times, and the amount of time spent on the water. In addition, recipients indicate the number of days per month that they take trips and the primary activities in which they engage while at a favorite destination. They are also asked to identify and rank reasons for selecting departure sites and travel routes.

**Spatial Database Design: A Boating Resource Geographic Information System:** A Boating Resource GIS serves as an information management system to capture, store, integrate, analyze, and display mapped information. The Boating Resource GIS is used to integrate the boater survey information with data from diverse federal, state, county, and local agencies about marine use siting features and related uses on salt-water accessible parcels in the study area. The GIS is designed as a relational data base which couples an ecosystems-based approach to boating resource management at the parcel level.

The spatial data provided by respondents to the boater survey is digitized into the boating resource GIS using software such as ESRI ArcGIS. The information is entered into the GIS employing heads-up digitizing and using, as a basemap, aerial imagery such as United States Geological Survey (USGS) normal color Digital Orthophoto Quarter Quadrangles (DOQQ). USGS DOQQs and other relevant spatial datasets can be obtained from the Land Boundary Information System (www.labins.org) that is maintained by the Florida Department of Environmental Protection's (FDEP) Bureau of Survey and Mapping or from the University of Florida GEOPLAN Center's Florida Geographic Data Library (http://www.fgdl.org)

GIS data layers that depict the positions of marinas, ramps, navigation aids, and artificial reefs are used as background themes to enhance accuracy during the digitizing process. Trip departure

sites and congested spots are digitized as point features and each record is coded with the survey control number and trip number. Favorite destinations are digitized as point features and coded with the survey control number, trip number, and the activities that a respondent engages in while at each favorite destination. Travel routes are digitized as line features and coded with the following attribute information: survey control number, trip number, round trip or one way, and whether or not the trip extended beyond the study area.

The database structure allows information from survey questions to be linked to digitized spatial information via the survey control number (ID), which uniquely identifies the spatial and attribute information provided by each survey respondent. The selection and display of favorite destination point data within the GIS is illustrated in Figure 3 for a portion of the southern Sarasota Bay boating area. Red dots represent departure sites identified by survey respondents; green dots represent favorite destinations; yellow dots represent a sub-set of favorite destinations where survey respondents reported that they like to "nature view." The 'Select by Attributes' window - upper left corner of Figure 3 - illustrates a GIS database query that selects and displays favorite destination points that are associated with nature viewing (e.g., NV = "Y"). The 'Selected Attributes of Destinations' window - lower left corner of Figure 3 - displays all linked database records in yellow.

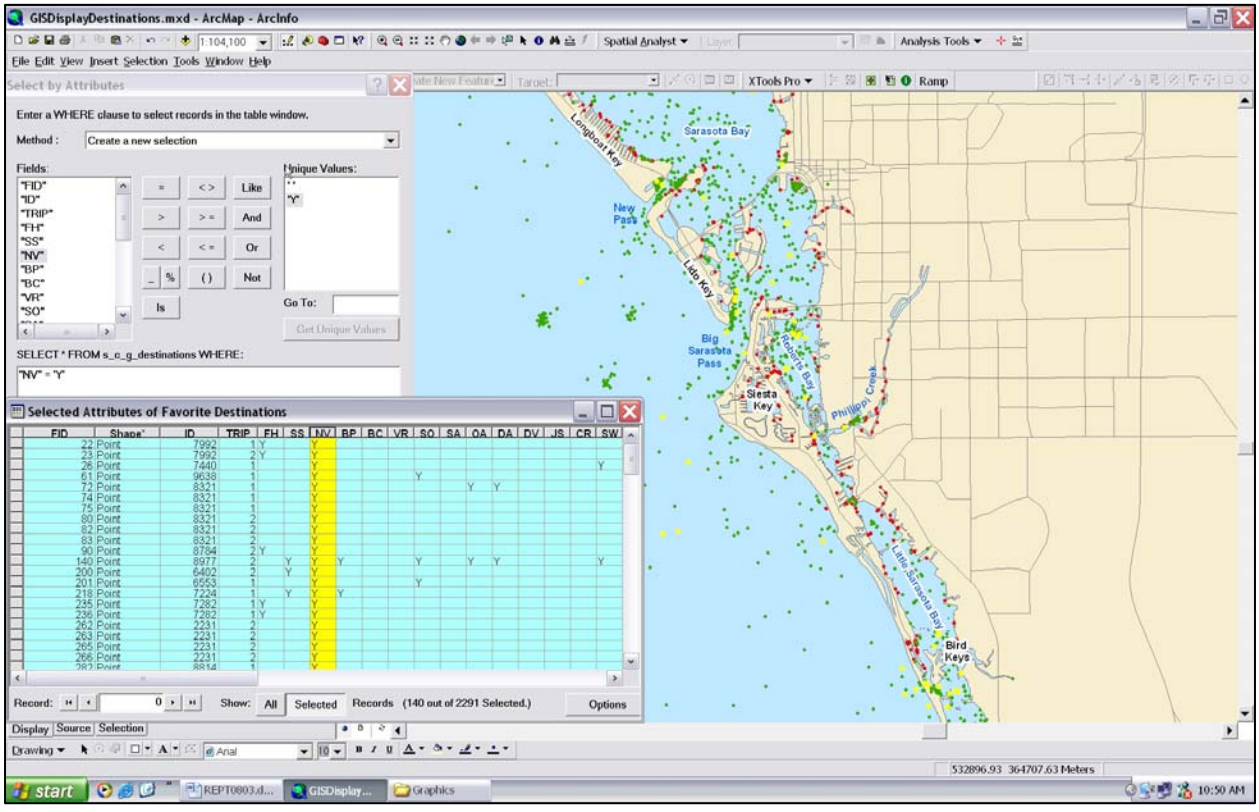


**Figure 3. Example of GIS Attribute Query and Display.**

Figure 4 exemplifies reported travel routes within the southern Sarasota Bay boating region. Pink lines represent travel routes digitized from returned surveys; red and green dots illustrate departure sites and favorite destinations, respectively. The cyan line depicted in the GIS view

represents one travel route that has been selected for display. The corresponding database record that is 'linked' to the travel route via the survey control number ID is also highlighted blue in the 'Attributes of Routes' database window at the lower left of Figure 4.

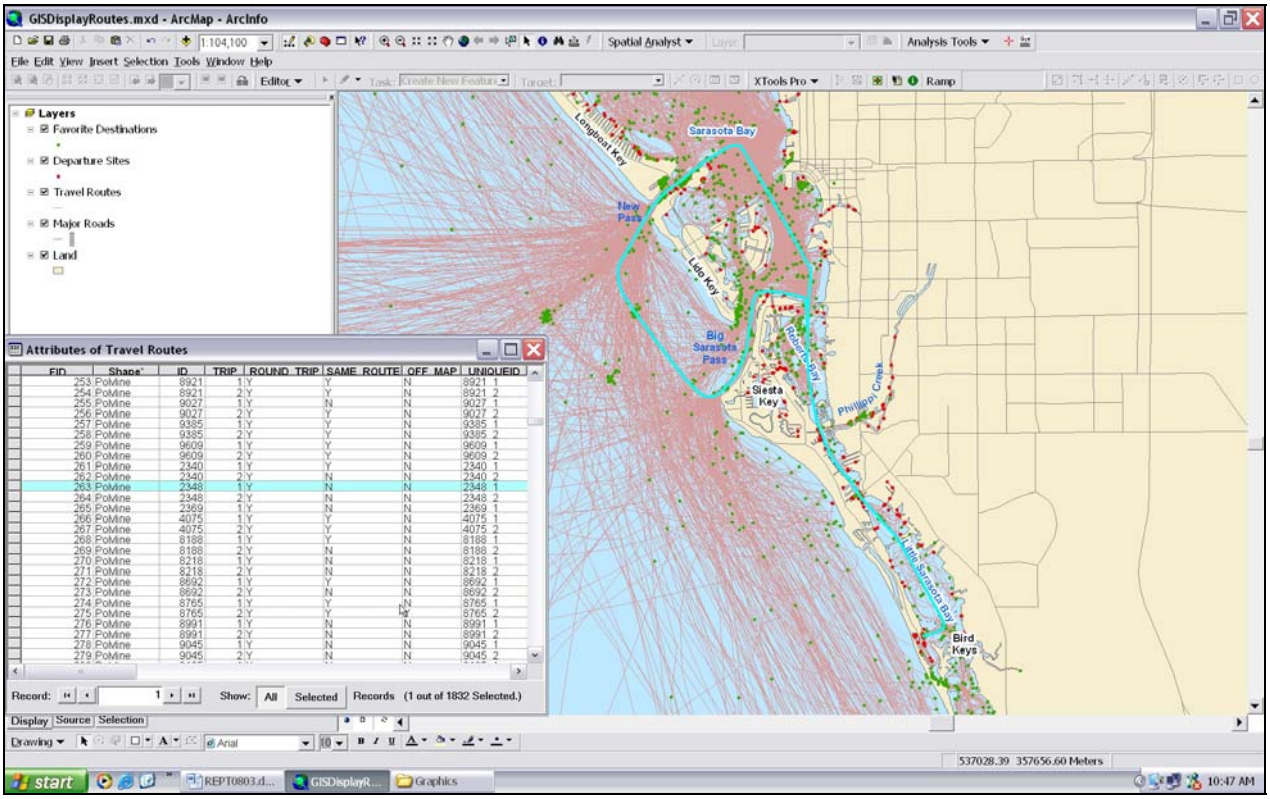


**Figure 4. Example of GIS Attribute Query and Display: Reported Travel Routes.**

## Determining Landside and Waterside Service Areas of Boat Facilities

The purpose of the boating facility service analysis is to develop a spatial model that delineates and maps land- and waterside service areas, and to assess use potential for boat ramps in the study area. The analysis relies on (1) the survey of boat facility users described above, (2) the delineation of landside primary service areas (PSA) for particular facilities, (3) a determination of the use potential for specific ramps, and (4) an assessment of the contribution of individual facilities to recreational use within specific waterside destination regions (SDR).

The mailing address obtained for patrons of boating access facilities is used to determine GIS coordinates for mapping landside origin locations. The delineation of landside service areas for facilities is dependent upon accurately locating the homes of boaters that use the facilities. This can be accomplished using GIS software or through online commercial geocoding services, such as *TeleAtlas* (*www.geocode.com*).The geocoding output is used to generate a GIS point layer that maps the home location of facility patrons. Appendix 3 explains the geocoding process.

Figure 5 presents the spatial distribution of ramp patrons, normalized by the number of households, for each of the four counties (Sarasota, Manatee, Hillsborough, and Pinellas) that comprise the Tampa and Sarasota Bay boating region.

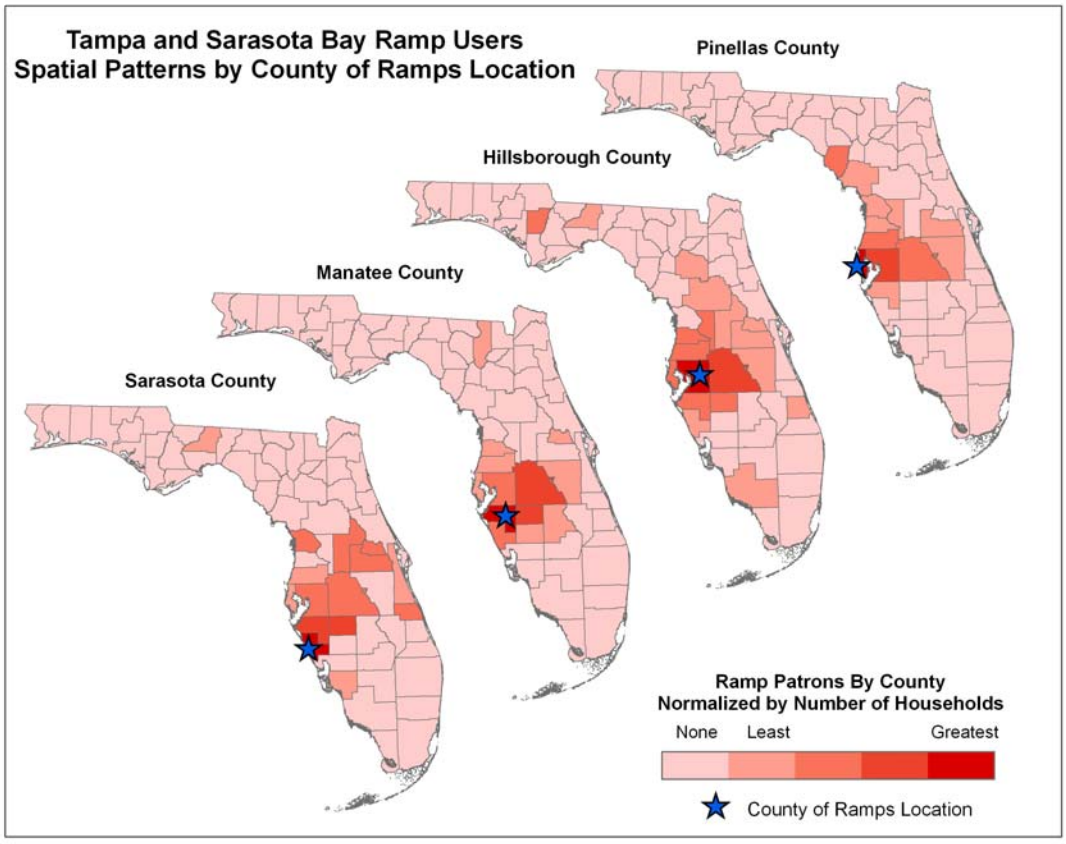


**Figure 5. Spatial Patterns of Ramp Use by County.**

**Delineating LandSide Service Areas:** The pie wedge-casting methodology developed by Fik and presented in Sidman et al (2005) is recommended to delineate landside service areas for boating access facilities. The method results in a regional service area (RSA) which can be thought of as an abstract representation of a region's landside boater trafficshed, showing the outward reach and directional variations in reach and use intensity from the "average" facility location (Figure 6). The RSA is based on the aggregate analysis of geocoded patron data pertaining to sampled boating facilities and it highlights the extent to which boaters are drawn to facilities and the variability in the intensity of facility use. A primary service area (PSA) is specific to a boating facility and delineates the geographic area that best encompasses the locations of boaters most likely to use a specific facility.

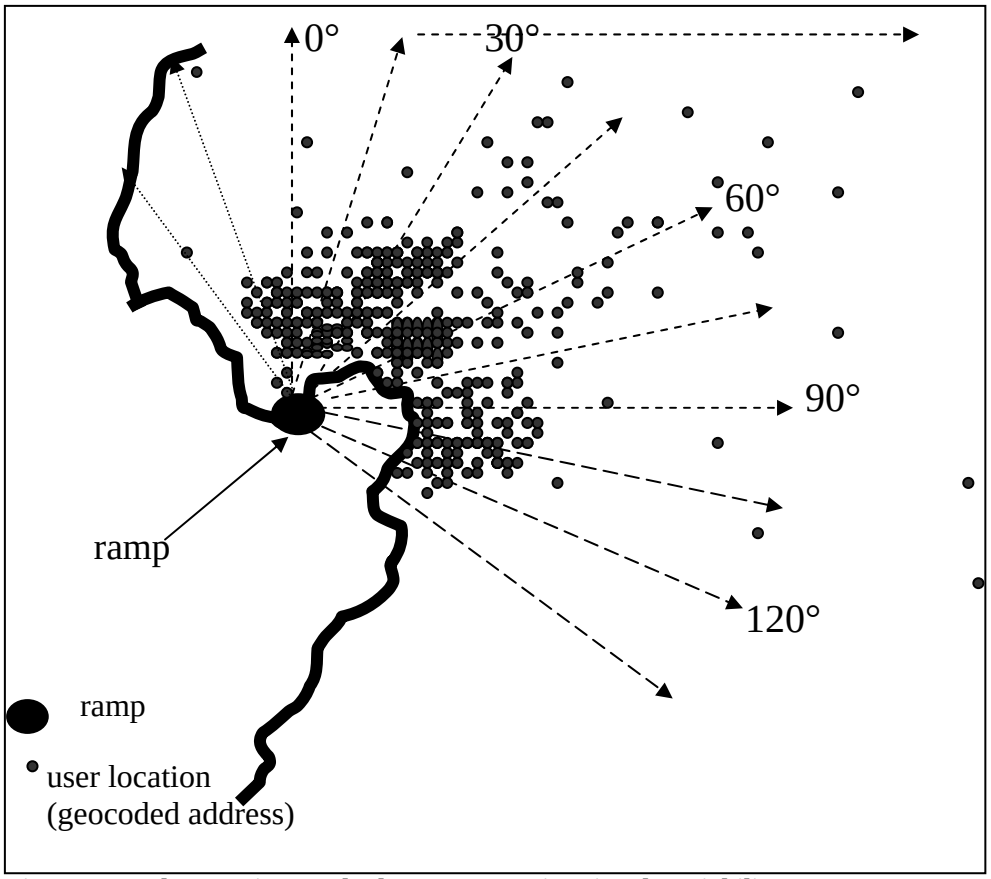


**Figure 6. Wedge-Casting Method to Capture Directional Variability.**

This approach assumes that use-intensity typically declines with increasing distance from a given facility, and in particular, from boat ramps. In addition, the rate of decline in use and the subsequent "reach" or draw of a ramp will vary depending on location and direction. Thus, it can be said that use-intensity of a given ramp will, in general, decay or decline with distance. However, the rate of decline will not be the same in all directions. Directional variability may be attributable to variations in accessibility related to the location of the ramp relative to the spatial distribution of patrons. Directional variability is captured by mapping the point distributions of ramp patrons for each ramp in the study region, using latitude and longitude location coordinates provided by the GIS address geocoding algorithm. Next, a series of transects and wedges, centered about each ramp, are drawn within the GIS for equally spaced intervals of 15-degrees (i.e., from 0 to 360 degrees) to cover all possible land-based origins of boaters that were observed using a particular ramp (Figure 6).

**Delineating Water-side Destination Regions:** A K-means clustering algorithm (Kachigan, 1986) is used to determine if spatial associations exist for favorite destinations reported by survey respondents. Cluster analysis is a statistical procedure used to group and/or classify individual observations in a data set according to their spatial similarities. Individual observations that are deemed 'similar' are grouped together to form clusters of observations. In this way, the cluster analysis can be used to determine the number and geographic extent of waterside specific destination regions (SDR). To determine regions by cluster analysis, favorite destinations are partitioned into near-shore (i.e., less than two miles from the shoreline) and

offshore (i.e., greater than two miles from the shoreline) destinations.[6] The division between near-shore and offshore is based on a review of on-the-water activities. For instance, in Tampa Bay there is a tendency for certain activities to take place close to the shore (e.g., near-shore fishing, nature viewing, anchoring, beach camping and picnicking, restaurant visitation) and for others to take place at a greater distance from the shore (e.g., sailing, cruising, off-shore fishing) (Figure 7).

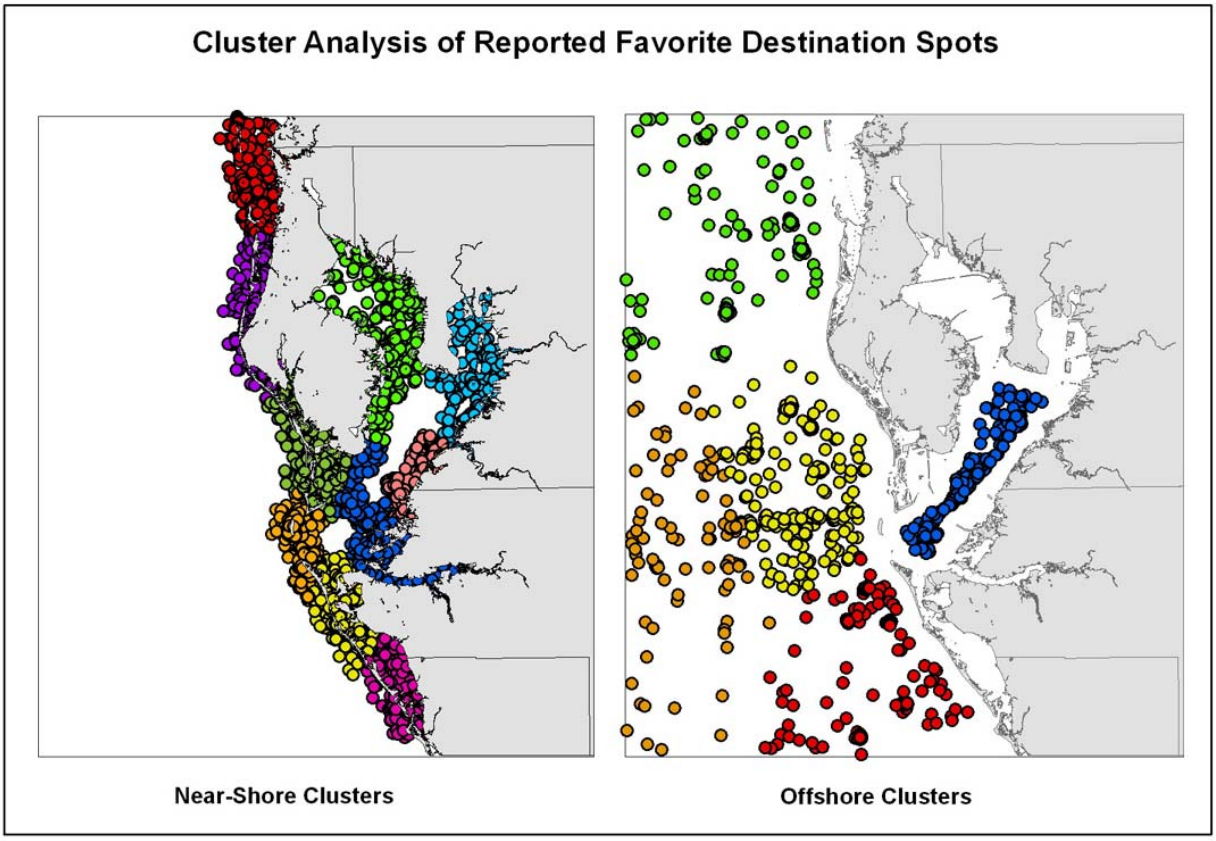


**Figure 7. Cluster Analysis to Spatially Associate Favorite Destinations.**

## Projecting Future Demand for Boating Access Facilities

Several methods can be used to estimate future demand for boating access facilities. The method presented in this manual combines (1) procedures developed by Bell and presented in Antonini et al (1997) with (2) the mapped landside service areas described above. The outcome of the analysis is an estimate of the geographic distribution of future boating access demand within the study area.

The first step is to construct a demand model and to fit the equation to vessel registration data for the study area; boat registrations are used to characterize the stock of boats. The National Marine Manufacturers Association index—expenditures per recreational boat series—is used to

[6] For previous work, a two-mile buffer of the USGS 1:24,000 DLG shoreline was selected as a reasonable distance to differentiate between near-shore and offshore destinations. This was based on a visual inspection of mapped destination activities.

construct a price variable. The Consumer Price Index (CPI) values for aggregate commodities and for the real price of gasoline are used to approximate the operating cost of a recreational boat. Population projections are obtained from the U.S. Population Census and the University of Florida Bureau of Economic and Business Research (www.bebr.ufl.edu).

Growth trends in boat registrations are evaluated for the study area by boat length class and, based on a trend analysis, demand functions are estimated for each boat class. The main factors that drive the projections are personal per capita income and the study area population (Bell, 1994).

Probability estimates of demand for boating access facilities are derived from responses to the random sample survey questionnaire to boaters. These estimates consider projected changes in the numbers of boats in different length (size) classes. A predictive model is then developed to derive vessel draft from boat length. Data from a random sample boater telephone survey can then be used to test and calibrate this equation.

## Site Suitability Analysis

The purpose of a site suitability analysis is to evaluate the potential use of a parcel for expanding existing boating access facilities and/or for siting new ones. The analysis outlined in this manual consists of a point system that scores a parcel's land-based attributes and waterside environmental conditions. Many of the GIS datasets required for the siting analysis can be obtained from the Florida Geographic Data Library (FGDL) maintained by the University of Florida's GeoPlan Center (www.fgdl.org).[7] While the FGDL serves as a valuable clearinghouse for geographic data, it is best to check whether entities within the study area that are charged with maintaining the regions GIS infrastructure have more recent information. Parcel data should be obtained from the local GIS and/or property appraiser.

In some instances, bathymetric surveys may have been conducted for the area of interest. The availability of pertinent studies should be ascertained by contacting local and state entities. However, general characteristics of boat access and water depth can be ascertained from NOS hydrographic small-craft charts. As a last resort, it may be necessary to conduct field surveys to acquire necessary data. All data sources are combined and edited in the Boating Resource GIS.

A development suitability rating is assigned to each candidate parcel based on an evaluation of developmental and environmental criteria, such as vacant adjoining parcels, acreage, land use, land-side infrastructure (e.g., water, sewer, road), aquatic preserve, wetland, seagrass, water depth, and boat access.[8] Sites with a cumulative low point score for environmental and developmental parameters are considered poor candidates for intensive uses, such as sport and industrial marinas or waterfront hotels. They may be considered adequate for less intensive uses, including boat ramps, waterfront restaurants, and residential developments.

[7] The FGDL is a mechanism for distributing spatial (GIS) data throughout the state of Florida. The data is organized by county and state and contains data layers on land use, hydrology, soils, transportation, political boundaries, environmental quality, conservation, census, and more.

[8] The specific criteria to be included in the analysis should be decided upon by local personnel in consultation with DCA.

The suitability of a parcel is determined by assigning an impact rating (0,1,2) based on the condition of each of the parcel's environmental (e.g., sea grass, wetland, aquatic preserve) and developmental attributes (e.g., boat access, water depth, central sewer, water service line). The Total Environmental Impact Score for a parcel is the sum of all environmental attribute impact ratings, and the Total Developmental Impact Score is the sum of all developmental attribute impact ratings (Table 1). The final suitability rating for a parcel is the difference of the Total Environmental Impact Score and the Total Developmental Impact Score. A site receiving a final suitability rating of 0-5 points is one suitable for the less intensive uses. Parcels receiving higher ratings (6-13) would be fair candidates for more intensive uses.

**Table 1. Rating index for Boating Access Facilities.**

| Attribute | Assessment Points |
|---|---|
| **Environmental Considerations** | |
| **Wetlands** | |
| Yes | 2 |
| No | 0 |
| **Seagrass** | |
| Dense | 2 |
| Sparse or Patchy | 1 |
| None | 0 |
| **Aquatic Preserve** | |
| Yes | 2 |
| No | 0 |
| **Developmental Considerations** | |
| **Access** | |
| Improved | 2 |
| Unimproved | 0 |
| **Water Depth** | |
| >= 3 feet | 2 |
| < 3 feet | 0 |
| **Water Line Service Availability** | |
| Yes | 2 |
| No | 0 |
| **Central Sewer Availability** | |
| Yes | 2 |
| No | 0 |
| **Roads** | |
| Collector or larger for Marina | |
| Yes | 2 |
| No | 0 |
| Any Paved for Ramp | |
| Yes | 2 |
| No | 0 |
| **Acreage of vacant adjacent parcel** | |
| < 1 acre | 0 |
| 1 - 5 acres | 1 |
| > 5 acres | 2 |

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**Appendix 1. A Description of the Method Used to Determine the Sampling Design for Ramp Surveys and a Schedule of Ramp Survey Dates**

## *Sampling Time Periods*

The goal of this exercise is to estimate the number and distribution of survey dates that are required to receive sufficient numbers of returned surveys from ramp users for each of the following three time periods:

**Time period 1** (2006): March, April, May, June
**Time period 2** (2006): July, August, September, October
**Time period 3** (2006-2007): November, December, January, February

Based on average return rates of 20 to 25 percent achieved during three prior implementations of the mail survey, a sample frame of approximately 2,000 unique ramps users for each time period is needed to receive a sample of 378 completed surveys. This is the estimated sample required for a population that approximates 25,000 and was determined based on a tolerable error of ± 0.05 and a confidence level of 95 percent (McCall, 1982).

A survey of ramps, implemented by Brevard County and Florida Sea Grant field personnel, will extend over twelve months (March 2006 through February 2007). Each time period listed above culminates with the month during which a mailing is scheduled to occur (shown in red). Surveys will be mailed during the first week of June 2006, October 2006, and February 2007.

Due to the project start date (March 2006), the first time period consists of three survey months, whereas the second and third periods each consist of four survey months. The second mailing will be based on ramp survey data collected during the months of June, July, August, and September 2006); the third mailing will be based on ramp survey data collected during the months of October, November, December (2006), and January (2007). Three mailings are expected to adequately capture seasonal boating patterns; the seasonal analysis will be based on the "most recent" trips reported by respondents.

## *Assumptions*

The following assumptions underlie the estimate of the number of ramp users likely to be surveyed during any given month.

1. The relative distribution of boating activity each month (for weekends and weekdays) throughout a year was estimated using data collected during a statewide survey of 1,140 Florida boaters. "An Assessment of Florida Boaters and their Awareness of the Clean Vessel Act and Clean Marina Program" (Swett, Fann, and DeLaney 2005).
2. Peak boating occurs during the months of May, June, July, and August and accounts for 41 percent of yearly boating activity (Swett, Fann, and DeLaney 2005).
3. An average weekday of boating activity is estimated to be 60 percent less than that which occurs on an average weekend day. This estimate is based on aerial survey counts of boating activity during the May 2004 – January 2005 period in Broward County (Gorzelany 2005).

4. An 80 percent match rate of trailer/auto tags to Florida's vehicle registration database is anticipated based on previous implementations in Greater Charlotte Harbor (Sidman, Swett, Fik, Fann, Fann, and Sargent 2005) and Sarasota County (Sidman, Swett, Fik, Fann, and Sargent 2006).
5. Adjustments to the sample design will be made, if necessary, based on on-going data collection efforts by field survey crews

## *Sample Design*

A combination of weekend and weekday sampling is preferred to assess differences in weekend and weekday ramp use. The sampling method is designed to estimate the number of survey days required to obtain a minimum of 2,000 unique trailer tag numbers for each of the three time periods. A statewide survey of 1,140 Florida boaters was used to calculate the relative proportion of yearly boating activity that takes place during each month of the year (Swett et al. 2005). That survey indicated that peak boating activity occurs during the months of May, June, July, and August and accounts for 41 percent of yearly activity (Figure 1). According to survey results, approximately 10 percent of all boating excursions occur during each of the peak months (11 percent in July). This general trend is corroborated by the percentages of trips reportedly taken by Tampa Bay, Sarasota County, and Greater Charlotte Harbor boaters over the course of a year–Figure 2 (Sidman, Fik, and Sargent 2004; Sidman, Swett, Fik, Fann, Fann, and Sargent 2005; Sidman, Swett, Fann, and Sargent 2005). To project the number of patrons who visit ramps on an average weekend day for each month throughout the year, the estimates of monthly boating activity derived from the statewide survey were used in conjunction with data collected at ramps by Brevard County staff on the weekend days of March 11 and 12, 2006.

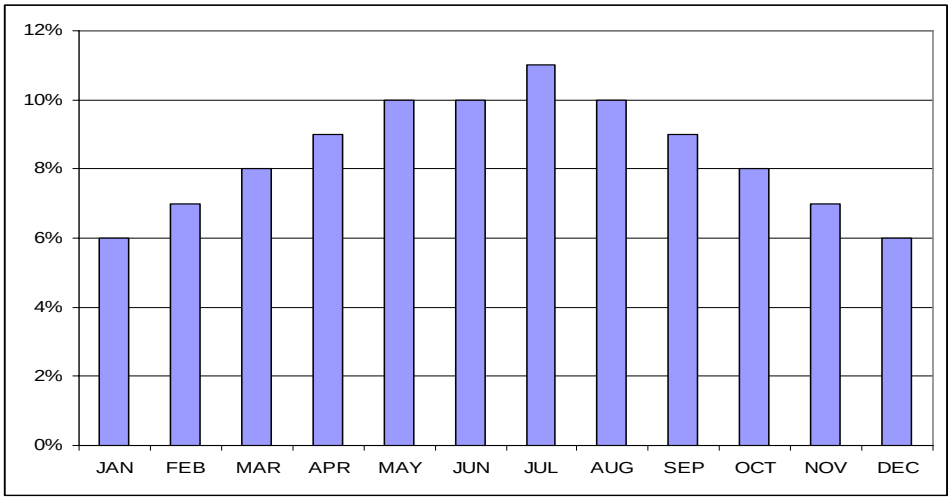



**Figure 8.** Relative monthly distribution of boating activity during a one year period (Swett, Fann, DeLaney 2005).

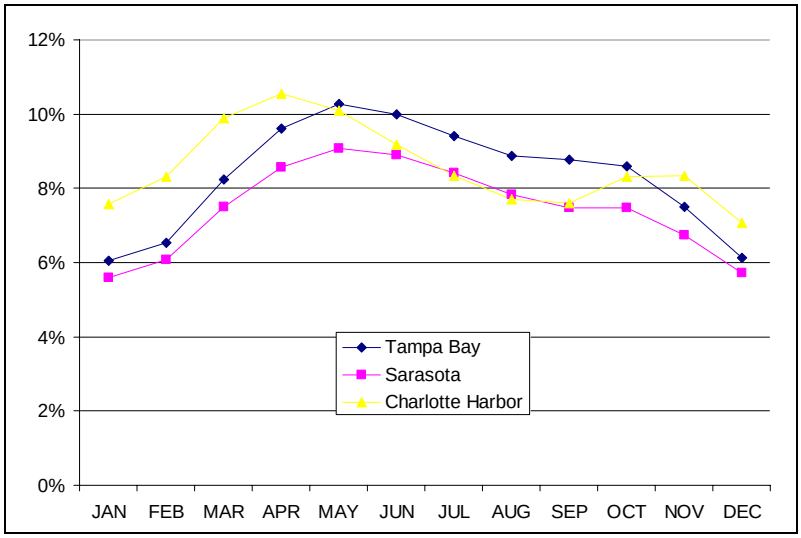



**Figure 2.** Relative monthly distribution of boating activity during a one year period for Tampa Bay, Sarasota County, and Charlotte Harbor.

Brevard County staff logged 712 boat trailers at 21 ramps during the March 11/12 weekend (Table 1), which, according to statewide survey results, represents approximately 73% of the boating activity projected to occur during a weekend in the peak boating month of July (Table 2, Relative Use). To estimate the number of trailers (Projected Users) that likely will be surveyed on an average weekend for any month of the year, the March data was divided by the Relative Use proportion (Table 2). For example, the projected number of trailers at ramps during an average July weekend is estimated to be 979 (712 / 0.727). The projected use values were then multiplied by 0.80 (80% Match, Table 2) to account for an estimated 20 percent of trailer and auto tag numbers that will not match listings in the Department of Highway Safety and Motor Vehicle registration database.

**Table 2.** Brevard County ramps to be surveyed.

| Ramps | Surveyed March 11/12 |
|---|---|
| Riverwood Park | |
| River Breeze Park | |
| Old ScottsMoor Ramp | |
| Beacon 42 | Yes |
| Bairs Cove | |
| Bio Lab | |
| Eddy Creek | |
| Mims Boat Ramp | Yes |
| Parrish Park | Yes |
| Marina Park | |
| Kennedy Point Park | |
| Port St. John | Yes |
| Freddie Patrick Park | |
| Port End Park | |
| Kelly Park | Yes |
| McFarland Park | |
| Kiwanis Island Park | Yes |
| Constitution Bicentennial Park | |
| Lee Wenner Park | Yes |
| Ramp Road Park | |
| POW/MIA Park (Pineda) | Yes |
| Eau Gallie Causeway | Yes |
| Ballard Park | Yes |
| Front Street Ramp | Yes |
| Melbourne Riverview Park | |
| H. Pollak Park | Yes |
| Alex Goode Park | Yes |
| John Jorgensen Landing | Yes |
| Honest John's Fish Camp | |
| 1$^{St}$ Street Ramp | Yes |
| Long Point Park | Yes |
| Sebastian Inlet St. Rec Facility | |
| Main Street Boat Dock | Yes |
| Sebastial Yacht Club | Yes |
| Wabasso Causeway | Yes |
| Scurrah's Landing | Yes |
| Haulover Canal | Yes |
| Titusville Marina | Yes |

**Table 2**. Estimates of weekend ramp use (peak use months shaded).

| Weekend | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Relative Use | 73% | 82% | 91% | 91% | 100% | 91% | 82% | 73% | 64% | 55% | 55% | 55% |
| Projected Users | 712 | 801 | 890 | 890 | 979 | 890 | 801 | 712 | 623 | 534 | 534 | 534 |
| 80% Match | 570 | 641 | 712 | 712 | 783 | 712 | 641 | 570 | 498 | 427 | 427 | 427 |

Months in red are those in which surveys will be mailed.

To estimate ramp use for one weekend day, the projected weekend use (two days) from Table 2 were halved and multiplied by 0.4 (Table 3, Projected Use). This calculation is based on assumption three listed above, which states that an average weekday of boating activity is estimated to be 60 percent less than that which occurs on an average weekend day. The assumption is derived from aerial survey counts of boating activity in Broward County by Gorezelany (2005). Estimates of weekday projected use were then multiplied by 0.80 (Table 3, 80% Match) to account for an estimated 20 percent of trailer and auto tag numbers that will not match listings in the Department of Highway Safety and Motor Vehicle registration database.

**Table 3.** Estimates of weekday ramp use (peak use months shaded).

| Weekday | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weekend Day Use | 356 | 401 | 445 | 445 | 490 | 445 | 401 | 356 | 312 | 267 | 267 | 267 |
| Projected Use (60% less than weekend day) | 142 | 160 | 178 | 178 | 196 | 178 | 160 | 142 | 125 | 107 | 107 | 107 |
| 80% Match | 114 | 128 | 142 | 142 | 157 | 142 | 128 | 114 | 100 | 85 | 85 | 85 |

Months in red are those in which surveys will be mailed.

**Boating Holidays:** Ramp surveys also should be conducted during the following boating holidays to capture peak use:

Memorial Day (May 27, 28, or 29 – Saturday, Sunday, or Monday)
Independence Day (July 1, 2, 4 – Saturday, Sunday, or Tuesday)
Labor Day (September 2, 3, or 4 – Saturday, Sunday, or Monday)
Thanksgiving (November 24, 25, and 26 – Friday, or Saturday, Sunday)

Chuck Nelson: please advise if it is feasible for County staff to survey ramps during the above boating holidays. If not, Florida Sea Grant will make arrangements to have the ramps surveyed on the days to which your staff can not commit.

Table 4 lists the days on which weekend and weekday ramp surveys are scheduled to occur. Weekend dates were selected to provide an even sampling distribution throughout the year. The five weekday dates for each time period were randomly selected; some dates were then adjusted to allow for (1) the inclusion of each day of the week (Monday, Tuesday, Wednesday, Thursday, and Friday) during a time period, (2) an even distribution (non-consecutive) of sampling dates over the course of each time period, and (3) survey dates that do not directly proceed or follow a selected weekend sampling date. In the event that a survey date needs to be rescheduled due to inclement weather the next available weekend or weekday should be surveyed.

To project the total number of unique usable auto/trailer tags that are expected to be logged during each of the three time survey periods, the monthly values associated with an 80% match rate for weekend (Table 2) and weekdays (Table 3) were summed for the sample days listed in Table 4 (totals in red).

**Time Period 1** (March – June 2006): **3,887**
Five weekends per season (2 days each): (570 + 570 + 641 + 712 + 712) = 3,205
Five weekdays per season: (128 + 128 + 142 + 142 + 142) = 682

**Time Period 2** (July – October, 2006): **4,983**
Six weekends per season (2 days): (712 + 783 + 783 + 712 + 641 + 641) = 4,272
Five weekdays per season: (142 + 157 + 142 + 142 + 128) = 711

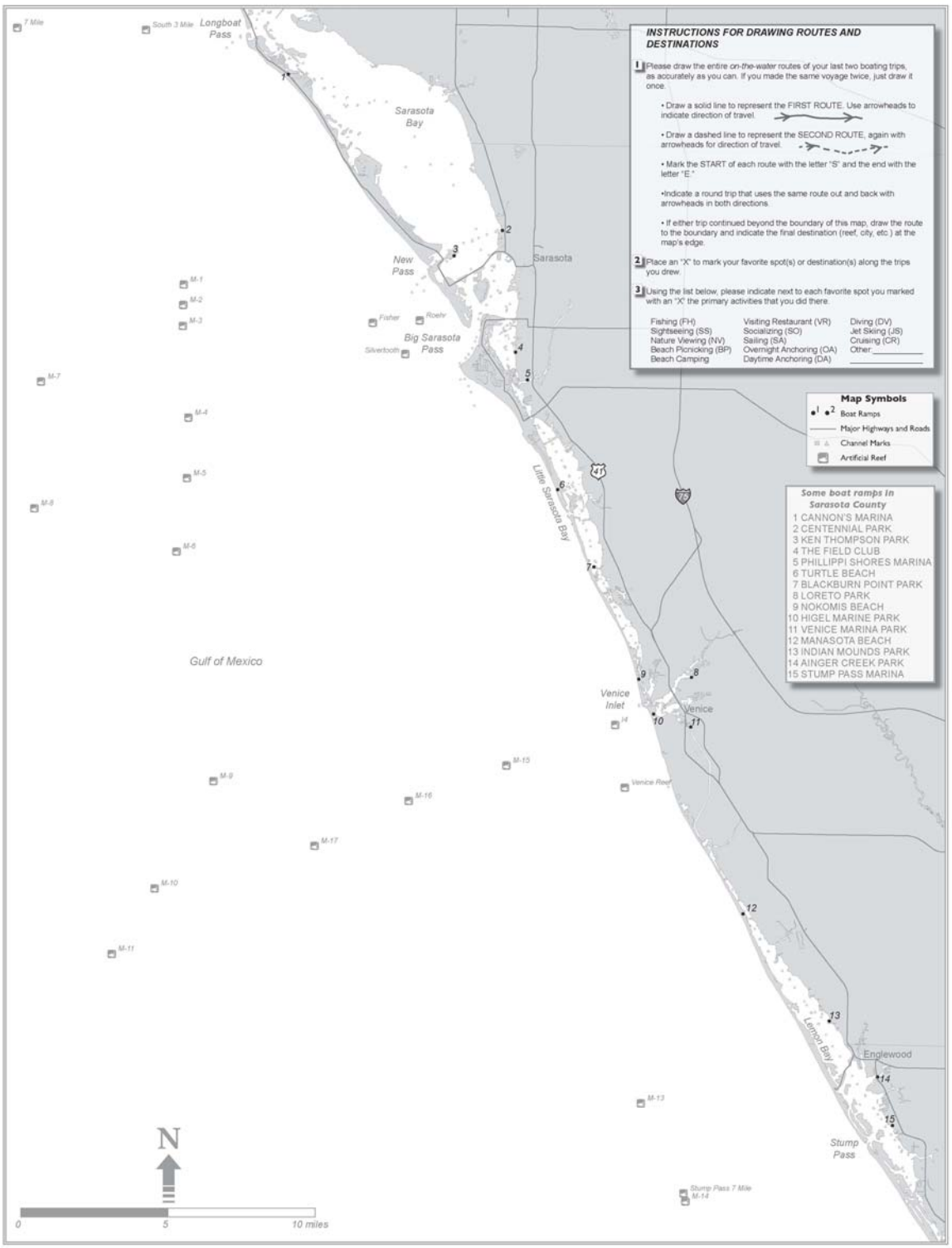
**Time Period 3** (November 2006 – February 2007): **3,388**
Six weekends per season (2 days each): (570 + 570 + 498 + 427 +427 + 427) = 2,919
Five weekdays per season: (114 + 100 + 85 + 85 + 85) = 469

**Table 4.** Weekend and weekday ramp survey dates.

| Weekends | | | Weekdays | | |
|---|---|---|---|---|---|
| Month | Date | Day | Month | Date | Day |
| March | 11 | Saturday | April | 12 | Wednesday |
| March | 12 | Sunday | April | 20 | Thursday |
| April | 8 | Saturday | May | 5 | Friday |
| April | 9 | Sunday | May | 15 | Monday |
| May | 13 | Saturday | May | 23 | Tuesday |
| May | 14 | Sunday | June | 21 | Wednesday |
| May* | 27 | Saturday | July | 10 | Monday |
| May* | 28 | Sunday | August | 1 | Tuesday |
| June | 10 | Saturday | August | 24 | Thursday |
| June | 11 | Sunday | September | 8 | Friday |
| July* | 1 | Saturday | October | 18 | Wednesday |
| July* | 2 | Sunday | November | 10 | Friday |
| July | 22 | Saturday | December | 3 | Thursday |
| July | 23 | Sunday | January | 8 | Monday |
| August | 12 | Saturday | February | 6 | Tuesday |
| August | 13 | Sunday | | | |
| September* | 2 | Saturday | | | |
| September* | 3 | Sunday | | | |
| September | 16 | Saturday | | | |
| September | 17 | Sunday | | | |
| October | 7 | Saturday | | | |
| October | 8 | Sunday | | | |
| October | 28 | Saturday | | | |
| October | 29 | Sunday | | | |
| November | 25 | Saturday | | | |
| November | 26 | Sunday | | | |
| December | 9 | Saturday | | | |
| December | 10 | Sunday | | | |
| December | 30 | Saturday | | | |
| December | 31 | Sunday | | | |
| January | 20 | Saturday | | | |
| January | 21 | Sunday | | | |
| February | 10 | Saturday | | | |
| February | 11 | Sunday | | | |
| February | 24 | Saturday | | | |
| February | 25 | Sunday | | | |

* Boating Holiday

## Appendix 2. Questionnaire Map



## Questionnaire

### PART 1. PLEASE DRAW THE ROUTE OF YOUR LAST TWO BOATING TRIPS

On the other side of this questionnaire is a map of Sarasota County coastal waterways. We would like you to provide information regarding your last two boating trips in this area. This will include marking your launch or departure sites, drawing your boating travel routes, and marking your favorite boating spots or destinations along those routes. ***Please refer to the instructions in the upper right portion of the map for completion of this part of the questionnaire. Thank you.***

### PART 2. PLEASE DESCRIBE YOUR LAST TWO BOATING TRIPS

**Question 1.** Were the last two travel routes that you drew on the map typical, or not -- do you travel these routes when boating in Sarasota County waterways depicted on the map more often than not? (*Please check the appropriate box for each travel route that you drew)*

| | | | | |
|---|---|---|---|---|
| First Trip (**solid line**) | Typical | ☐ | Not typical | ☐ |
| Second Trip (**dashed line**) | Typical | ☐ | Not typical | ☐ |

**Question 2**. About what time did you get on the water for each of the two trips that you drew on the map? *(For example, 7:30AM)*

| | |
|---|---|
| First Trip (**solid line**) | Second Trip (**dashed line**) |

**Question 3.** About how long were you on the water on each of the two trips that you drew on the map? *(Please write in the number of hours **or** days.)*

| | | |
|---|---|---|
| First Trip (**solid line**) | Hours | Days |
| Second Trip (**dashed line**) | Hours | Days |

**Question 4.** Please circle the day of the week that you took each of the two trips that you drew on the map.

| | |
|---|---|
| First Trip (**solid line**) | Mon Tues Wed Thurs Fri Sat Sun |
| Second Trip (**dashed line**) | Mon Tues Wed Thurs Fri Sat Sun |

**Question 5.** Please circle the month(s) in which you took each of the two trips that you drew on the map.

| | |
|---|---|
| First Trip (**solid line**) | Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec |
| Second Trip (**dashed line**) | Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec |

**Question 6**. From the list below, please check the box beside the vessel type that best describes the boat that you used on each of the two trips that you drew on the map.

| **Trip 1** | **Vessel Type** | **Trip 2** |
|---|---|---|
| ☐ | Jet Ski / Personal Watercraft | ☐ |
| ☐ | Kayak / Row / Canoe | ☐ |
| ☐ | Sailboat (no cabin) | ☐ |
| ☐ | Sailboat (with cabin) | ☐ |
| ☐ | Speed: Runabout / Jet Boat (no cabin) | ☐ |
| ☐ | Speed: Scarab / Cigarette (with cabin) | ☐ |
| ☐ | Open Fisherman / Flats / Skiff / John boat | ☐ |
| ☐ | Offshore Sportfisherman (with cabin) | ☐ |
| ☐ | Power Cruiser (with cabin) | ☐ |
| ☐ | Deck Boat | ☐ |
| ☐ | Pontoon Boat | ☐ |
| ☐ | Other (specify)_____ | ☐ |

**Question 7.** Please enter the make/model, length, and draft of the boat(s) that you identified above.
(*Draft is how far below the water surface your prop or hull extends*.)

| | | | |
|---|---|---|---|
| First Trip (**solid line**) | Make / Model | Length (feet) | Draft *(feet / inches)* |
| Second Trip (**dashed line**) | Make / Model | Length (feet) | Draft (feet / inches) |

## *PART 3. PLEASE DESCRIBE YOUR TYPICAL BOATING TRIPS*

**Question 8**. Please indicate, in the boxes below, the number of days per month that you operate your boat within the mapped Sarasota County coastal waterways.

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Question 9.** Which of the following are important to you in selecting your typical boating routes? (*For a-k in the table below, check the box that best describes your opinion.*)

| **Statement** | **Strongly Agree** | **Agree** | **Neutral** | **Disagree** | **Strongly Disagree** |
|---|---|---|---|---|---|
| a) I try to avoid congested areas / crowds. | ☐ | ☐ | ☐ | ☐ | ☐ |
| b) I try to avoid shallow water. | ☐ | ☐ | ☐ | ☐ | ☐ |
| c) The fishing is good. | ☐ | ☐ | ☐ | ☐ | ☐ |
| d) I prefer well-marked channels. | ☐ | ☐ | ☐ | ☐ | ☐ |
| e) I prefer calm protected waters. | ☐ | ☐ | ☐ | ☐ | ☐ |
| f) I try to avoid speed zones. | ☐ | ☐ | ☐ | ☐ | ☐ |
| g) None are important. I just cruise around. | ☐ | ☐ | ☐ | ☐ | ☐ |
| h) Easy access to supplies or fuel | ☐ | ☐ | ☐ | ☐ | ☐ |
| i) Quick access to my favorite boating spots | ☐ | ☐ | ☐ | ☐ | ☐ |
| j) I enjoy the scenic beauty. | ☐ | ☐ | ☐ | ☐ | ☐ |
| k) Other (*specify*) | ☐ | ☐ | ☐ | ☐ | ☐ |

**Question 10.** From the list (*a–k*) above, circle the letter associated with the most important reason for selecting your favorite boating routes.

**Question 11.** Please check the box to the left of your typical departure site.

☐ Boat ramp ☐ Shoreline / causeway ☐ Marina wet slip
☐ Home dock ☐ Condominium dock ☐ Marina dry storage
☐ Other (*specify*)

***If you normally depart from a marina, the shoreline, or a ramp, please answer the following questions. If you normally depart from a residential or condominium dock, please skip to Question 18.***

**Question 12.** What marina do you depart from most often? (*If you launch from a ramp, including a marina ramp, please skip to Question 14.)*

Name / Location _____

**Question 13.** About how long does it take to drive from your home to the marina that you depart from most often?

Hours _____ Minutes _____

**Question 14.** If you use the shoreline or boat ramps (*including marina ramps*), please identify your two most frequently used shoreline locations or ramps and the approximate number of times per year do you use each. (*A list of some ramps is provided on the other side of this questionnaire.)*

| Ramp or Shoreline Name/Location | times per year |
|---|---|
| First Choice | |
| Second Choice | |

**Question 15.** About how long does it take to drive from your home to the shoreline locations or two ramps that you identified in Question 14?

| | Ramp Name/Location | Hours | Minutes |
|---|---|---|---|
| First Choice | | | |
| Second Choice | | | |

**Question 16.** What is important to you in selecting a marina, shoreline, or ramp? (*For a-n in the table below, check the box that best describes how important it is to you, or leave blank if not applicable.*)

| Statement | Very Important | Important | Neutral | Unimportant | Very Unimportant |
|---|---|---|---|---|---|
| a) Deep-water access | ☐ | ☐ | ☐ | ☐ | ☐ |
| b) Availability of restrooms | ☐ | ☐ | ☐ | ☐ | ☐ |
| c) No parking or launching fee | ☐ | ☐ | ☐ | ☐ | ☐ |
| d) Well-marked access channels | ☐ | ☐ | ☐ | ☐ | ☐ |
| e) Proximity to my favorite boating spots | ☐ | ☐ | ☐ | ☐ | ☐ |
| f) Adequate parking | ☐ | ☐ | ☐ | ☐ | ☐ |
| g) Availability of fishing supplies, bait | ☐ | ☐ | ☐ | ☐ | ☐ |
| h) Short wait to launch. | ☐ | ☐ | ☐ | ☐ | ☐ |
| i) Gas, pump-out, or maintenance service | ☐ | ☐ | ☐ | ☐ | ☐ |
| j) Nearby amenities (e.g., restaurant) | ☐ | ☐ | ☐ | ☐ | ☐ |
| k) Proximity to my home | ☐ | ☐ | ☐ | ☐ | ☐ |
| l) Ease of launching and retrieving boat | ☐ | ☐ | ☐ | ☐ | ☐ |
| m) Safe and secure parking area | ☐ | ☐ | ☐ | ☐ | ☐ |
| n) Other factor (*specify*) | ☐ | ☐ | ☐ | ☐ | ☐ |

**Question 17.** From the list (*a–n*) above, please circle the letter associated with the most important reason for selecting a marina, shoreline, or ramp.

**Question 18**. What are your activities on your typical boating trips? (Check all that apply.)

☐ Beach Picnicking (**BP**)
☐ Cruising (**CR**)
☐ Diving (**DV**)
☐ Fishing (**FH**)
☐ Ski / Water Sports (**WS**)
☐ Nature Viewing (**NV**)
☐ Daytime Anchoring (**DA**)
☐ Overnight Anchoring (**OA**)
☐ Sailing (**SA**)
☐ Other (**O**) (*specify*)_____
☐ Sightseeing (**SS**)
☐ Socializing (**SO**)
☐ Visiting Restaurant (**VR**)
☐ Swimming (**SW**)

**Question 19.** Based on your boating experiences **over the past year**, have you avoided or left your favorite spots or destinations because of too many other boaters?

☐ Yes ☐ No

**Question 20**. In which areas, if any, have you experienced the greatest amount of boat congestion?

**Please mark congested areas on the map with the letter "C."**

*(**"**Congestion" refers to the presence of more boats than you would prefer.)*

## PART 4. PLEASE DESCRIBE YOURSELF

**Question 21.** How many months per year do you live in Florida? _____(*Months*)

**Question 22.** How long have you been operating a vessel in Florida's coastal water? _____(*Years*)

**Question 23.** Have you ever taken a boat safety or seamanship course? ☐ Yes ☐ No

**Question 24.** In what year were you born? _____

**Question 25**. Would you participate in a future internet and / or mail survey to provide further information on your boating experiences?

**Internet** Yes ☐ No ☐ **Mail** Yes ☐ No ☐

**Question 26**. What detracts most from your boating experience?

**Question 27.** What is needed most to improve your boating experience?

---

***PLEASE RETURN THE QUESTIONNAIRE AND MAP IN THE ENCLOSED POSTAGE-PAID ENVELOPE***

THANK YOU VERY MUCH FOR YOUR TIME AND PARTICIPATION!

---

**Questionnaire Control Number**

(used only to keep track of survey returns)

## Appendix 3. Geocoding

Geocoding refers to the process of matching address information between two data sources,

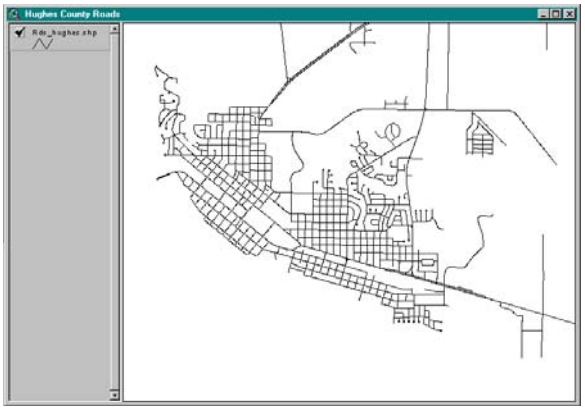
(1) a database that contains the mailing address of ramp users *without* map position information such as latitude (Y-Coordinate) and longitude (X-Coordinate) reference, and

Before geocoding:

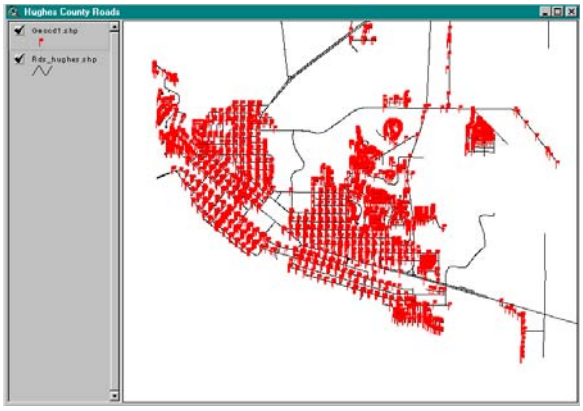
| Address | Zip Code | X-Coord | Y-Coord |
|---|---|---|---|
| 2425 E Pawn St | 57501 | | |

(2) a reference street, parcel or other database/GIS layer *with* map position information such as latitude (Y-Coordinate) and longitude (X-Coordinate) reference.

BEFORE
GIS street reference database with street segment address ranges.




AFTER
GIS street reference database with geocoded addresses as red points.




The geocoding process assigns a latitude and longitude position to each address based on a comparison of address elements to a GIS reference database (a street database in the case of this

example). The result of the geocoding process is a GIS point data layer that contains map position information.

After geocoding:

| Address | Zip Code | X-Coord | Y-Coord |
|---|---|---|---|
| 2425 E Pawn St | 57501 | -100.318837 | 44.35275 |