Third DRAFT
FOR PUBLIC COMMENT

CANANDAIGUA LAKE

PEAK BOAT USE INVENTORY AND CARRYING CAPACITY ANALYSIS

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1.0 Introduction

The Canandaigua Lake Watershed Council (consisting of publicly elected officials of the fourteen watershed and water purveying municipalities), was established in the mid 1990s as the lead coordinating entity in the creation and implementation of the Watershed Management Plan. The Watershed Council is working in partnership with the Ontario County Planning Department to complete a comprehensive review and analysis of the six shoreline municipalities' existing lakeshore zoning regulations and the Uniform Docks and Moorings Law as part of the overall watershed protection plan. The objective of this review and analysis is to determine whether the existing framework of laws is meeting their intended purpose of balancing the multiple uses of the lake while protecting the ecological integrity of the Canandaigua Lake Watershed. This peak boat use and carrying capacity report is a critical component of the overall review and analysis.

The purpose of this report is to estimate the current number of boats on the lake during periods of peak use and to provide an analysis of the carrying capacity of the lake. Understanding the carrying capacity of Canandaigua Lake is critical to determining if the existing rules and regulations are meeting the intended purpose of the law. Carrying Capacity is defined by this report as the maximum number of boats (expressed as acres/boat) that can be operated on the lake at one time without compromising the lake's multiple uses, aesthetic enjoyment, natural beauty and environmental quality.

This report will assist the Watershed Council, Planning Department and lakeshore municipalities in determining if the existing framework of laws is meeting their intended purposes of multiple use balance and environmental protection. This multiple use balance is recognized in the purpose section of the Uniform Docks and Moorings Law (1992, 2004):

"The purposes of this local law are to regulate lakeshore activities in or on the waters of Canandaigua Lake in order to protect the public health, safety and welfare, and to provide reasonable public access and recreational use of Canandaigua Lake without overcrowding, congestion or safety hazards while protecting the resources of the lake."

This report is also intended to be used as a planning tool and guide for local municipalities' in their review of specific project proposals that have access to the lake.

The issues of development and access to Canandaigua Lake are not unique. In fact, most every inland lake struggles with balancing the multiple human uses of a lake against protecting the natural resources of the lake. The question for most lake communities becomes whether or not municipalities that have the primary land use authority around a lake are willing to take an active leadership role in the management of the access and use of the lake. The municipalities around Canandaigua Lake have a solid history of active leadership in protecting the lake through their adoption of the original Docks and Moorings Law and creation and leadership of the Canandaigua Lake Watershed Council. The Watershed Council has won state and national awards and recognition for their intermunicipal leadership in watershed protection.

Several attempts have been made over the last 25 years to quantify boat use on the lake. Appendix B provides a brief summary of these previous boat traffic studies on Canandaigua Lake. Each of these studies had some limitations or are now outdated but were useful in the development of this current inventory. Two surveys of Canandaigua Lake watershed residents were completed in 1990 and 2001 and identified that the there are significant concerns regarding overcrowding and the

resulting impacts on Canandaigua Lake. An example of lake overcrowding being an issue common to inland lakes is best explained by the following passage taken from a report developed for four townships in Michigan facing overcrowding of local lakes:

"Lakes are a finite resource with seemingly unlimited demand. As more development occurs around lakes, boating and other recreational activities on area lakes can be expected to increase accordingly. This fact, coupled with the tremendous increase in the number, size, and speed of today's watercraft, has brought the issue of lake access and overcrowding to the forefront in many communities."

-Progressive Architecture Engineering (2001)

1.1 Multiple Uses of Canandaigua Lake

Canandaigua Lake, although large, is a finite resource. A summary of Canandaigua Lake's physical characteristics include: 15.5 miles long, 1.1 miles wide on average, 276 feet deep, surface area of approximately 10,500 acres, holds approximately 429 billion gallons of water and has approximately 38 miles of shoreline of which the overwhelming majority is in private ownership (The Canandaigua Lake Watershed Management Plan (2001).

The lake is used by humans in multiple ways that can be in conflict if the lake is overcrowded. The highest and best use of Canandaigua Lake is as a water supply for over 60,000 people (Article 15 New York State Environmental Conservation Law and The Canandaigua Lake Watershed Management Plan (2001). Other uses of the lake include fishing, swimming, nature watching, power boating, waterskiing/tubing, sailing, canoeing, and enjoying the natural beauty of lake and its surrounding watershed. Balancing these sometimes conflicting uses requires a better understanding of the current use of the lake, forecasting future use, understanding when environmental impacts take place and developing an informed carrying capacity policy goal based on this information.

The multiple human uses of the lake are an important catalyst to the local economy. The lake influenced tax assessed value is estimated to be over one-billion dollars. Studies done by the Keuka Lake Association document that 20% of the shoreline tax base would be impacted by reductions in water quality. Tourism and recreation that are associated with the lake bring in millions of dollars to the local economy each year. Additionally the lake/watershed region is seeing substantial development when compared to the overall Finger Lakes region due to well-developed transportation corridors (State Route 332) that connect to the Rochester area and the natural beauty and high water quality this lake and watershed provides. Obviously, access to the lake is a significant driver of the local economy.

The *Canandaigua Lake Watershed Plan, 2001* references Garret Hardin's Tragedy of the Commons when reviewing recreational sources of pollution: "Unrestricted use of commonly-owned resources usually degenerates to abuse of that resource." The struggle of local municipalities who have primary land use authority is to avoid any degradation of water quality and natural beauty of Canandaigua Lake while promoting and encouraging the multiple uses of the lake. The Carrying Capacity analysis portion of this report is an attempt at helping municipalities better understand the limits to using Canandaigua Lake so they can better manage these multiple uses without degrading the water quality and natural beauty of Canandaigua Lake.

1.2 Defining Carrying Capacity

In this report, carrying capacity is defined as the number of boats that can be operated on the lake without compromising the lake's multiple uses, aesthetic enjoyment, natural beauty and environmental quality. This definition represents a synthesis of carrying capacity descriptions taken from a variety of literature sources included in the reference section of the report. Each report in the literature defined carrying capacity somewhat differently by stressing certain uses over others. Several carrying capacity definitions focused solely on minimum recreational safety and did not incorporate environmental uses of a lake in determining carrying capacity. A more comprehensive definition of carrying capacity that includes consideration of environmental quality and multiple uses is used in this report to determine an appropriate carrying capacity goal. The carrying capacity section in this report (Section 4.0) provides a review of several methods to determine a lake's carrying capacity taken from across the country. The report concludes by recommending a boat carrying capacity for Canandaigua Lake based on the various approaches to determining the carrying capacity as well as the current usage of the lake.

There are limits to being able to absolutely define a lake's carrying capacity. "Although determining the carrying capacity of a given lake is an important part of the management of the resource, there is no conclusive answer to the question, How many is too many?" (Wagner 1991). Each lake is different, and various users will have different perspectives on what constitutes overcrowding, aesthetic impacts and environmental degradation. For this reason, "a carrying capacity analysis should be used as a tool to evaluate the range of options that are available to help minimize multiple use conflicts, environmental concerns, and other problems associated with lake overcrowding" and should help to "establish a framework for decision making and provide a basis for regulatory action" (Progressive AE 2001). "Carrying capacity determination is not a matter of computing and rigidly enforcing a single, explicit maximum value. Instead, carrying capacity includes an element of perception from recreation area users and managers, who add the human component to recreational carrying capacity. For this reason, the carrying capacity determination is never purely objective. As such, capacity is often reported in the form of a range of estimates as opposed to a maximum value." (Bosley, 2005)

Even with these limitations it is important to point out that exceeding the carrying capacity has many negative effects including degraded water quality, decreased boating safety, decreased boating enjoyment, habitat impacts, conflicts between various uses of the lake, and noise and aesthetic impacts. To reduce negative impacts it is important to determine as best as possible, the carrying capacity of the lake and to use it as a guide for regulating existing and future uses of the lake.

1.3 Environmental Impacts of Boat Use

The impacts of boat use on aquatic environments can occur through a variety of mechanisms. Significant research has been done to identify these mechanisms and the associated impacts. These studies have identified the most common ways that boats directly impact environmental quality. They include:

- Fuel emissions
- Propeller contact
- Turbulence from propulsion systems
- Wave action from movement

- Noise
- Human waste

The result of these disturbances often leads to a cascade of events beginning with diminishing water quality and ultimately resulting in degradation of aquatic plant, fish, and wildlife communities. Disturbance impacts include:

- Hydrocarbons in water column (Hassett and Avallone 2003)
- Suspension of bottom sediments (Asplund 1996; U.S. Army Corps of Engineers 1994; Hilton and Phillips 1982; Yousef et al. 1980).
- Shoreline erosion (Johnson 1994; Nanson 1994; Bhowmik et al. 1992)
- Decreased water transparency (Asplund 1996; U.S. Army Corps of Engineers 1994; Hilton and Phillips 1982; Yousef et al. 1980)
- Destruction/ Disturbance of fish communities (Kempinger et al.. 1998; Mueller 1980; Lagler et al. 1950)
- Destruction of aquatic plants (Asplund and Cook 1997; Mumma et al. 1996; Vermaat and de Bruyne 1993; Murphy and Eaton 1983; Zieman 1976)
- Loss of valuable fish and wildlife habitat (Stalmaster and Kaiser 1998; Madsen 1998; Rodgers and Smith 1997; Kahl 1991)
- Mis-management of human waste leading to increased pathogen and nutrient levels (Canandaigua Lake Watershed Management Plan 2001)

Most of the research examining these effects is somewhat new, and measures only short term impacts; therefore very little is known about long term impacts of boat use on aquatic communities (Asplund 2000).

It is clearly understood that boats create wave action and turbulence resulting in erosion of the shoreline and disturbance of lake sediments. This increases the amount of particulates in the water column and decreases water clarity (Asplund 1996; U.S. Army Corps of Engineers 1994; Yousef 1980). Sediment disturbance also releases pollutants such as nutrients (phosphorus and nitrates) and/or metals (lead, cadmium, mercury) that have settled to the lake bottom (Hallock and Falter 1987; Schenk et al. 1975). Both of these events alter the physical habitat of the lake, thereby changing the living conditions for aquatic plant and animal communities (Asplund 1996). Local research conducted by Dr. Bruce Gilman and Kevin Olvany has shown a trend of increasing phosphorus levels in Canandaigua Lake (Gilman, Olvany 2006). One of the several sources of phosphorus is possibly related to boat traffic disturbing bottom sediments and releasing phosphorus.

Plant communities are affected by boats in a variety of ways. For example, when aquatic plants are damaged by direct cutting from propellers or from scouring of lake sediments by propulsion systems the result is most often a reduction of plant biomass (Asplund and Cook 1997). However, in some cases plants such as Eurasian milfoil, an invasive species, are spread by cutting. Johnstone (1985) showed that the spread of this species is "accelerated due to the prop-chop action of motor boats." Eurasian milfoil often shades out other native aquatic vegetation; therefore the spread of this species can have dramatic effects on native plant communities. Since plant community structure is vital to aquatic animals, these impacts are ultimately seen in fish and aquatic wildlife communities.

Recently, there have been many studies that examined the impacts of boat emissions and exhaust on water quality. In some cases, polyaromatic hydrocarbons (PAH) have been found at detectable

levels. Since PAH is a carcinogenic compound, there is particular concern for lakes and reservoirs that are used for drinking water supplies. A study of a particular reservoir used for drinking water showed that PAH was highest in summer months corresponding to peak use periods of motorboats (Mastran et al. 1994). The Canandaigua Lake Watershed Management Plan (2001) proposes (as a rough estimate) that "spillage of unexpended hydrocarbons by motorboats indicates average spills of over one hundred gallons per day and thousands of gallons during a boating season." The gradual transition from more polluting two stroke engines to less polluting four stroke engines will cause these numbers to decline.

Research conducted on Canandaigua Lake in 2003 by Dr. John Hassett, Chairman of the Chemistry Department, SUNY College of Environmental Science and Forestry documented that during busy summer weekends water quality standards for components of gasoline (toluene and zylene) exceed state standards at the north end of the lake. The particular compounds of interest, styrene, xylene, and toluene, were found in highest concentrations on the north end of the lake where the greatest amount of boating activity occurs (Hassett and Avallone 2003). The report authors conclude that pollution from boats on Canandaigua Lake is real and needs to be managed.

There is also some concern regarding human waste introduction into the lake on summer days when there is heavy boat traffic on the lake. Oftentimes a large number of boats will park near the shore of Kershaw Park for several hours at a time. Most of these boats likely do not have restroom facilities and due to a lack of easily accessible bathroom facilities nearby, boaters may be using the lake as a toilet.

2.0 Inventory of Current Boat Access and Peak Use on Canandaigua Lake

The following section provides a current inventory (May, 2008) of motorized/sail boat access on Canandaigua Lake from each type of access point (see below). Boat access information was collected using field observations, phone conversations, aerial imagery and public records of boat access to Canandaigua Lake. The inventory reviews motorized/sail boat access at each of the access points and does **not** include an inventory of residential and other access points for canoes/kayaks and other non-motorized watercraft. This limitation to the inventory was considered when estimating total boat use to the lake and developing an appropriate carrying capacity on the lake.

The peak boat use section provides a range of estimates for determining how many boats that have access to the lake are actually on the lake during a peak use period. There are several factors that can influence peak use rates. Weather conditions, gas prices and the overall economy are just some of the many issues that can play a role in impacting the peak use rate for a particular summer season. Conversations during the summer 2008 boating season with staff and visitors to the north end state boat launch have confirmed that higher gas prices and rainy weekends have significantly dampened the use of the boat launch this year. This decreased use of the boat launch more than likely corresponds with an overall reduction in peak use from the various access points. The report provides a range of peak use rates to try and take into account the range that can occur from year to year.

The access points for motorized/sail boats include:

- **Commercial/private marinas**
- **Residential parcels**

- **Dockominiums**
- **Boat launching facilities**
- **Rentals, cruise boats and sheriff's boats**

2.1 Commercial /Private Marinas

The information in Table 1 shows the number of motorized boats that can access the lake via commercial and private marinas. Access information was gathered using aerial imagery, interviews with marina owners and through field observations. Storage facilities include boat slips, moorings, dry dock, rentals/miscellaneous boats. Canandaigua Lake currently has five commercial marinas, one yacht club primarily for sailboats and whose membership is open to the general public, and a privately owned set of seven moorings available for lease just off the east side of the City Pier. The figures presented here do not account for the ability of marinas or private clubs to allow the launching of boats beyond those that are included in dry dock storage.

Table 1. Summary of Boat Access at Commercial/Private Marinas.

Marina	Slips	Moors	Dry Dock	Totals
German Brothers	33	35	35	**103**
Smith Boy Jansen	66	2	0	**68**
Pelican Point	45	0	150	**195**
Seagar Marine	88	0	0	**88**
Sutter's	192	0	80	**272**
Canandaigua Yacht Club	0	71	31	**102**
City Pier Moorings	0	7	0	**7**
Totals	**424**	**115**	**296**	**835**

2.2 Residential Access

Residential access to the lake was considered only for those residential parcels with actual lake frontage ownership. Upland parcels that do not have actual lakeshore ownership but do have easements or other access rights were not considered in counting the total number of parcels with access. This approach is based on the Dock Law which stipulates that the number of boat slips/moorings is allocated to each parcel based on the lineal feet of shoreline. The total number of parcels with lake frontage ownership is 1,518 and a breakdown by municipality and feet of shoreline is documented in Table 2. This information was obtained from the Ontario County Planning Department.

Table 2. Canandaigua Lake frontage by municipality.

CANANDAIGUA LAKE - LAKE FRONTAGE BY MUNICIPALITY

	0 - 25'	25' - 50'	50' - 100'	100' - 150'	150' - 200'	200+	TOTALS
City of Canandaigua							
# of Parcels	0	0	0	0	0	7	7
Total Length	0.00	0.00	0.00	0.00	0.00	7,419	7,419
Average	0.00	0.00	0.00	0.00	0.00	1059.86	1059.86
Town of Canandaigua							
# of Parcels	8	43	210	112	57	72	502
Total Length	154.86	1,845.45	14,219.83	13,664.16	9,733.99	25,079.25	64,697.54
Average	19.36	42.92	67.71	122.00	170.77	348.32	128.88
Town of Gorham							
# of Parcels	16	77	232	88	23	29	465
Total Length	275.76	3,349.18	15,540.59	10,233.72	3,881.69	8,987.58	42,268.52
Average	17.24	43.50	66.99	116.29	168.77	309.92	90.90
Town of South Bristol							
# of Parcels	4	21	66	65	41	68	265
Total Length	90.74	744.02	4,716.66	7,842.60	7,060.36	23,661.49	44,115.87
Average	22.69	35.43	71.46	120.66	172.20	347.96	166.47
Town of Italy							
# of Parcels	0	7	15	4	2	2	30
Total Length	0.00	280.96	970.64	516.80	335.47	4,346.67	6,450.54
Average	0.00	40.14	64.71	129.20	167.74	2173.34	215.02
Town of Middlesex							
# of Parcels	8	10	60	85	35	51	249
Total Length	143.77	382.73	4,724.52	10,081.62	5,770.80	18,846.19	39,949.63
Average	17.97	38.27	78.74	118.61	164.88	369.53	160.44
Totals							
# of Parcels	36	158	583	354	158	229	1518
Total Length	665.13	6,602.34	40,172.24	42,338.90	26,782.31	88,340.18	204,901.10
Average	18.48	41.79	68.91	119.60	169.51	385.76	134.98

Source: Ontario County Tax Map Data 2007
Yates County Tax Map Data 2004

One limitation of just looking at the allocation of boat slips/moorings per parcel based on the Dock Law is that it does underestimate the total number of boat slips/moorings due to the fact that a substantial amount of lakeshore parcels have a certificate of non-conformity because they exceeded the number of allowable slips/moorings when the original Dock Law was instituted by each of the six shoreline municipalities in 1992. Calculating the number of dock law exceedences is beyond the scope of this study, but information from the Town of Gorham suggests that between 80-100 parcels have a certificate of non-conformity in the Town of Gorham. However, the dock law exceedence issue was considered when estimating the current average number of actual boats per parcel.

Table 3 shows that a total of 5,910 boats can access the lake through the residential shoreline area at full build out (if all allowed residential boat slips/moorings were built on each parcel). This figure was obtained by categorizing parcels by total lake frontage, determining the number of boats allowed in the Dock Law for each lineal range, and summing boat totals for each category (Table 3). For example, parcels with 0 - 25' of lake frontage are allowed 1 boat based on parcel size. There are 36 parcels in this category; therefore 36 boats are allowed access to the lake through these parcels (Table 3).

Table 3. Boat slips and/or moorings allowed in the Residential Category of the Docks and Moorings law for lakefront parcels as determined by shoreline length.

Lake Frontage (ft)	0 - 25'	25' - 50'	50' - 100'	100' - 150'	150' - 200'	200+	Total
# of parcels in each category	36	158	583	354	158	229	1518
Boat Slips/moorings allowed per parcel	1	2	3	4	5	7	-
Total boat slips/moorings allowed for each category	**36**	**316**	**1749**	**1416**	**790**	**1603**	**5910**

Table 3 shows that there are currently a total of 5,910 boat slips/moorings allowed under the residential land use category of the Dock Law. This equates to an average, 3.9 boat slips/moorings per parcel. This figure does not represent the current number of boats per parcel, but does provide an accurate build out scenario of the number of boats per parcel if all allowed docking/moorings were used.

The next step was to estimate the actual number of boats per parcel. A survey regarding boat ownership conducted by Canandaigua Lake Pure Waters in 2001 (Lewandowski 2001) showed that the average number of boats (motorboats, sailboats, PWCs, canoes, and kayaks) per residential parcel was 2.34. The RSM-DEIS review of boat access to the lake used survey information from Lewandowski (2001) to estimate that each residential parcel has on average 1.53 motor/sailboats. However, the Lewandowski survey included not just shoreline properties, but properties within 500 feet of the lake. These upland properties may not have as many motor/sail boats as shoreline properties thus reducing the overall average of motorized/sail boats per parcel in the survey.

As stated previously there are non-conforming properties that exceed the dock law allocation. In addition, there are many lakeshore properties that have easements on them for upland properties to access the lake. Finally there are property owners that own personal watercraft (PWC) and are able to avoid the Dock Law by pulling the PWC up on shore. Based on all this information an estimate of 2 boats per parcel is used to determine the current total number of boats with access through the 1518 residential properties (Table 4). This estimate is in accordance with the "State of the Lake Report" (1994), which also estimates two boats per parcel. If 1.5 boats per parcel were used instead of boats then a total of 2,277 boats would currently have access through residential shoreline parcels.

Table 4. Summary of boat access from residential parcels located on the shoreline.

County	Parcels	Boats per Parcel (3.9 per parcel average)	Boats per Parcel (2 per parcel)
Ontario County	1239	4832	2478
Yates County	279	1088	558
Total	**1518**	5920	**3036**

A possible result of future development of large shoreline length parcels (designated in Table 3 as having more than 200 ft. of frontage) is the subdivision of those parcels. There are currently 229 parcels with more than 200 feet of frontage. One example of the impact of subdividing is if a parcel with 307 ft. of shoreline which is allowed 7 boats was subdivided into parcels of 51 feet in length, a total of 18 boats would be allowed on those 307 feet of shoreline. If these parcels are part of an upland development that is able to gain access to the lake through the "all other land use category" of the Dock Law than the number of allowed boat slips would increase by more than ten-fold.

2.3 Dockominiums

Table 5 shows a summary of boat access from condominiums, town houses and City Pier boat houses collectively called "dockominiums." Figures in the "Number of Boat Slips/Moorings" category represent current access. The "Number of Boat Slips/Moorings Pre-Approved" category represents additional pre-approved slips/moorings at a given dockominium.

These access points all predate the institution of the Dock Law and the condos/town houses are examples of keyhole or funnel development where a portion of shoreline is allowed access to upland parcels at a much greater rate than normal shoreline residential development would allow. The Dock Law was instituted in part to control and manage access for all residential development based on the lineal feet of shoreline and not the number of upland homes built.

Table 5. Summary of boat access from dockominiums.

Dockominium	Number of Boat Slips/Moorings	Number of Boat Slips/Moorings Pre-Approved
Rosepark	52	52
Yacht Club Cove	99	99
Holiday Harbor	132	132
Town Harbor	52	52
Bristol Harbor	150	290
Vine Valley	75	75
Boat Houses	87	87
Total	**647**	**787**

2.4 Boat Launches

There are a total of three public boat launches on Canandaigua Lake (Table 6). The overwhelming majority of boats that are accessing the lake through these facilities are motor boats or sailboats. The notes below the table provide the calculations used to develop the number of spaces per launch.

Table 6. Summary of boat access from boat launching facilities.

Boat Launching Facility	Parking Spaces (Boat Trailers)
State Boat Launch (north end)	250 [1]
State Boat Launch (south end)	75 [2]
Vine Valley Launch	25 [3]
Total	**350**

[1] From Dock Law SEQR report. There are 100 paved parking spaces for trailers and the grassed area is 1.5 times the size of paved area. On busy days trailers are parked near the end of the grass, along the access road and in old Wegmans lot.
[2] State boat launch at south end- 65 paved parking spaces, also park along road (field observation).
[3] Estimate from local residents and Dock Law SEQR.

2.5 Rental/Cruise/Sheriff's boats

Table 7 shows an inventory of rental boats, cruise boats, and sheriff's boats that have access to the lake. On a typical weekend, the two sheriff's boats and three cruise boats are in use on the lake. The rental boats listed here only account for motorboats and do not include canoes, kayaks or sailboards.

Table 7. Summary of rental, cruise, and sheriff's boat access to the lake.

Marina	German Brothers	Smith Boy Jansen	Sutter's	Cruise boats	Sheriff's boats	**Total**
Totals	3	8-12	4	3	2	**24**

2.6 Peak Use Rate

Table 8 documents that there are approximately 4,892 boats that currently have access to Canandaigua Lake through each of the access points identified in the previous tables. However, only a certain percentage of the total boats that have access to the lake are on the lake during a peak use period. Peak use rate can therefore be defined as that fraction or percentage of the total number of boats that have access to the lake that are in use on a peak use day. Determining an accurate peak use rate for each access point is critical because carrying capacity analyses are developed to manage the peak use periods.

Peak use rates vary among lakes and for each type of access point. Each lake has its own unique population, cultural and access attributes that influence peak use rates. Additionally, previous surveys on this lake have identified that each access point (residential, commercial, boat launch, dockominiums and rentals) has a different peak use rate.

The various approaches to estimating peak use levels include: user surveys, aerial fly-over surveys, parking lot counts at public launches, on the water surveys, interviews with public launch staff and literature reviews. Based on previous counts and surveys on this lake along with numerous studies on other lakes, a range of reasonable peak use estimates were determined. Fly-over surveys were not

considered viable for 2008 due to the significant spike in gas prices. Additionally, an independent analysis completed through the RSM-DEIS provided a range of peak use rates that are in close proximity to the peak use rates established in this report.

There are numerous factors that affect current and future peak boat use. Weather condition, gas prices, overall economic conditions and population levels are just a few of the many factors that influence peak use rates. Because of these multiple factors it is difficult to determine a peak use rate that remains constant over time. Applying a range of current peak use rates is the best way to account for the various factors that can increase or decrease peak use.

One example of why a peak use range is appropriate is demonstrated by slightly altering one factor. For example, changing the residential usage rate from 13% to 15% increases the number of boats on the lake during a peak use period by 60. This increases the overall density of boats on the lake by 0.57 acres/boat. The literature supports both potential usage rates by documenting a range of usage rates for residential properties from 10-25%. Another way of looking at the comparison of the 13% or 15% usage rate is that 87% or 85% of the available residential boats are not being used on a peak use day.

2.7 Summary of Peak Boat Usage

Table 8 presents three scenarios with different peak use percentages for each of the types of access along with the associated number of "Boats in Peak Use." **Scenario 1** uses peak use rates taken from a Rosepark development study completed by MRB Group (1989), in which each boat access point has its own peak use rate. The RSM-DEIS peak use rates were also derived from this study, with an update of the public launch peak use rate from 87% to 100%.

An 87% peak usage rate for the boat launches was used in an MRB Marine Traffic Study on Canandaigua Lake (1985) which states: "a peak boat trailer count of 143 was recorded at 2:00 pm at the State Boat Launch on the peak traffic day of July 20. In 1985, the number of parking spaces available was 164. This translates into an in-use percentage of 143/164 or approximately 87%." However, the state boat launch at the north end has been expanded and now has 100 paved parking spaces for boat trailers and the grassed area is 1.5 times the size of paved area. Numerous field observations during busy days have shown that trailers are often parked throughout the grassed area, along the access road, and in the old Wegman's lot. The number of trailer parking spaces at the north end launch used in this report has been estimated at 250. Field observations of the South end boat launch and Vine Valley boat launch have shown that these launches also meet or exceed capacity on peak days. This estimate meets or exceeds previous full capacity estimates; therefore the usage rate used in this report is 100%. The RSM DEIS (2008), the State of the Lake Report (2001) and anecdotal conversations with boat launch users are in accordance with this change.

Scenario 2 uses a higher peak use rate of 15% for residential access points. Residential peak use rates can vary considerably and have been documented to be as high as 25% or as low as 10% (Warbach and Wyckoff 1994). Using 15% as the peak use rate for residential boats (in place of 13% used in Scenario 1) increases peak residential use from 395 to 455 boats. **Scenario 2** also incorporates the peak use rate for dockominiums used in a MRB Marine Traffic Study on Canandaigua Lake (1985) which indicated that the peak use rate of boats accessing the lake from dockominiums is closer to 20%. A 20% peak use rate increases the number of boats on the lake from dockominiums from 84 to 129 on a peak use day.

Scenario 3 uses a low peak use rate of 10% for residential, dockominium and commercial access points, but maintains the same percentage for launches and rental/cruise/sheriff's boats. This peak use rate is among the lowest of those represented in boat traffic studies (Warbach and Wyckoff 1994). This peak use rate may mimic times when there has been a spike in gas prices such as 2008.

Table 8. Summary of total boat access on Canandaigua Lake under current conditions and buildout conditions using three peak use rates.

	Residential	Dockominium	Marinas	Launch	Rentals/Cruise boats/Sheriff's boats	Total
Scenario 1 (using RSM peak use rates)						
Current Boat Storage Capacity	3036	647	835	350	24	4892
Peak Use Rate	**0.13**	**0.13**	**0.16**	**1.00**	**0.80**	
Boats in Peak Use	395	84	134	350	19	**982**
Scenario 2 (using higher peak use rates)						
Current Boat Storage Capacity	3036	647	835	350	24	4892
Peak Use Rate	**0.15**	**0.20**	**0.16**	**1.00**	**0.80**	
Boats in Peak Use	455	129	134	350	19	**1,087**
Scenario 3 (using lower peak use rates)						
Current Boat Storage Capacity	3036	647	835	350	24	4892
Peak Use Rate	**0.10**	**0.10**	**0.10**	**1.00**	**0.80**	
Boats in Peak Use	304	65	84	350	19	**822**

2.8 Current Peak Use Boat Density on Canandaigua Lake

One of the first steps to identifying the carrying capacity is to determine the usable acreage of the lake. Usable acreage is defined as the net usable lake surface area that is available to boaters for power boating/sailing activity. The total surface area of the lake is 10,500 acres however; the usable lake surface area for Canandaigua Lake is 9,560 acres. This was determined by applying the 200 foot no-wake buffer (not appropriate for power boating) on the entire shoreline length. This excludes 940 acres extending from the lake perimeter that is considered from the total 10,500 acres leaving 9560 acres of usable surface area. This does not take into account the increased buffer around public swimming areas, shallow zones beyond 200 feet and areas with heavy growth of aquatic vegetation. The buffer only extends from the shoreline and does not take into account the additional length of docking structures that are incorporated into the 200 foot no-wake zone. The calculation for determining the usable acreage of the lake is shown below.

Useable Acreage= 10500 –940 acres (200 foot no wake zone) = 9,560 acres

Peak use boat density is the number of boats that are operating on the lake during a peak use period and is shown in this report as acres of lake surface area per watercraft. In order to calculate peak use boat density, the useable acreage of lake is divided by the number of boats in peak use. The resulting output is somewhat counterintuitive with more available acres per boat resulting in less dense (less crowded) conditions (Table 9). The calculations for peak use boat density are shown below.

Peak Use Boat Density

Scenario 1: 9,560 acres ÷ 982 boats = 9.74 boats
Scenario 2: 9,560 acres ÷ 1,087 boats = 8.79 boats
Scenario 3: 9,560 acres ÷ 822 boats = 11.6 boats

Table 9. Comparison of boats in use during a peak use time and the density of boats during a peak use time on Canandaigua Lake.

	Scenario 1 (using RSM peak use rates)	Scenario 2 (using higher peak use rates)	Scenario 3 (using lower peak use rates)
Boats In Peak Use	982	1,087	822
Usable Lake Surface Area (10,500 acres – 940 acre buffer)	9560	9560	9560
Peak Use Boat Density (acres per boat)	**9.7**	**8.8**	**11.6**

The current peak use boat density estimates range from 8.8 to 11.6 acres/boat. This is in close proximity to the range of current peak use boat densities established in the RSM-DEIS of 10.2-11.2 acres per boat (Appendix P Table 27). Also provided in the RSM-DEIS is a population trend analysis, which shows that the 2016 build scenario will increase the peak use boat density resulting in a reduction of the available acres by 1.1 acres per boat. Based on these estimates, in eight years we will have a peak use boat density of 7.7 to 10.5 acres per boat.

3.0 An Inventory of Boat Density in the Northern One-Third and Southern Two-Thirds of Canandaigua Lake

3.1 Northern Third: North end to Menteth Point

On a peak use day, boat density is likely much greater in the northern third of the lake than in the southern two-third's of the lake. Dividing the lake into two parts and looking at the number of

boats with access to the lake in the northern third compared to combined access in the southern two-third's may help to clarify which portions of the lake are the most congested. Tables 10, 11 and 12 show the number of boats with access to the northern third of the lake. Tables 13, 14 and 15 shows the number of boats with access to the southern two-thirds of the lake combined. The northern third of the lake is on average slightly wider than the southern two thirds of the lake. Therefore the northern third has slightly more useable lake surface than the southern two thirds. This was factored into the lake surface size of each segment.

The approach used in this segment analysis was to separate for counting purposes boats originating in either the two segments from mixing or traveling with boats from the other segment. The boats originating from Pelican Point, which is in close proximity to the border between the northern third and southern two-thirds were divided in half between the two segments. Obviously, mixing does occur on the lake, but it was felt that mixing would be impossible to model and that mixing would occur in both directions thus having little impact on the actual number of boats in each segment.

Table 10. The number of boats with access to Canandaigua Lake in the northern third of the lake.

Boat Access Type	Name	Total Number of Boats	Estimated Boats in the Northern Third
Marinas	German Brothers	103	103
	Pelican Point	195	97
	Seagers	88	88
	Sutters	272	272
	Canandaigua Yacht Club	102	102
Shoreline residential	725 Shoreline Residences	2 per residence	1450
Dockominiums	Rosepark	52	52
	Yacht Club Cove	99	99
	Holiday Harbor	132	132
	Town Harbour	52	52
	Boat Houses	87	87
Boat Launch	State Boat Launch (north end)	250	250
Rentals/ Cruise Boats/ Sheriffs boats		10	10
Totals	**-**	**-**	**2794**

[1]Figure was obtained by multiplying original total by 0.5 to account for boats from these areas using the middle and southern thirds of the lake.

Table 11. Summary of total boat access on the northern third of Canandaigua Lake.

	Residential	Dockominium	Marinas	Launch	Rentals etc.	Total
Scenario 1 (using RSM peak use rates)						
Current Boat Access Capacity	1450	422	662	250	10	2794
Peak Use Rate	0.13	0.13	0.16	1.00	0.80	
Boats in Peak Use	189	55	106	250	8	**608**
Scenario 2 (using higher peak use rates)						
Current Boat Storage Capacity	1450	422	662	250	10	2794
Peak Use Rate	0.15	0.20	0.16	1.00	0.80	
Boats in Peak Use	218	84	106	250	8	**666**
Scenario 3 (using lower peak use rates)						
Current Boat Storage Capacity	1450	422	662	250	10	2794
Peak Use Rate	**0.10**	**0.10**	**0.10**	**1.00**	**0.80**	
Boats in Peak Use	145	42	66	250	8	**511**

Table 12. boats in use during a peak use time, and the density of boats during a peak use time on the northern third of Canandaigua Lake.

Boats In Peak Use	608	666	511
Usable Lake Surface Area 3,500 acres	3,500	3,500	3,500
Peak Use Boat Density (acres per boat)	**5.7**	**5.2**	**6.8**

Table 11 shows that a range of 511 - 666 boats are on the northern third of the lake on a peak use day. The total usable acreage of the northern third is estimated at 3,500 acres. Therefore, the peak use boat density in this area is approximately 5.2 - 6.8 acres per boat.

3.2 Southern Two-thirds: Menteth Point to South end

Table 13. The number of boats with access to the middle and southern thirds of Canandaigua Lake.

Boat Access Type	Name	Total Number of Boats	Actual Number of Boats (estimated)
Marinas	Pelican Point	195	98
	Jansens	80	80
Shoreline residential	793 Shoreline Residences	2 per residence	1586
Dockominiums	Bristol Harbor	150	150
	Vine Valley	75	75
Boat Launch	State Boat Launch (south end)	75	75
	Vine Valley	25	25
Rentals/ Cruise Boats/ Sheriffs boats		14	14
Totals	**-**	**-**	**2103**

Table 14. Summary of total boat access on the middle and southern thirds of Canandaigua Lake.

	Residential	Dockominium	Marinas	Launch	Rentals etc.	Total
Scenario 1 (using RSM peak use rates)						
Current Boat Access Capacity	1586	225	178	100	14	2103
Peak Use Rate	0.13	0.13	0.16	1.00	0.80	
Boats in Peak Use	206	29	28	100	11	**374**
Scenario 2 (using higher peak use rates)						
Current Boat Storage Capacity	1586	225	178	100	14	2103
Peak Use Rate	0.15	0.20	0.16	1.00	0.80	
Boats in Peak Use	238	45	28	100	11	**422**
Scenario 3 (using lower peak use rates)						
Current Boat Storage Capacity	1586	225	178	100	14	2103
Peak Use Rate	**0.10**	**0.10**	**0.10**	**1.00**	**0.80**	
Boats in Peak Use	159	23	18	100	11	**311**

Table 15. Comparison of boat storage capacity, boats in use during a peak use time, and the density of boats during a peak use time on the middle and southern thirds of Canandaigua Lake.

Boats In Peak Use	374	422	311
Usable Lake Surface Area 6,060 acres	6,060	6,060	6,060
Peak Use Boat Density (acres per boat)	**16.2**	**14.4**	**19.5**

Table 14 shows that a range of 374 - 422 boats are on the middle and southern thirds of the lake on a peak use day. The total usable acreage of the middle and southern thirds is estimated at 6,060 acres. Therefore, the peak use boat density in this area is approximately 14.4 -19.5 acres per boat.

4.0 Developing a Carrying Capacity for Canandaigua Lake

Carrying capacity is defined previously as the maximum number of boats that can be operated on the lake without compromising the lake's multiple uses, aesthetic enjoyment, natural beauty and environmental quality (expressed in acres/boat).

The development of a boat carrying capacity for Canandaigua Lake is not a new idea. Many lake management organizations have already developed suggested carrying capacities. In fact, during the development of the original Docks and Moorings Law for Canandaigua Lake several build out scenarios were completed by the Navigation Law Committee. The scenarios developed peak use boat densities for different amounts of boat slips and moorings based on the lineal feet of shoreline per parcel on both residential and commercial properties. Attachment B in the SEQR documentation for the Dock Law states that the "Navigation Law Committee applied a wide range of numbers to the land use tables to arrive at an acceptable density of 9.1 acres/boat, that was above the State's recommended minimum threshold for recreational safety (6-8 acres per boat) and was a fair and uniform system to apply to all municipalities." However, there was no rationale or analysis documented on how the 9.1 acre per boat carrying capacity was derived to justify its acceptance by the Navigation Law Committee.

The development of the 9.1 acre per boat carrying capacity predates water quality studies, comprehensive plans, surveys of residents and the watershed plan that review recreational activities as sources of pollution and/or creating user conflicts on the lake. This scenario may also be outdated based on suggested carrying capacities from across the country and more recent research on Canandaigua Lake including, but not limited to a hydrocarbon study outlined in section 1.3 of this report (Hassett and Avallone 2003).

Due to the lack of a comprehensive analysis to justify the 9.1 acre per boat guideline, a carrying capacity analysis was completed for Canandaigua Lake using four different methodologies taken from published carrying capacity reports (shown below). Additionally, a listing of published carrying capacities from other lakes are shown in Table 20 to provide perspective on what other lake communities are doing to manage boat access.

4.1 Methodology 1: Carrying Capacity Analysis & Ordinances Providing Lake Access Regulations (Warbach and Wyckoff 1994)

One of the carrying capacity methodologies used as a model in this report was developed by a planning and zoning consultant team in Lansing, MI entitled "Carrying Capacity Analysis & Ordinances Providing Lake Access Regulations." The report was funded and reviewed by the surrounding towns and counties along with the Michigan Department of Natural Resources (MDNR). The funding sources for this project are similar to those of the Canandaigua Lake Watershed Council in that they are municipal and county governments.

This approach uses a scoring matrix that accounts for thirteen characteristics of inland lakes. Scores for each characteristic fall under one of two categories: score toward less restrictive carrying capacity or score toward more restrictive carrying capacity. The difference in sums of the "less restrictive" and "more restrictive" categories is used to calculate the overall carrying capacity,. A brief description of each characteristic along with an explanation of scoring for each characteristic as it applies to Canandaigua Lake can be found in the Appendix A of this report. Table 16 is a summary of all the information presented in the carrying capacity analysis.

Table 16. Summary of carrying capacity analysis for Canandaigua Lake.

	Score toward less restrictive	Score toward more restrictive
1- Lake Size	-	-
2- Lake Shape Factor	1	-
3- % Lake Under 5' Depth	4	-
4- Bottom Soil Type	-	1
5- Bank Characteristics	-	1
6- Predominant Shoreline Soil Type	-	1
7- Option: Water Quality Protection	-	4
8- Flushing Rate	-	1
9- % Shoreline Dev. or Developable	-	2
10- Avg. Frontage of Building Sites	1	-
11- Ownership Pattern	-	1
12- Community Master Planning	-	1
13- Multi-Boat Access Site Factor	-	2
TOTAL:	**6**	**14**

The difference in the "less restrictive" and "more restrictive" sums is +8 for Canandaigua Lake (the + sign indicates that the "more restrictive" sum was greater than the "less restrictive" sum). The MDNR utilizes a base level of 30 acres per boat for the carrying capacity of in a given lake. The overall carrying capacity for Canandaigua Lake using this approach is 38 (30 + 8) acres per boat. The equations below show that the total carrying capacity is 252 boats.

14 (score in the more restrictive category)
– 6 (score in the less restrictive category)
+ 8 acres per boat

30 (base level of acreage per boat)
+ 8 (calculated from carrying capacity analysis)
38 acres per boat (total carrying capacity)

9560 acres (useable lake surface area)
÷ 38 acres per boat (total carrying capacity)
252 boats (maximum number of boats on the lake at one time)

The MDNR carrying capacity model determines 30 acres per boat to be an appropriate base level carrying capacity. A rationale for why this amount of acreage per boat is considered appropriate is not provided in the MDNR report. However, it is similar to other recently published suggested boating densities of motorized vessels (Table 20). The additional eight acres per boat using the scoring matrix reflect certain features of Canandaigua Lake or management strategies of the community that indicate a need for added protection. With 38 acres required for each boat on approximately 9560 acres, the maximum number of boats operating at one time on the lake should not exceed 252 boats. According to the current inventory of boat peak boat use there is a current range of 822- 1,087 boats are operating on the lake at one time resulting in a peak use boat density of 11.6 - 8.8 acres per boat. The current estimated peak use boat density is among the lowest limits of those suggested in Table 20, and is considerably denser than the 38 acres per boat calculated using this methodology.

One of the major criticisms of this methodology is the use of 30 acres per boat as the base level carrying capacity. The boating density information in Table 20 shows a wide range of suggested boating densities, depending on boating use, from as low as 5 acres per boat to as high as 50 acres per boat. In some cases, as stated in the 1983 NYS Recreation Plan, these boating densities are only minimum requirements of acreage per boat. Adopting a lower base level carrying capacity in place of the 30 acres suggested by the Michigan Department of Natural Resources would result in an increased capacity of the lake (shown below). All figures include the additional 8 acres per boat calculated from the MDNR carrying capacity analysis.

Carrying capacity at 20 acres per boat (base level)

20 (base level of acreage per boat)
+ 8 (calculated from carrying capacity analysis)
28 acres per boat (carrying capacity) = **341 boats**

Carrying capacity at 10 acres per boat (base level)

10 (base level of acreage per boat)
+ 8 (calculated from carrying capacity analysis)
18 acres per boat (carrying capacity) = **531 boats**

Although adopting a lower base level of acreage per boat increases the total carrying capacity of the lake, the total number of boats on the lake at carrying capacity (341 - 531) is still much lower than the current number of boats operating on the lake during a peak use time (822 - 1,087).

4.2 Methodology 2: Weighted Average Approach:

In the Draft Environmental Impact Statement (DEIS) "Lake Use Assessment" developed by RSM for the West Lake Marine Club, Appendix P is provided to address the issues associated with current peak boat use and carrying capacity. Included in this appendix is a table that outlines a potential range of suggested carrying capacities (Table 17). This approach is based on estimating percentages of boats (by type) that are on the lake including: % power boats, % sail boats, and % non-power boats. The percentage by type of boat used in this approach was taken from a boating survey of shoreline residences that indicated the mix of boat types was approximately 45% power, 20% sail boats, and 35% non power among residential properties (Lewandowski 2001). After adjusting these percentages to account for boats from marinas, dockominiums and public boat launches, which are primarily motorboats, the mix of boat types was determined to be 70% powerboats, 20% sailboats, and 10% non-power boats.

The suggested density of boats by type is often shown as a range. For example, the RSM-DEIS stipulates that the suggested density for power boats ranges from 15-20 acres per boat. Therefore, four options are considered in the RSM-DEIS (Table 17) that accounts for the low and high end of each range for each boat type. The "Percent of Type" for each of the three boat types is multiplied by the corresponding "Density for Type" in a given option to obtain a "Weighted Density". The sum of the weighted densities for all three boat types is the "Overall Density."

Table 17. Potential Range of Suggested Carrying Capacities- Table 25 in RSM DEIS.

		Option 1		Option 2		Option 3		Option 4	
Type	Percent of Type	Density for Type	Weighted Density	Density for Type	Weighted Density	Density for Type	Weighted Density	Density for Type	Weighted Density
Power	70%	20	14.0	20	14.0	15	10.5	15	10.5
Sail	20%	10	2.0	8	1.6	10	2.0	8	1.6
Non-Power	10%	8	0.8	5	0.5	8	0.8	5	0.5
Overall Density (acres/boat)			**16.8**		**16.1**		**13.3**		**12.6**

The overall suggested carrying capacities shown in Table 17 range from 12.6 to 16.8 acres per boat. Currently, the peak use boat density on Canandaigua Lake is estimated to range from 8.8 to 11.6 acres per boat on a peak use day (Table 8). By comparison, it is clear that all of the current boat density estimates are in excess of the range of suggested carrying capacities proposed in Table 17.

The use of a weighted average to determine a suggested carrying capacity may be flawed. Certain types of boats and boating activities require more acreage to minimize environmental impacts and to operate safely. For example, power boats need a larger amount of acreage to operate safely especially when boaters engage in activities such as waterskiing or tubing. Because this is a multiple use lake and these uses are not segregated to different portions of the lake, the weighted average approach can create user conflicts when used to determine an appropriate carrying capacity for the entire lake. Additionally, Appendix P does not provide significant detail on whether the weighted average approach takes into account environmental protection factors when considering an appropriate carrying capacity. A better approach may be to make sure that all uses fall within the suggested carrying capacity of power boating.

4.3 Methodology 3: Progressive Architecture Engineering (PAE 2001)

Progressive Architecture Engineering (PAE) is a consulting firm that has developed management plans for several inland lakes in Michigan. Two studies, Four Township Recreational Carrying Capacity Study (2001) and Lake Charlevoix Manangement Plan (1987), are often referenced in the development of carrying capacities (Bosely 2005). Based on previous studies of suggested carrying capacity, PAE has determined that a "conservative, aggregate estimate of optimum boat density" be from 10 to 15 acres per boat. A calculation (shown below) based on the proportion of high speed watercraft (personal watercraft and boats with motors greater than 25 hp) was developed by PAE to determine a more exact figure that a community should adopt as its carrying capacity. The calculation produces the same range of 10-15 acres per boat based on the proportion of high-speed watercraft. The higher the proportion of high speed watercraft, the lower the suggested carrying capacity.

Carrying Capacity (in acres per boat) = 10 + 5 * (proportion of high-speed watercraft)

Based on the percentage of high speed watercraft provided in the RSM-DEIS "Lake Use Assessment," approximately 70% of the boats on Canandaigua Lake are high speed watercraft. Using this information, the suggested carrying capacity using this approach is 13.5 acres per boat (see equation below).

10 + 5 * (0.70) = 13.5 acres per boat

4.4 Water Recreation Opportunity Spectrum (Aukerman and Haas 2004)

The Water Recreation Opportunity Spectrum (WROS), developed by the U.S. Department of the Interior Bureau of Reclamation, is a comprehensive analysis of the spectrum of recreational activities and ways to manage activities based on the overall setting. The report can be used as "a tool to understand the type and location of six types of water related recreation opportunities, otherwise known as WROS classes. The six WROS classes range across a spectrum of urban, suburban, rural developed, rural natural, semi primitive and primitive classes. Each WROS class is defined by a particular "package" of activities, setting attributes, experiences, and benefits."

The WROS system is a comprehensive attempt at balancing the water related recreational opportunities with the goals of the community.

The WROS report states that there is diversity among recreationists, water resource settings, and the agencies that manage these resources. This diversity is good and should be conserved. Likewise, recreation managers recognize that each specific water resource (e.g., lake, river, reservoir, and bay) has a niche and contributes to a larger system of diverse recreation opportunities. Thus, the overarching goal of WROS is to provide planners and managers with a framework and procedure for making better decisions for conserving a spectrum of high quality and diverse water recreation opportunities. The conservation of recreation diversity is a fundamental purpose of the WROS system.

Tables 18 and 19 come directly from the WROS report and document the range of reasonable boating capacities based on the classification of the area. Below Table 18, the definitions of "Suburban" and "Rural Developed" are also provided from the WROS report. Based on these definitions as well as a review of the comprehensive plans of the six shoreline municipalities and an analysis of the current land use setting, Canandaigua Lake Watershed would fall in between the "Rural Developed" and "Suburban" classification. Using Table 19, a boating range decision tool, the report authors would place Canandaigua Lake in the mid range of the spectrum. Therefore, the resulting carrying capacity would range between 15 to 35 acres per boat.

Table 18. WROS range of boating capacity coefficients.

Figure 24. A Range of Reasonable Boating Capacity Coefficients		
WROS Class	**Range of Boating Coefficients**	
	Low end of range	High end of range
Urban	1 acre/boat	10 acres/boat
Suburban	10 acres/boat	20 acres/boat
Rural developed	20 acres/boat	50 acres/boat
Rural natural	50 acres/boat	110 acres/boat (1/4 sq. mi.)
Semi primitive	110 acres/boat	480 acres/boat (3/4 sq. mi.)
Primitive	480 acres/boat	3,200 acres/boat (5 sq. mi.)

Suburban Setting: A suburban WROS area is on the fringe of the urban area. The sights, sounds, and smells of development and built structures are widespread. The built environment tends to be commercial and residential. The sights, sounds, and smells of commerce and everyday living are very obvious and prevalent, while naturally appearing settings may be found in community parks, greenways, trails, open space, natural areas, wetlands, estuaries, and tidal marshes. The water resources tend to be highly channelized, manipulated, or altered to contain large fluctuations in water flow and for the protection of public safety and property. Recreation management is very prevalent (e.g., personnel, rules, facilities, signs, services, conveniences, security). Recreation use, diversity, socialization, concentration, sense of security, and conveniences are very prevalent and obvious. The sights, sounds, and smells of recreation and non-recreation use (e.g., municipal, industrial, residential) are obvious but not dominant in a suburban setting. Examples of suburban WROS areas can be found on the outer edges of most metropolitan areas in the United States.

Rural Developed Setting: A rural developed WROS area is beyond a metropolitan area and the suburban ring of development. Rural developed areas may serve as "bedroom" communities for urban areas and may contain working farms and ranches, and towns and primary road networks are common. Development will be prevalent and common, yet the setting has a pastoral sense because of an interspersing of forests, water resources, hills, valleys, canyons, wetlands, open spaces, and agricultural land uses. Natural appearing shoreline edges are common, although various water controls or other structures are also common. Recreation management is prevalent and common but not as extensive as in an urban setting (e.g., personnel, rules, facilities, signs, services, conveniences, security). Recreation

use, diversity, socialization, concentration, sense of security, and conveniences are common but less so than in a developed suburban or urban setting. The sights, sounds, and smells of recreation and non-recreation use are common, yet interspersed with locations and times when a sense of tranquility and escape from everyday challenges may be experienced by the urbanized visitor. Examples of rural developed areas may include areas with country estates, second homes and cabins, dams, power stations, primary and secondary roads, communication lines, resorts, marinas, small communities, full-service campgrounds, county and State parks, farms, ranches, and small commercial and industrial establishments.

Table 19. WROS boating capacity range decision tool.

Figure 25. A Boating Capacity Range Decision Tool

The purposes of this decision tool are to help ensure that managers consider important factors affecting boating capacity and to help document the reasoned analysis used in making a boating capacity decision. For each WROS zone, consider the following factors that may affect boating capacity. *Circle the descriptor that best matches the situation.* The preponderance of the answers will indicate which part of the capacity range may be more reasonable.

Typical size of boats	<15 feet	16 to 25 feet	>25 feet
Typical speed of boats	<10 mph	10 to 25 feet	>25 feet
Diversity of boating: 1. different types of boats 2. different size of boats 3. different speed of boats	 low low low	 moderate moderate moderate	 high high high
Boater visitation pattern	simple/ predictable	moderate	complex/ unpredictable
Level of boater stewardship/ civility/respect for resource and others visitors	high	moderate	low
Shoreline configuration	simple/ circular	moderate	complex/ meandering
Boater destination or pass-through area	pass-through corridor/in-transit	mixed	destination area/overnight area
Extent of sensitive resources/ potential for impact	low	medium	high
Compatibility with adjacent recreation/non-recreation land uses	high	moderate	low
Islands/shallows/hazards	infrequent	occasional	frequent
Historic public safety record/ accidents/complaints/conflicts	infrequent	occasional	frequent
Level of boater management/rules/ information/education/compliance	high	moderate	low
Other factors:			
Suggested capacity range	**lower end (more boats)**	**mid-range**	**higher end (fewer boats)**

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4.5 Suggested Carrying Capacities from other lakes

There have been many lake management agencies and research studies throughout the U.S. that have attempted to determine the carrying capacities for specific waterbodies. Table 20 provides a list of current published carrying capacities from across the country that incorporate multiple boating uses. The last row documents that the average of the available suggested carrying capacities is 22 acres per boat. The list documents that there is a wide spectrum of suggested carrying capacities based on each entity's/study's definition of carrying capacity. Some definitions were based on minimum recreational safety (New York), while others included both recreational safety and environmental factors (Michigan). However, the documentation that accompanied each of the

suggested carrying capacities did not include a comprehensive rationale for the methodology used for its derivation.

Each lake has unique characteristics; therefore, listing and averaging what other lake communities are doing is not sufficient in determining the carrying capacity for Canandaigua Lake. However, this list does provide an important check on whether the carrying capacities derived from the four methodologies falls within the spectrum of what other lake management agencies are suggesting. Since the average of the carrying capacities from the four methodologies and the listing of carrying capacity boat densities from other communities are essentially equal lends credence to the methodologies applied to Canandaigua Lake.

Table 20. Published carrying capacity guidelines.

Source	Boating Uses	Suggested Carrying Capacity (acres per boat)
Minnesota Department of Natural Resources 2005	All uses combined	20
Michigan Department of Natural Resources	All uses combined	400 boats for the first 10,000 acres; 40 acres per boat above 10,000
Kusler 1972 – Upper Great Lakes	Waterskiing combined with all other uses	40
New York Statewide Recreation Plan 2003 NYS "The following do not provide optimum conditions but rather represent a minimum requirement"	Power Boat and Sailing	6-8
Jaakson et al. 1990 - Michigan	All uses combined	10
Warbach and Wyckoff 1994	All motorized (>5HP) uses	30
Lake Ripley, Wisconsin	All uses combined (stationary and moving)	20
Wagner 1991	All boating activities	25
Ashton 1971 – Southeastern Michigan	All uses combined	5-11
Keuka Lake Management Plan	All uses combined	25
Florida Dept of Environmental Protection	Unlimited power	10-20
AVERAGE		**22**

4.6 Critiques of Carrying Capacity Methodologies

There are opponents to the use of carrying capacity methodologies like the ones used in this report. In 1995, the Michigan Boating Industries Association and the Michigan Department of Park,

Recreation and Tourism Resources sponsored a workshop entitled "Recreational Boating Capacity: A Framework for Managing Inland lakes." One of the underlying themes of the workshop is to discredit the use of "cookbook" carrying capacity methodologies. Several speakers at the workshop emphasized that carrying capacity is a management strategy that should be based on "creating, restoring, and maintaining conditions" not on determining fixed maximum allowable use densities (ex. 12 acres per boat). Participants suggested that a range of estimates that "reflect the demand of users and the level of environmental quality that they are willing to accept" be used in place of a single density figure. Emphasizing the use of carrying capacity as a management decision based on community perceptions and goals was reiterated by several presenters.

At some point, however, it seems necessary that a management goal of the community should be to establish that "range of estimates" in order to "accommodate use and still achieve resource protection objectives." Using a set of mathematical formulas to determine an absolute carrying capacity (hard cap) does not seem appropriate, but using a series of published capacity methodologies and other inland lake carrying capacities as a guide in defining potential environmental and recreational limits is a necessary part of establishing management objectives.

5.0 Carrying Capacity Recommendation for Canandaigua Lake

Based on the information presented in this report and the factors that are listed and described later in this section, the recommended carrying capacity range for Canandaigua Lake is 15-20 acres per boat. This equates to a recommended range of 478 - 637 boats on the lake at one time. This recommendation is less than the average of the four methodologies presented in this report (22 acres per boat) and the average of the published boating densities (22 acres per boat). The 15-20 acre per boat recommendation is a compromise between the theoretical carrying capacity of 22 acres per boat (based on this analysis) and the actual current peak use boat density of 8.8 – 11.6 acres per boat.

Many factors were considered in this recommended carrying capacity range for Canandaigua Lake including:

- Four methodologies analyzed in this report
- Average density guidelines for other lakes
- Current estimated boat use range on the lake
- Current estimated use in the northern third of the lake compared to the southern two-thirds
- Economic importance of Canandaigua Lake
- Multiple active recreational uses of the lake (swimming boating, waterskiing, fishing)
- The highest and best use of the Lake as a water supply
- Multiple passive uses of the lake (canoeing, bird watching, enjoying the solitude the lake can provide)
- Protecting the water quality and ecological integrity of the lake and watershed ecosystem
- Previous surveys and current public sentiment that there are user conflicts on the lake during peak use weekends
- Subjective components of the carrying capacity analysis
- There are as many as 30 peak boat use days during the summer boating season (June, July, and August weekends and holidays)
- Population trends that are showing increased densities in future years

The four carrying capacity methodologies presented in this report suggest a range of carrying capacity from 12.6 to 38 acres per boat. Methodology 1 (section 4.1) from the Michigan Department of Natural Resources takes into account thirteen characteristics and management strategies of the lake. It shows that a suitable carrying capacity would be 38 acres per boat. Methodology 2 (section 4.2), an analysis developed by RSM for the West Lake Marine Club is based on a weighted average approach for determination of carrying capacity. Using this method, an appropriate carrying capacity range is considered to be from 12.6 to 16.8 acres per boat. Methodology 3 (section 4.3), developed by Progressive Architecture Engineering (PAE) is based on the proportion of high speed watercraft on the lake. It shows a carrying capacity of 13.5 acres per boat to be appropriate. Methodology 4 (section 4.4), taken from the Water Recreation Opportunity Spectrum is based on land use around the lake. This method shows a suggested carrying capacity range to be from 15 - 35 acres per boat. The resulting average of these four methodologies is 22 acres per boat.

Each of the methodologies presented in this report (4.1 - 4.4) has a level of subjectivity that must be taken into account. However, these four methodologies were chosen because each provided a credible rationale for determining carrying capacity. Of the four methodologies, 1 and 4 provided the most robust rationale to explain their methodology in determining carrying capacity.

The average of the suggested carrying capacities for other lakes (Table 20) was equal to the average of the four carrying capacity methodologies applied to this lake. Although this average may not directly correlate to Canandaigua Lake; the fact that the two averages are equal does strengthen the use of the average of the four carrying capacity methodologies when applied to this lake. It also demonstrates that our recommendation falls within the mid range of what other lakes are doing.

The current boat use inventory included in this report documents an estimated range of 822 - 1,087 motor/sailboats are on the lake at one time on a peak use day. The resulting current peak boat use boat density on the lake ranges from 8.8 - 11.6 acres per boat. Thus, the current peak use boat density estimate is approximately double the average suggested carrying capacity of 22 acres per boat derived from the four carrying capacity methodologies and the published density guidelines. The reality of the situation would make it very difficult to meet this "optimum" goal.

As previously stated, many factors have been considered during the development of a carrying capacity recommendation including: the economic importance of Canandaigua Lake, the multiple recreational uses of the lake (active and passive), the importance of maintaining the high quality of our drinking water supply and the importance of protecting the lake ecosystem. Also considered was the fact that the lake already substantially exceeds the 22 acres per boat suggested carrying capacity during peak use times. This is especially true in the northern third of the lake (5.2 - 6.8 acres per boat) which has a much higher density of boat traffic compared to the southern two-thirds of the lake (14.4 - 19.5 acres per boat). Finally, consideration of previous efforts that document public sentiment regarding user conflicts and consideration of the current strong feelings among a large portion of the public to protect the lake played a role in the development of the following carrying capacity recommendation.

Establishing a carrying capacity of at least 15-20 acres per boat would still allow for multiple recreational uses of the lake while minimizing conflicts among those uses. It would also help to provide the proper balance between the economic and environmental benefits that the lake provides. The 15-20 acre per boat range is a realistic goal considering that an optimum peak use density of 22 acres per boat will not occur without dramatic reductions in the existing boating population. Maintaining a 15-20 acre per boat carrying capacity would be a compromise between

the suggested and the current level. This range is also similar to the current peak use boat density in the southern two-thirds of the lake where there are less user conflicts than in the northern third. Finally, this range conforms to RSM DEIS suggested density range of 15-20 acres per boat for power boats.

There can be as many as 30 peak use days (June, July, and August weekends and holidays) during the summer boating season. On a peak use day, boat use on the lake will substantially exceed the 15 – 20 acre per boat carrying capacity recommendation. Thus, at estimated current peak use levels, Canandaigua Lake is likely to experience lake overcrowding, user conflicts, and environmental degradation as a result of boating activity. As development around the lake continues, increases in the demand for boat access are inevitable. This increased demand will likely increase the number and intensity of actual peak use days.

It is becoming increasingly important for community planners and local leaders to recognize that there are limits to the use of Canandaigua Lake. By doing so, the region will be better able to manage these multiple uses without degrading the water quality and natural beauty of Canandaigua Lake.

The purpose of this report and recommendation is to provide the Canandaigua Lake Watershed Council, municipalities, area residents and stakeholders a better understanding of the current boat use of the lake and the development of a boat use carrying capacity recommendation. The carrying capacity recommendation is intended to be used as a planning tool in the review of the lakeshore regulations and docks and moorings law along with being an important piece of information for reviewing agencies when analyzing the impacts of specific developments that have access to the lake. The carrying capacity of the lake should be a major consideration when making decisions related to increasing boat access to the lake.

The lakeshore zoning and docks and moorings components of this overall project will provide options on how to better manage lake access based on the recommendations in this report. The report will also be provided to state agencies that control access points to Canandaigua Lake and to encourage them to consider the carrying capacity when managing their facilities. Adopting this recommendation as a goal for the watershed community will be an important part of balancing the multiple uses of the lake and planning for a sustainable future.

APPENDIX A

Carrying Capacity Analysis & Ordinances Providing Lake Access Regulations (Michigan Department of Natural Resources)

Scores shown in bold print apply to Canandaigua Lake

1- Lake Size: Total lake acreage. A lake with a smaller surface area is more prone to impacts from boating activity. The total acreage for Canandaigua Lake is 10,500 acres. This places Canandaigua Lake in category 4 and no score is assigned for lake size in either category.

	Score toward less restrictive	Score toward more restrictive
1- < 50 acres	-	3
2- 50 to <300 acres	-	2
3- 300 to 1000 acres	-	1
4->1000 acres	-	**-**

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2- Lake Shape Factor (LSF): An expression of the relationship between the surface area of the lake to the length of the shoreline. Narrow, irregular lakes have higher LSF and making the shorelines prone to erosion. The formula is the total length of shoreline (36 miles) divided by (2 times the square root of the area of the lake (16.4 square miles) multiplied by pi (3.14)). The LSF of Canandaigua Lake is 1.41 indicating the irregular finger shape of the lake. This gives the lake a score of 1 in the "less restrictive" category.

	Score toward less restrictive	Score toward more restrictive
1-Round (LSF < 1.25)	2	-
2-Irregular (LSF >1.25-1.75)	**1**	**-**
3-LSF>1.75-2.5	-	2
4-LSF>2.5	-	4

3- % Lake Under 5' Depth: The percentage of the lake with a depth less than five feet. The larger this percentage is, the greater the effect of boating on water quality. The % lake under 5' depth is less than 10% in Canandaigua Lake giving a score of 4 in the "less restrictive" category.

	Score toward less restrictive	Score toward more restrictive
1-<10%	**4**	**-**
2-10-30%	2	-
3->30%	-	4

4- Bottom Soil Type: The dominant soil type at the bottom of the lake. Sand bottoms are associated with clear, cold lakes while muck bottoms are found in warmer weedy lakes. Muck bottoms disturbed by high boat traffic contribute to water quality degradation by releasing phosphorus and sediments from the bottom. The dominant soil type on the bottom of Canandaigua Lake is sand/muck giving a score of 1 in the "more restrictive" category.

	Score toward less restrictive	Score toward more restrictive

1-Mostly muck	-	1
2-Sand/muck	**-**	**1**
3-Mostly sand	1	-

5- Bank Characteristics: Higher banks are more prone to erosion when exposed by anthropogenic activity, therefore releasing sediments and contributing to water quality degradation. With the low bluff shoreline in the northern portions of the lake and the high bluffs in the middle and southern portions, the overall bank characteristics of Canandaigua Lake is considered moderate giving a score of 1 in the "more restrictive" category.

	Score toward less restrictive	Score toward more restrictive
1-High Bluff (over 10')	-	2
2-Moderate Bluff (5'-10')	**-**	**1**
3-Low Bluff (under 5')	1	-

6- Predominant Shoreline Soil Type: Anthropogenic activity often disturbs vegetative growth on the shoreline and exposes the underlying soils. Boating activity increases erosion of exposed silts, clays, and loamy soils and has negative impacts on water quality. The shoreline of Canandaigua Lake is made up of silts, clays, loams, and shale. Although many portions of the shoreline are laden with shale, other portions with soils are predominantly made up of silts, clays, and loams giving a score of 1 in the "more restrictive" category.

	Score toward less restrictive	Score toward more restrictive
1- Silts, clays, and loams	**-**	**1**
2- Sands and gravel	1	-

7-Option-Water Quality Protection: This characteristic is designed to account for a community that wants to "place emphasis on protecting water quality from further degradation from boating activity" (Warbach et al. 1994). Selecting water quality protection means that the community feels that the lake is a valuable natural and recreational resource that must receive maximum protection from overuse. Canandaigua Lake supplies water for over 60,000 people, and is certainly considered to be a valuable natural and recreational resource for the community, therefore, its protection is imperative. A score of 4 in the "more restrictive" category is assigned for this characteristic.

	Score toward less restrictive	Score toward more restrictive
1- Water Quality Protection	**-**	**4**
2- No Water Quality Protection	-	-

8- Flushing Rate: The length of time it takes for the inlets and outlets of the lake to replace the entire volume of water in the lake. The accumulation of human impacts on water quality is greatly increased in lakes with a flushing rate of one year or more. Research results have shown that the flushing rate of Canandaigua Lake is approximately 13.4 years giving a score of 1 in the "more restrictive" category.

	Score toward less restrictive	Score toward more restrictive

1- Less than 2 months	2	-
2- 2 months to 1 year	1	-
3- Over 1 year	**-**	**1**

9- % Shoreline Developed or Developable: Total percent of existing or potential shoreline development. The higher the percentage of shoreline development, the greater the impact of impervious surfaces like roofs, driveways, and roads on water quality. Impervious surfaces increase the temperature, velocity, and quantity of stormwater entering the lake in addition to other pollutants. The % of shoreline developed or developable in Canandaigua Lake exceeds 70% giving a score of 2 in the "more restrictive" category.

	Score toward less restrictive	Score toward more restrictive
1- >70%	**-**	**2**
2- 10 to 70%	-	1
3- <10%	2	-

10-Average Frontage of Building Sites: The length of the shoreline divided by the number of lots along the lakefront. Large numbers of small lots again increase the amount of impervious surfaces negatively contributing to the water quality of the lake. The average frontage of building sites along Canandaigua Lake is 134 feet per site giving a score of 1 in the "less restrictive" category. As more development occurs along the shoreline this average will decrease.

	Score toward less restrictive	Score toward more restrictive
1- up to 100'	-	1
2- 100' and greater	**1**	**-**

11- Ownership Pattern: A measure of the amount of lakefront owned by individuals or groups of individuals (condominiums, mobile home parks, etc.). Group ownership typically results in a higher use load on the lake and subsequent negative impacts on water quality. The ownership pattern on Canandaigua Lake is predominantly individual giving a score of 1 in the "more restrictive" category.

	Score toward less restrictive	Score toward more restrictive
1- Predominantly individual	**-**	**1**
2- Over 25% owned in groups	1	-

12- Community Master Planning: "The comprehensive land use plan of the community sets policies and allocates different land uses at varying intensities to different parts of the community." Master plans that protect water quality are designed to retain forested buffers and open spaces along the water front in addition to limiting development and creation of impervious surfaces near water resources. The community master planning around Canandaigua Lake typically contributes to high intensity land use giving a score of 1 in the "more restrictive" category. There are efforts to reduce the intensity of land use along the lake, but current development proposals that are gaining approval show a high intensity use of the shoreline.

	Score toward less restrictive	Score toward more restrictive
1- High intensity land use	**-**	**1**

2- Low intensity land use	1	-

13- Multi-boat Access Factor: The average number of boats allowed access to the lake through multi-boat access sites (i.e. State boat launches). The average number of boats allowed access to the lake through multi-boat access sites in Canandaigua Lake is approximately 87 boats per access site giving a score of 2 in the "more restrictive" category.

	Score toward less restrictive	Score toward more restrictive
1- <30 boats	2	-
2- 30-60 boats	-	1
3- >60 boats	**-**	**2**

APPENDIX B

Summary of Previous Boat Use Studies of Canandaigua Lake

Several attempts have been made over the last 25 years to quantify the recreational use on the lake. The following is a brief summary of these previous boat traffic studies on Canandaigua Lake. Portions of the summary come directly from the West Lake Marine Club-RSM project Draft Environmental Impact Statement and the 1994 State of the Lake Report. Both the RSM DEIS lake use study and this report document the substantial increase in the resident fleet of boats on the lake and the resulting increase in boat traffic.

1982 Army Corps of Engineers Study
The Army Corps of Engineers studied Canandaigua Lake for flood-prevention analysis of the Oswego River basin. The study determined that:

- A total of 1,561 docks are on the lake
- 95.6% of the landowners surveyed owned a boat
- Commercial marinas offer 246 pier moorings and a total of 150 docks
- The study also provided a fleet mix
- A total of 3,522 boats use Canandaigua Lake

1985 Marine Traffic Study
The Marine Traffic Study was conducted for the Canandaigua Point project at the north end of the lake. Key points from the study include:

- On July 20th, 236 boats were counted on the northern third of the lake between 1:45 and 3:30 pm (peak use time).
- This count was completed from the City Pier looking south to the Thendara Boat House- putting into question the accuracy of the count
- The majority boats were concentrated in the north end near Kershaw Park.
- 185 of the 236 boats originated from the state boat launch (north end)
- The peak usage rate for boats originating from condominiums was 20%.
- 1,011 cottages and residences counted (much less than other counts) and estimated to have one boat per property (which is contradicted by every other study of the residential fleet.

1989 Boat Traffic Study for Rosepark
The Boat Traffic Study was part of the environmental impact statement for the Rosepark development at the north end of the lake. Drawing on the results of the 1985 Marine Traffic Study, the 1989 Boat Traffic Study identified the following peak use rates per boat access type:

- 13% for residential boats
- 16% for boats stored at marinas
- 87% for capacity available at state launches
- 80% for available rental boats

The study uses these ratios to project 457 boats on the lake during the July 20th, 1985 period. Also noted in this study was a boating growth rate of nearly 12% from 1985, which exceeded growth projections for that time period. However, the report concluded that the lake is well below capacity in terms of boat traffic and the impact of Rosepark would be minimal.

1990 Canandaigua Lake Watershed Taskforce Recreation Committee Survey
This survey was sent to 2000 residents in the watershed and had 452 respondents. Of those respondents, 41% owned lakefront property therefore there are significant limitations to determining the lakeshore residential fleet from this survey. Some of the key points of the survey include:

- 67% of respondents owned power boats
- 44% of respondents primarily used their boats for sightseeing
- 65% of respondents felt that there were safety problems related to boating
- Speed and density of traffic were listed as the major issues that compromised the multiple uses of the lake

1990 Statewide Boating Use Survey
This statewide survey was conducted to determine the use of the state boat launches at the north and south ends of the lake. Counts showed that the two state launches have a parking capacity of 190 spaces. The current parking capacity of the two the north end and south end launches is estimated at 325 an increase of 135 spaces. It was noted that the north end launch received 11,208 boating trips and the south end received 4,698 trips. The surveyors completed boat counts using aerial reconnaissance during a peak use time (although the two summaries do not document the date and time of the aerial survey or the weather conditions), provide the following information:

- The resident boat populations is 2,065
- The north end and south end launches have a total of 190 parking spaces
- A total of 264 boats were on the lake
- 158 of these boats were from private residences
- 106 of these boats were from public launch facilities

1991 Navigation Law Study
The Ontario County Planning Department conducted a study of the shoreline of Canandaigua Lake as part of the development of the docks and moorings regulations. They developed estimates of existing peak use by applying the use rates developed in the Rosepark Boat Traffic Study in 1989. This study included:

- An inventory of 1,441 lakeshore parcels containing 1,062 residences
- An estimate of the number of "boats in residence" (i.e., the number of boats residing at lakefront residential properties) of 2,124 boats (2 boats per parcel).
- An estimate of 490 spaces for dockominiums, 160 miscellaneous residential
- spaces, 475 marina spaces, and 250 spaces at the state boat launches.
- An estimate of the total number of boats on the lake at peak time of 654
- (calculated by applying the peak use rates from the 1989 Boat Traffic Study)
- An estimate 7,361 boats representing maximum "build out" of residential parcels. This translates into 1,238 boats on the lake during peak use periods.

Table 1. Boat Storage Capacity and Boats in Peak Use – 1991

	Residential	Marina	Launch	
Estimated Boats	Residences 1,062 × 2 × 2 boats/res. Dockominium 490 Miscellaneous 160	Existing 475	Existing 250	
Total Boat Storage Capacity	2,774	475	250	
Peak Use Rate[1]	0.13	0.16	0.87	
Boats in Peak Use	361	76	217	**654**

Source: Navigation Law Study, Ontario County Division of Planning and Research, 1991, as reported in "Chapter 7: Recreation" from the *State of Canandaigua Lake Watershed Report*, 1994.

[1] Peak use rates from Boat Traffic Study for Rosepark, Clark Engineers, 1989.

1992 Capacity Analysis for the Dock Law

The maximum lake build-out scenario developed for the Uniform Docking and Mooring Law is based on the inventoried 1,441 residential parcels and the maximum number of boats per parcel permitted under the proposed Dock Law. An estimate of boating density at peak use was developed by dividing the full lake surface area by the peak number of boats. A lake surface area of 11,283 acres was applied, resulting in 9.1 acres per boat (11,283 acres/1,238 boats). This lake surface area is approximately 783 acres larger than the actual lake surface area.

- The maximum number of boats allowed by the Dock Law under the "residential land uses" category would be 5,616 boats.
- The maximum build-out scenario included 490 spaces for dockominiums and 160 miscellaneous residential spaces.
- 745 marina spaces were assumed (the existing 475 previously identified plus 270 spaces for new marinas). This number only reflects wet-boat storage and does not account for dry dock spaces.
- 350 spaces were assumed for the state boat launches (the existing 250 previously identified plus 100 spaces to account for overflow parking capacity).
- Using the above numbers and the peak use rates from 1989, the number of boats on the lake at peak under the full build-out scenario was estimated as follows:

Table 2. Boat Storage Capacity and Boats in Peak Use – Maximum Lake Build-Out

	Residential	Marina	Launch	
Estimated Boats	Max. Allowable Residential Boats 5,616 Dockominium 490 Miscellaneous 160	Existing 475 New Marinas 270	Existing 250 Overflow 100	
Total Boat Storage Capacity	6,266	745	350	

Peak Use Rate[1]	0.13	0.16	0.87	
Boats in Peak Use	815	119	304	**1,238**

Source: "Attachment D.1 – Canandaigua Lake Wet-Boat Storage Capacity" from the Environmental Assessment for the Canandaigua Lake Uniform Docking and Mooring Law, June 1992.

[1] Peak use rates from Boat Traffic Study for Rosepark, Clark Engineers, 1989.

1994 State of the Lake Report:

Page 7-116 of the 1994 State of the Lake Report states "The present motorized associated with Canandaigua Lake numbers about 3,000, and the potential for recreation-based water pollution is great." This figure represented the number of boats gaining access to lake through residences and marinas. The current boat inventory count for residential properties and marinas in 2008 show that the fleet of residential motorboats has exceeded 4,500, a 50% increase since 1994. An increase of this magnitude in such a short period of time is clearly a cause for concern. One way to address this issue is to determine the carrying capacity of the lake and use it as a guide for future management.

2001 Recreation Survey

In 2001, Canandaigua Lake Pure Waters, Ltd. (now called the Canandaigua Lake Watershed Alliance) conducted a recreation survey to obtain information about the current recreational uses of Canandaigua Lake. The survey addressed a variety of recreational issues including boat ownership, preferred boating activities, boat usage, and opinions about boating safety. A total of 521 surveys were mailed to property owners randomly selected from a list comprised of 1,673 properties within 500 feet of the lake shore. Of these, 177 surveys were completed and returned, representing a 10.6% sample of the original 1,673 properties. Several key findings are summarized below.

- The 177 respondents reported owning 415 boats.
- An estimate of 2.34 boats per residential property (Applying this estimate to the 1,673 properties within 500 feet of the lakeshore yielded an estimate of 3,923 boats in residence on Canandaigua Lake).
- Respondents indicated that the most frequently used boat was a motorboat.
- 10% of survey respondents indicated they did not own a boat.
- Primary boat uses included sight-seeing, water skiing, and fishing (a larger percentage of respondents indicated these were their main activities than respondents in 1990).
- The majority of respondents (79%) reported that the average time spent in their boats was 0 to 2 hours; 14% indicated they spend 2 to 4 hours in their boat on average. In 1990, 56% reported spending 0 to 2 hours in their boats and 35% reported spending 2 to 4 hours.

2008 RSM Draft Environmental Impact Statement Lake Use Assessment

The RSM DEIS Appendix P has provided a review of current and potential boat use along with an attempt at defining the carrying capacity of the lake. This report provides a carrying capacity range from 12.6- 16.8 acres per boat. Their current peak use boat usage estimated between 10.2- 11.2 acres per boat. The report also provides a boat density estimate for 2016 which increases the boat density range to 9.1- 10.1 acres/boat.

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