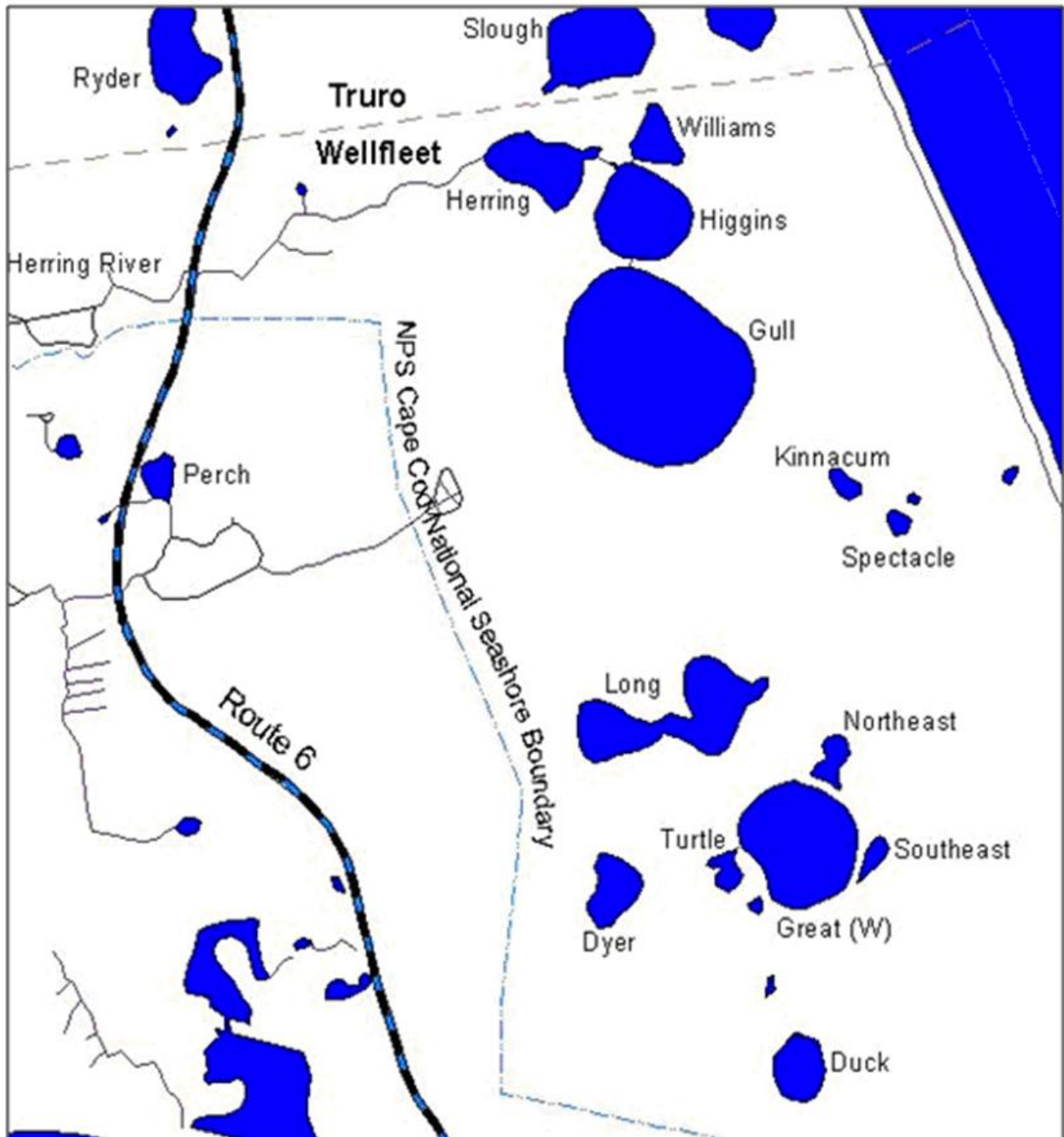


A PONDS MANAGEMENT PLAN

Wellfleet, Massachusetts



PONDS MANAGEMENT PLAN

TABLE of CONTENTS

Overview	Page 2
Summary of Recommendations	Page 3
Chapter One: Historical & Management Overview	Page 4
Chapter Two: Water Quality	Page 8
Chapter Three: Shoreline Issues	Page 12
Chapter Four: Specific Ponds	Page 14
Gull	
Long & Great	
Duck & Dyer	
Crowell, Squires & Perch	
References and Acknowledgements	Page 22

Natural Resources Advisory Board
February 2011

OVERVIEW

The focus of this Ponds Management Plan will be the kettle ponds of Wellfleet, especially the great ponds, and their key management issues, namely, water quality and shoreline management. The emphasis will be on the role of the Town of Wellfleet in ponds management. The first chapter is an overview of the ponds' human intervention, ownership, access and management. Chapter Two addresses water quality concerns, Chapter Three addresses shoreline use issues, and Chapter Four discusses issues for the ponds of major public use in Wellfleet: Gull, Great, Long, Duck and Dyer. All four chapters will refer occasionally to larger themes that are common to all resource concerns in our fragile, water bound environment. They include developing long-term perspectives on a shared resource, respect for what we don't know about the resource, awareness of multiple, traditional and historical uses, and the issues associated with public access. A key issue, developed more fully in Chapter Three is the idea that we may be "loving the ponds to death" with increasing human use.

Wellfleet is blessed with approximately 20 freshwater ponds (Table 1 and front cover). They are places of great beauty and tranquility, mostly surrounded by a national park. The waters are clear and sparkling. They are special places enjoyed by residents and visitors alike for swimming, boating, walking, family outings, skating and fishing. They are important to Wellfleet's tourist business as key attractions for summer visitors.

The popularity of the ponds can create conditions of overuse which threatens the very features which make the ponds popular in the first place. There needs to be a balance between use and preservation. There is no simple set of guidelines or regulations that will ensure this balance. We will need to keep in mind that it is much easier to cause damage to the resource - a damage that may appear only slowly over time - than it is to remediate that damage. The ongoing challenge of pond management in Wellfleet is maintaining a balance between their use by the public and their preservation as a multifaceted resource.

SUMMARY of RECOMMENDATIONS

The recommendations of this Ponds Management Plan are summarized in two groups:

- Change or Do
 - These are recommendations in the usual sense, for action
- Keep & Improve
 - We identify actions underway or regulations already in effect, urging that they continue and be supported by the Town

CHANGE ACTIONS

- Shorelines
 - Monitor for erosion
 - Undertake shoreline repairs at Gull (main beach & sluiceway) and Duck Ponds
 - Maintain naturally vegetated borders, banks and forested slopes around all ponds, in co-operation with private land owners and CCNS. Manicured lawns can be particularly harmful and should be discouraged
 - Educate all pond visitors and users on need to respect shoreline erosion risks
 - Enforce parking, Chapter 91 and other regulations
- Paths and Parking
 - Repair parking at Gull Pond and define parking areas
 - Repair path to Duck Pond
 - Manage the parking related overuse stress at the Sluiceway
- Water quality
 - Support CCNS water quality review: be prepared to act if remediation needs are demonstrated
 - Remind abutters of simple steps to help preserve water quality (see Ch 2, p7)

KEEP and IMPROVE ACTIONS

- Maintain user friendly toilets at all Town landings
- Prohibit dogs and other domestic animals from ponds and pond beaches during the summer season; enforce this rule
- Gull Pond: limit kayak/canoe racks and rentals; prohibit in water boat moorings
- Annual Ponds Review by the Beach Administrator, with participation by CCNS, the Conservation Commission, and NRAB
- Education programs to emphasize the care needed to preserve Wellfleet's wonderful ponds

CHAPTER ONE: HISTORICAL & MANAGEMENT OVERVIEW

Pond Geology and Setting

All the ponds in **Table 1** are “kettle ponds” (ref. 1,”the Ponds Atlas”). The depressions that are currently the kettle ponds were formed after the ice age by blocks of remnant ice. Some of the great ponds – Duck, Dyer, Great, Long and Williams – are “perched” ponds. These have semi-permeable bottoms of silt and clay and started to fill with water 11,000 years ago, perhaps within a few thousand years of glacial retreat. The other great ponds – Gull, Higgins and Williams – started to fill only about 5,000 years ago, when sea level rise pushed the ground water from the Chequessett lens high enough to intercept their bottoms. Currently, most of the water filling the ponds arrives as groundwater from the Chequessett lens

Table 1. Wellfleet Ponds

NAME	GREAT POND	PUBLIC ACCESS	AREA (Ac)	DEPTH (m)
* Gull	Y	Y	108.7	19
Great	Y	Y	44	16
Long	Y	Y	37.1	15
* Higgins	Y	Y	27.9	6
* Herring	Y	Y/boat	20	4
Duck	Y	Y	12.6	18
Dyer	Y	Y	11.9	10
* Williams		Y/boat	8.9	2
Perch			6	2
Northeast			4.2	4
Turtle		Y	4	2
Southeast			2.7	4
Kinnacum			2	2
Squires		Y	2	6
Spectacle 1		Y	1.2	7
Crowell's		Y	1	3
Grassy			0.6	
* Black			0.3	
Doane's Bog			0.3	
Spectacle 2		Y	0.3	

Note: * Located in Wellfleet Harbor Area of Critical Environmental Concern (ACEC)

that underlies Wellfleet. None of the ponds is stream-fed; only Herring Pond has a stream exit – the Herring River. The seven great ponds in Wellfleet lie above the high ridge of the lens. The highest surface of these ponds is Duck Pond, at about 8-9 feet above sea level, varying somewhat from dry to wet years.

The kettle ponds of Wellfleet do not have identical geological histories as is thoroughly discussed in the Ponds Atlas. Over the centuries they have all evolved but significant differences continue to exist. Change in the ponds has not stopped. In recent memory and even in the last decade, the ponds as a group, as well as individually, have shown they are far from static. Water level differences are perhaps the most obvious to lay observers, but there are other variations, too. Although this document makes no effort to provide a detailed history of the ponds, it is our intent to highlight the fact that there are both natural and human causes for short and long-term changes in the ponds. The geology of the ponds, so-called natural changes and human use/intervention in the environment of the ponds, as well as their water quality, are closely intertwined. Thus, developing a management plan is a complex task.

Human Intervention

The earliest indication of human intervention affecting the ponds' natural evolution was a change in sedimentary remains in the Gull Pond chain (Herring, Higgins, Williams and Gull Ponds), suggesting that Native Americans altered the Gull Pond complex by creating or improving sluiceways between the ponds. This was probably done to improve the herring run, perhaps as much as 1000 years ago.

Among the more significant human activities around the ponds that appear to have had a serious impact was the almost total deforestation of the outer Cape in the late 17th and early 18th centuries. Increased runoff from the denuded land apparently changed pond chemistry significantly for a period of time. It is known, for example, that phosphorous, a key pond nutrient causing increased plant growth is released from eroded soils when they wash into ponds. With reforestation beginning in the late 19th and early 20th century, these changes were largely reversed.

Shoreline erosion continues to threaten several of the ponds heavily used by property owners, summer renters and visitors from nearby towns: Gull, Higgins, Dyer, and Duck, Great and Long Ponds. Especially in the last 25 years human intervention has been due to increased use of the ponds area. Residential properties are intensively used, either by owners or renters. The few public landings are crowded throughout the summer. As a result, shoreline devegetation is again an issue. Also, there is a concern that nutrients – phosphorous and nitrogen – leaching into ponds via groundwater may lead to water quality degradation. The water in many of Wellfleet's ponds is remarkably clear and crystalline, so that even a small loss of quality is noticeable.

Pond Ownership, Access and Management

Seven of Wellfleet's ponds are "great" ponds: Gull, Higgins, Herring, Great, Long, Duck and Dyer. Great ponds are defined as those whose surface area is 10 acres or greater. This is significant because in Massachusetts law, all great ponds and the land beneath them are the property of the Commonwealth. Common ownership of great ponds is a long-standing legal principle in Massachusetts, tracing back to colonial common law. Ponds and their submerged lands under 10 acres, are owned by shoreline property owners.

All of Wellfleet's great ponds lie within the boundaries of the Cape Cod National Seashore (CCNS). However, legal ownership of great ponds remains with the Commonwealth. As a practical matter, though, the state has had little direct involvement in the management of Wellfleet's ponds in recent years. Local responsibility – through the Town of Wellfleet and the CCNS – remains paramount.

Various sections of shoreline on Wellfleet's great ponds are owned by the CCNS, by the Town of Wellfleet or privately. The mix of ownership varies greatly from pond-to-pond. As a consequence, the management of shoreline activity on the great ponds is a shared responsibility among the Commonwealth, the CCNS, the Town of Wellfleet, and private shoreline owners. Town agencies involved in pond management include the Health and Conservation Departments, the Conservation Commission and the Beach Department. The Board of Selectmen represents the Town of Wellfleet and its taxpayers in this responsibility.

The management structure of the ponds is thus complicated. Cooperation amongst the many stakeholders – government entities, the CCNS, private landowners, abutters and visitors – is essential. It is particularly important to recognize the relationship between the Town and the CCNS, as the two largest entities. For example, a walker of dogs can start at the Town dog walk area at the old Boy Scout camp, access trails that cross CCNS property, come to a public pathway on CCNS land that leads down to the Town landing on Duck Pond. There are many common management issues in this scenario: land management, consistency of animal and other regulations, enforcement, opportunities for education, etc. Many examples of good cooperation on these issues can be cited and some of them are described in Chapters Two and Three. Continued emphasis on this cooperation will be even more important in the future.

Public access is granted to all great ponds by Massachusetts law. The Town of Wellfleet owns landings on Gull, Higgins, Great, Long and Duck Ponds; the CCNS owns a landing on Dyer Pond. The Town landings are managed by the Beach Administrator. Beach Administrators have been and continue to be proactive in maintaining a balance between resource protection and human use.

Massachusetts law requires a Chapter 91 Waterways license for any structure – such as piers or

floats – placed in great ponds. Locally, the Conservation Commission oversees Chapter 91 issues. Gull, Higgins, Williams, Herring and Black Ponds, sometimes called the “gull ponds”, are interconnected as part of the Herring River system. They are all located within the Wellfleet Harbor Area of Critical Environmental Concern (ACEC). These ponds and their immediate shorelines thus have two layers of protection administered by the Town Conservation Commission. In addition to state wetlands regulations, the land within the ACEC must meet specific performance standards as established by the Wellfleet Environmental by-law and its regulations.

As stated previously, the CCNS, as the major owner of the uplands surrounding the ponds, has a critical role in local ponds management. The CCNS General Management Plan has specific goals for the kettle ponds within its boundaries:

“Activities at kettle ponds – The National Park Service will encourage the consistent management of human activities at kettle ponds under municipal, state or federal jurisdiction in order to protect the ponds from degradation due to development, overuse, or inappropriate use.”

In addition to the great ponds, smaller ponds and their shorelines within and owned by the CCNS are also open to the public unless restricted for resource or public protection purposes. The CCNS has worked closely with abutters (e.g. – Dyer and Duck Ponds) and the Town itself (e.g. – the Sluiceway) to protect the resource which lies within its borders.

Usually, but not always, the many stakeholders work together to protect and sustain the ponds. It should be noted that private owners and residents have sometimes been pro-active in mounting efforts to protect the ponds. Several neighborhood conservation and advocacy groups have developed, notably the Gull Pond Area Conservation Association (GUPACA). This organization in particular has worked consistently to encourage “best practices” for shoreline home owners and other pond users to maintain water quality and to carefully conserve the ponds as valuable resources. GUPACA currently has an excellent web-site of ponds information, which is linked to the Town of Wellfleet web-site and is listed among other references at the end of this document.

CHAPTER TWO: WATER QUALITY

Water quality is an essential feature of Wellfleet's ponds. Monitoring of ponds for water quality and chemistry is required to understand any changes in water quality and the causes of such changes. Monitoring and scientific studies of Wellfleet ponds go back to at least the mid-1950s. With the formation of the CCNS, this monitoring has been a priority activity of the park since about 1980. The early data were summarized in 2001 in the Ponds Atlas.

The Park Service is currently undertaking an extensive analysis of all the data. This should be ready in 2011/2012. One issue that makes this a major undertaking is that each pond has to be seen as unique. This report will be a critical factor in helping guide decisions about any remediation steps for pond water quality.

The great ponds of Wellfleet form a chain from south to north: Duck, Dyer, Great, Long, Gull, Higgins, Herring. These ponds sit above a ridge of the Chequessett groundwater lens, which underlies most of Wellfleet. This freshwater lens is recharged by rain water. (The geology of groundwater under the Cape has been mapped by the United States Geological Survey (USGS); refs. 7 & 8.)

The surface water level of these ponds is the top of the lens crest, which, in Wellfleet, takes the form of a narrow ridge running south to north. The highest of the ponds is Duck Pond, at a local high point of the lens ridge, about 9 feet above sea level. From thence, the lens ridge slopes gradually down to the north. The surface of Herring Pond in the Herring River valley headwaters is about 6 feet above sea level. Groundwater in the lens flows gradually downhill south to north from Duck Pond towards Herring Pond, and also west and east towards Cape Cod Bay and the Atlantic Ocean. The bay, the ocean and the Herring River estuary act as ground-water drains or release valves for discharging ground water. The rate of flow averages about a foot a day.

Included in the USGS studies is a delineation of the recharge areas of the ponds. A recharge area is the land area that actually contributes water, via groundwater inflow, to a pond. The size and shape of a recharge area depends on the shape of the water table. In general, the recharge areas around Wellfleet ponds are extremely narrow. A consequence of this is that only a limited number of land-based sources could contribute contaminants into the ponds. Many of the properties in the ponds area of Wellfleet are outside recharge areas of the ponds. The specific recharge area for Gull and Duck ponds has also been determined (ref. 9): these are discussed in Chapter 4.

For most of Wellfleet's great ponds, one feature soon becomes apparent: the water is not only clean but remarkably clear. For some of the ponds (such as Duck), the transparency depth can be over 50 feet in the early spring. The implication of this is that the ponds are relatively biologically non-productive. In Wellfleet harbor, transparency depths are 3-6 feet: the harbor is naturally a much more biologically productive body of water than the ponds.

Several water quality tests are used to characterize and monitor the state of water in the ponds:

- 1) Secchi depth – the measure of water clarity is determined using a black & white disk, lowered into the pond until it is no longer visible; that depth is the Secchi depth
- 2) pH and alkalinity – pH is a direct measure of acidity; alkalinity is a measure of the ability of water to withstand (buffer) changes in acidity
- 3) Phosphorus (P) & Nitrogen (N) – phosphorus and nitrogen are nutrients essential for plant and animal growth; the main sources of P (as phosphate, PO₄) for the ponds are the soils, septic wastes and regeneration from bottom sediments formed by earlier soils erosion; the main sources of nitrogen (as nitrate, NO₃, or as ammonium, NH₄) are septic wastes, rainwater and regeneration from high productivity organic sediments. Excessive amounts of phosphorous and nitrogen can lead to excessive biological activity in a pond, resulting in loss of water clarity and quality.
- 4) Dissolved oxygen (DO) – All animal life in the ponds requires adequate oxygen. For the highest quality pond surface waters, the state defines this limit as > 6 mg/l for cold waters (20C; 68F) and > 5 mg/l for warm waters (28.3C; 83F); see Massachusetts Department of Environmental Regulation 314CMR4.00). All of Wellfleet's great ponds meet this limit (refs. 1. "the Ponds Atlas" & 2. "the PALS report"). For deep ponds, in the summertime, pond waters can become stratified, with warmer surface waters above cold deep waters. These deep waters can become very low in oxygen – anoxic – until remixing occurs in the fall. Study of the current state of summer anoxia in Wellfleet's ponds will be an important piece of the CCNS ponds review.

The sands which underlie all of Wellfleet's ponds are granitic in origin, pulverized by the glaciers. These sands are low in nutrients such as nitrogen & phosphorous. (The sands, while low in general nutrients, do contain some phosphate. Soil erosion into the ponds will result in higher nutrient loadings. This issue is further discussed in Chapter 3.) The pond sands also lack basic alkali minerals, containing magnesium and calcium which provide alkalinity: there are no limestone soils on the Cape. Two consequences flow from these facts:

1. The low nutrients result in very low algal growth and therefore the clear waters mentioned above;
2. The low alkalinity results in a low buffering capacity and therefore waters which are very sensitive to human interference.

Not all ponds are expected to have crystal clear water. The process of eutrophication can be a natural one, progressing from pond to marsh to meadow. Eutrophication is especially active in shallow

ponds, where strong sunlight falling on the pond bed allows an active cycle of growth, decay and sedimentation. This is almost certainly the main process active at Kinnacum, Williams, Herring and Turtle ponds.

Of course, human activity can also result in a degradation of water quality, normally by introducing an excess of nutrients to the pond. There have been recent reports in the press about ponds issues in Falmouth and Brewster, where degradation related to older agriculture and recent over-development has required controversial and expensive treatment of ponds, using liming and alum methods. At the request of NRAB, CCNS undertook a brief summary review of Duck, Dyer, Great, Long and Gull Ponds: these are the five with the greatest human activity. No evidence of any severe or critical degradation was found.

Degradation of pond water quality has usually focused only on the effects of phosphorous. This has distinguished ponds from salt estuaries, where nitrogen loading is critical. However, some recently published science from CCNS labs (ref. 6) has suggested that both phosphorous and nitrogen can be important in Wellfleet's ponds. This work has recently been confirmed by some work in other Cape Cod ponds. In part, this may be due to the relatively lower natural pH of Cape Cod ponds, which therefore more readily dissolve phosphorous. If plenty of phosphorous is available, then the amount of nitrogen becomes important as both nutrients are needed for growth.

This finding could be important if human degradation is verified at any pond. Phosphorous can be controlled by moving septic tanks back from shorelines, by minimizing shoreline erosion, by using low phosphate detergents. Nitrogen as a nutrient comes from septic tanks and flows readily through the Cape's sandy soils. To control nitrogen requires tertiary or composting septic tanks, which are more expensive. Of course, the obvious step of eliminating the use of fertilizers is a good low cost first step in nitrogen reduction.

Five of the great ponds – Duck, Dyer, Great, Long and Gull – are actively used for swimming. Water quality at the beaches of these ponds has been regularly tested for coliform bacterial contamination by the Town acting for the state health department. In recent memory, none of these beaches has been closed for swimming, as the state would be required to do if contamination is found. Bacterial contamination comes primarily from human or animal wastes, through sub-standard septic systems or directly. The Board of Health and the Beach Administrator have been proactive in requiring high quality toilet facilities. Also, animals are prohibited from pond waters and beaches during the summer. However, there are still some sub-standard septic systems located near the shorelines of Wellfleet's ponds. These septic systems should be upgraded to Title V standards and located away from the shoreline (coliform bacteria also move slowly in groundwater). As an initial step, a survey of sub-standard septic systems is needed, including monitoring of pond water quality for bacterial and other contaminations.

Swimmers and pond waders can be a source of water quality degradation, especially during the crowded summer months. Rest room facilities are provided at the major Town landings. It is critical that these be kept clean and convenient to use by all family members.

Domestic animals on the beaches of ponds or in the water can leave fecal pollution. The Town Beach regulations of both the Town of Wellfleet and the CCNS prohibit any domestic animal on the beaches of Wellfleet Ponds or in the water during the season of greatest risk, from May 15 to October 15.

It is reasonable and prudent to expect that the intensive use of the ponds (see Chapter Three) might lead to degradation. Preventive measures can be taken now which should reduce future risk. We are encouraged that many pond abutters and the Town are already implementing many of these measures:

1. Take action to minimize or eliminate shoreline erosion (even though the pond sands are low in phosphorous, this can still be a trigger for plant growth). Of course, shoreline erosion can directly degrade water clarity from sedimentation. Well vegetated shorelines and banks will reduce the risk of erosion onto the ponds
2. Upgrade non-conforming septic systems in ponds watersheds to Title V
3. Move any septic systems as far back from the pond shoreline as possible: this will reduce phosphorous flow into the ponds. (The real rationale behind this recommendation is that Wellfleet soils contain high levels of iron. Iron traps and hold phosphate ions. So, moving septic systems back has a double benefit in reducing phosphorous nutrients reaching the ponds.)
4. Use no fertilizers on gardens and flower beds... or, if needed, use absolutely the minimum amounts
5. Dispose of any pharmaceuticals and drugs at the Town transfer station ... not into septic systems. These pharmaceuticals can interfere with the reproductive cycles of fish and other organisms living in the ponds (ref. 9).

Finally, pond sediment analysis (ref. 1, "the Ponds Atlas") has shown an increase in time of certain dissolved metals (arsenic, lead), due to local human activity. A recent addition to this list is mercury, which is generally agreed to come from power plants emissions further to the west (even as far as China). The dissolution of mercury, and its methylation to a highly toxic and biologically active form, is encouraged by the acidic nature of Wellfleet's ponds. This methyl-mercury accumulates in the bodies of fish. Fish in the ponds are now so contaminated that the state advises against their consumption, especially by children and pregnant woman.

CHAPTER THREE: SHORELINE ISSUES

The most difficult issue facing Wellfleet's ponds is finding the right balance between the legitimate and welcome use of the ponds (by residents, visitors and abutters) and protection of the resource. We recommend a general principle: the right balance is to limit use to current levels, with a few reductions in particular cases.

Overuse manifests itself in several ways:

- Pathways and parking areas can become degraded and expand slowly into adjacent native growths.
- Beaches can become eroded, causing sediments to flow into the ponds.
- Shorelines can become denuded of native vegetations. This not only can affect the aesthetic of the pond area but can contribute to water quality degradation, as discussed in Chapter 2.

Fortunately, most of Wellfleet's ponds are located inside the CCNS, eliminating the possibility of future development. Recent zoning changes in town will maintain the appropriate scale of future building. We are also fortunate that actions taken in the past – by the Town, by the Seashore and by shoreline owners – have helped to preserve the resource. Some examples are:

1. Moving the Long Pond parking across the road allowing shoreline vegetation at the beach
2. At Gull Pond, steps down to the beach (preserving the hillside) and upgrade of the bathrooms
3. At Dyer Pond, private owners and CCNS co-operation to restore a shoreline escarpment
4. Actions taken by many shoreline residents to limit phosphate use and to move septic systems away from the shorelines.

We recommend several measures that can be applied to all ponds. (Specific discussion of individual ponds issues follows in Chapter 4.)

1. Eroded shorelines should be restored.
2. Eroding parking areas and pathways should be reconstructed to minimize further loss.
3. Shorelines should be replanted, using native species.
4. Boundaries to all Town landings on the ponds should be clearly marked. Visitors should be encouraged not to walk further along fragile shorelines.

No individual visitor seeks to cause damage to the ponds. No recommendation can be stronger than educating all in the wise use and respect for the resource.

Many private landings and structures exist on Wellfleet's great pond shorelines. Most of these should require a Chapter 91 waterways license under the local jurisdiction of the Conservation Commission. A policy to deal with these landings and structures, often of considerable age, is recommended. (For more information about Chapter 91 issues, see the web-site of the state Department of Environmental Protection: <http://www.mass.gov/dep/water/resources/faqs03.htm>) A program of inspection for the purpose of suggesting improvements that would minimize shoreline damage would be useful. Maintaining a naturally well vegetated shoreline – for both Town and private lands – is essential to resource protection. It should be noted that not all shoreline structures are harmful to the environment. Many permit abutters to access the pond in a way that minimizes shoreline damage.

WALKING ACCESS

Many of the recommendations needed for Wellfleet's ponds necessarily require restrictions. We believe that providing sustainable ways to enjoy the ponds is also important. The upland areas around the ponds are deep oak-pine woodlands, filled with a variety of paths: sand roads, walking paths, animal tracks. Walking trails using the sand roads and other well considered paths can provide another way to appreciate the ponds area. Of course, any such trails must be used respecting private property rights and privacy and with permission of land owners including CCNS.

Encouraging the use of upland walking trails entails risk as well. Some walkers will leave the upland trail and cut through woods down to the pond shore. Pond shorelines and the slopes leading down to them are fragile and cannot sustain traffic. Examples of this fragility can be seen at Dyer and Duck Ponds. It is important to discourage this intrusion, especially by education of walkers. In some cases, owners are lead to pond shores by dogs: walking unleashed dogs violates both CCNS and Town regulations.

CHAPTER FOUR: SPECIFIC PONDS

GULL POND

Gull Pond is the most heavily used of all Wellfleet's ponds. The beach is popular and crowded on a summer's afternoon since the beach is shaded. The beach area is also used for Red Cross certified swimming lessons managed by the Town Recreation Department. Boating (kayaks, canoes, paddle boats, sunfish and electric powered rowboats only) on the pond is growing in use, which has led the Town to expand the canoe and kayak racks at the boat ramp (also a source of revenue). From Gull Pond it is possible to portage the Sluiceway and also paddle on Higgins and Williams Ponds. Gull Pond is stocked by the State with trout which provides a recreational opportunity.

The Gull Pond Landing and beach area were acquired by the Town of Wellfleet in a series of transactions from 1948-1953, predating the establishment of the CCNS.

In 2008, the Town Beach Administrator wrote a Gull Pond Management Plan (ref. 5, S.Thomas), submitted at that time to the Board of Selectmen. We broadly support the recommendations in the 2008 report. As a result of this plan, several important changes have happened at Gull Pond: an upgrade of the toilet facilities, provision of additional kayak racks, providing parking for clients at Jack's Boat Rental away from the waterfront. We urge that the Gull Pond plan be periodically updated. A similar plan for Long, Great, Duck and Dyer Ponds would be equally useful: such plans would be much simpler, as the issues are less complicated.

The parking area at Gull Pond becomes excessively crowded at times of peak use. The main parking area itself shows signs of erosion. We recommend that the parking area be repaired to minimize run-off ("water bars", which divert run-off to stable vegetation, could be used). The allowed parking spaces should be strictly delineated and enforced. With these changes, parking management at Gull Pond would be similar to that at Long and Great Ponds.

There is also evidence of shoreline erosion at the Gull Pond beach area. This is particularly noticeable just north of the main beach area, where there is only a narrow strip of beach on the way over to the kayak concession. This beach area should be rebuilt, perhaps using the opportunity to experiment in replanting underwater vegetation.

During peak summer use, the launching ramp is sometimes used by families who are there to enjoy the beach. Unfortunately, this is an illegal occupation of a public landing, which is legitimately used by others for boating. Fencing and signage should be installed to prohibit this beach usage.

Jack's Boat rentals, a Town licensed concession, has for many years provided another possibility for boating on Gull Pond. This should continue as part of the allure of Wellfleet as a vacation destination. We also believe that, by helping people appreciate the ponds, they will be more likely to join in steps to

protect them. However, the same concerns about overuse apply here as well. We recommend that, in the next contract, limits be continued on the number of boats to be rented. We also recommend that the boat rental concession be managed in a way that minimizes damage to the shoreline and also underwater vegetation.

We also recommend no further expansion of the kayak racks at Gull Pond. The swimming lessons at Gull Pond are a long-standing and worthwhile activity. We recommend that they be continued but that no other Town sponsored activities take place there, at least during the peak summer season. In the past, boat moorings have been located off the Gull Pond landing. There is no room for these, given current uses of the beach: the current prohibition should be maintained. Power boating on the ponds is currently allowed, provided that low power battery powered engines are used. Internal combustion engines are prohibited for reasons of safety and avoidance of hydrocarbon contamination. This policy should be continued.

Many ponds and watersheds around the country have been degraded by invasions of invasive plants. An example is hydrilla (*Hydrilla verticillata*) from Asia, which has clogged ponds in Florida and was recently found in Brewster. At the moment, the only invasives known in Wellfleet ponds are some phragmites on Herring, Long and Doane's Bog Ponds. These occupy a limited area. Prevention of more exotic species is the best long term policy. All watercraft coming from outside Wellfleet should be required to be absolutely cleaned of any vegetative matter before launching. Education of homeowners to avoid exotic plant or animal release from aquaria or home water garden features is on-going and needed.

SLUICEWAY

The sluiceway between Gull and Higgins ponds is another area of high intensity summertime use. It is easy to see why: it is a dramatic location between the two ponds. It is easy to reach by boat or car. For family swimming and picnicking it is an ideal venue. However, it is also an environmentally fragile location. Near-by parking is already limited to two places. These two spaces are quickly and continuously occupied during summer days, forcing other visitors to turn around on the narrow barrier beach, usually after discharging passengers and beach equipment, and drive elsewhere. This phenomenon results in a steady traffic jam with vehicles maneuvering right down to the shoreline of Higgins Pond, destroying vegetation and destabilizing soils. There is also high intensity use of the Sluiceway by boaters (mostly kayaks), either arrived for a summer beach outing or passing through to Higgins Pond. A specific concern at the sluiceway is shoreline erosion from pedestrians and even vehicles. A monitoring program (in co-operation with CCNS) would clarify the extent of the problem. We also recommend that steps be taken to find the best way to preserve or even restore the current shore line. (The same actions are needed at Dyer and Duck Ponds).

Reasonable limits on the sluiceway use are needed (see Gull Pond Plan of 2008). Both parking issues and kayak landing issues need to be considered. As any plan would involve changes on both Town and CCNS lands, a joint project approach would be the best way to proceed. There has in the past been good co-operation on ponds management issue between the Town and CCNS: this is another opportunity.

Management of the sluiceway area has continued to be a difficult issue, seeking the right balance between protection of the resource and the public's enjoyment of the area. Besides the excellent recommendations in the Gull Pond Management Plan of 2008, there are some other useful actions to consider:

1. Provide educational signage to help visitors understand the history and fragility of the site.
2. A limited use of fencing to protect vegetation and strategic placement of some benches, providing viewpoints but limiting shore line access, will also be useful. We have also noted at the sluiceway an abundance of poison ivy: some thoughtfully located warning signs would both help safety and protect vegetation.
3. Even though the Sluiceway is a remote area, enforcement of regulations there is important, keeping in mind the jurisdictional responsibilities of the Town and CCNS. Enforcement should be seen as complementing education, not replacing it. It is likely that the need for enforcement would be reduced with passing time, as the public became aware of the new standards.
4. It should be recognized that the overuse concerns arise only during the peak summer season: Memorial Day through Labor Day. Regulations that are needed to limit use during that period can be removed during the spring, fall and winter seasons.

Those who live on or near the ponds can and do play an important role in helping to preserve the resource. Active ponds associations have contributed to this effort. The most active currently is the Gull Pond Area Conservation Organization (GUPACA). This group has reported an increase in vegetative growth along the northeast shore of Gull Pond, replacing what was remembered as a clear, sandy bottom. The concern is that this growth might be due to human interference.

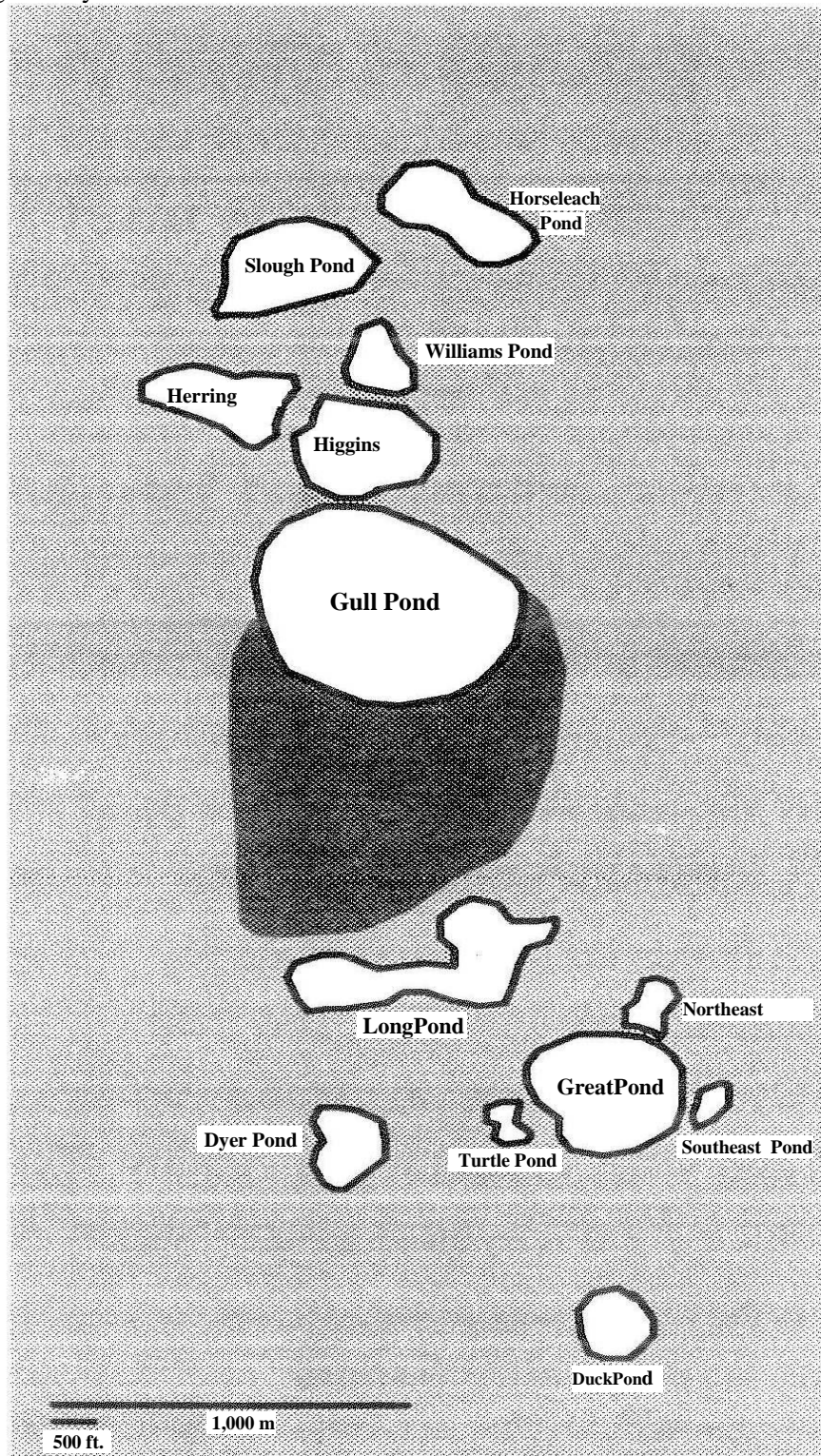
At the suggestion of GUPACA, CCNS investigated the issue (ref. 10). Aerial photography and ground surveys showed that the plant growth had existed in the past and existed along parts of the shoreline not built upon. Similar plant growth exists along the shores of other great ponds. The dominant plant was water lobelia, which has been reported to be an indicator of pristine, oligotrophic conditions. On the other hand, there is some older evidence from sediment analysis that phytoplankton have gradually increased in Gull Pond: this may be due to increases in nutrients. The CCNS report also emphasized that a

gradual pond-bottom slope, i.e. shallow water, promotes aquatic plant growth. The plants can be rooted in the bottom where the nutrients are and still receive lots of light energy. This could be a driving factor explaining the macrophytes on the shallower east side of Gull Pond.

If human activity has caused an increase in littoral plant growth, there needs to be a reason for that. Nutrients or shoreline erosion are the most likely causes. Both the summer winds (from the south-west) and the natural groundwater flow across the pond (from SW to NE, as a result of groundwater lens dynamics) might tend to concentrate nutrients along the north-east shoreline. Gull Pond has a substantial catchment area, running south almost to Long Pond. (See Fig 1)

The review of water quality by CCNS will include both nitrogen and phosphorous data. That could be indicative. If high nutrients are found, it will also be useful to do nutrient and vegetative surveys near the affected shoreline: a lack of local history, especially about nutrients, would make that a longer term project. The catchment areas for each specific pond could then be used to identify contaminant sources for each pond: septic systems, road run-off, shoreline erosion, thereby prioritizing a level of risk to each pond. Eventually, a full nutrient budget and the implementation of required nutrient limits may be needed for ponds which are at risk.

Fig.1 Recharge area for Gull Pond (ref. 8). The dark area shows the uplands from which groundwater can flow into Gull Pond, moving generally from SW to NE.



LONG & GREAT PONDS

Long Pond is very heavily used. It is a favorite fresh water swimming beach in Wellfleet. It has the highest density of shoreline dwellings of any of Wellfleet's ponds. It is near a heavily travelled road (Long Pond Road). This pond is a priority for further analysis and understanding.

CCNS data are consistent with a continued highest quality water designation of Long Pond. However, the PALS report (ref. 2) did suggest degradation concerns at Long Pond. The concern was based on low dissolved oxygen levels in the deep waters of the mid-summer pond. In mid-summer, the deep waters of the deepest ponds remain cool, being isolated from the warmer surface waters by stratification. The decay of bottom sediments can then use up the oxygen in the bottom water layer.

There also appears to be a long term, slow rise in the pH of Long Pond. This was first noticed in the CCNS Ponds Atlas and is confirmed by more recent CCNS data (H Bayley, communication to NRAB). One explanation for the pH rise would be an increase in phytoplankton. As with any plant, phytoplankton growth consumes CO₂. A decrease in dissolved CO₂ would result in lower levels of carbonic acid and higher pH. Of course, the increase in globally emitted CO₂, due to human industrial and transportation growth, could offset the trend.

Several years ago, the Town greatly improved Long Pond's management by moving the parking to the north side of Long Pond Road and by replanting the beach area. Any further recommendations for action at Long Pond await the CCNS summary report.

The parking area at Great Pond is located away from the beach area. No water quality concerns have been noted for Great Pond.

DYER and DUCK PONDS

These two smaller ponds are among the gems of the Wellfleet ponds. They have some of the clearest, most sparkling water amongst all of the great ponds. Use of these two ponds has grown over the past ten or twenty years, as Wellfleet has grown in popularity and as the other ponds have become more crowded. This growth in use has now created overcrowding conditions at both public beaches, even though a walk or a steep path is required to reach the beaches.

Shoreline erosion is a concern at both ponds, not only at the landings but at areas around the ponds. In the case of Duck Pond, the erosion issue is exacerbated as the pathway down to the pond from the parking is a steep, straight downhill walk. We recommend a broad plan of remediation at Duck Pond with the Town and CCNS working together. The pathway down from the parking area to the public landing needs to be repaired or rerouted. (Beach goers have already started this in seeking to avoid the old, degraded pathway.) The current path is a "Public Way" which crosses CCNS land: any project will

need CCNS engagement.

The beaches at both ponds show signs of erosion. There is increasing devegetation adjacent to the previously existing beach areas. Further expansion of the beach areas should be limited by fencing and educational signage. The landing at Dyer Pond is managed by the CCNS. The CCNS has started internal discussions about the feasibility of restoring the shoreline at Dyer Pond, which has become severely eroded. Any technology developed here could be used by the Town for similar restorations at Gull Pond, the Sluiceway and Duck Pond.

At both Duck and Dyer Ponds, concerns have been raised about access to the ponds away from the designated public landings. Given the steep shorelines around both ponds, additional erosion is inevitable. A site of particularly bad bank erosion at Dyer Pond is undergoing remediation due to co-operative action by the CCNS and abutters. The situation at Duck Pond also needs watching, as visitors leave Town properties to cross CCNS lands to the pond shore. One needed action is to work with the CCNS to discourage pond access away from the actual beach landings.

Parking control at the Duck Pond parking lot and along the access road-ways remains a priority. ATVs are used to access both Duck and Dyer Ponds. ATVs are greatly damaging to the uplands around these ponds. The use of any internal combustion engine on private or CCNS land is illegal without written permission from the land owner. This is another situation which requires adequate enforcement of already existing regulations, both local, park and, now, state.

Concerns have also been raised about water quality degradation (cloudiness) at Dyer and Duck Ponds. A statistical analysis of Secchi disk data by CCNS shows no long term significant trend. A different analysis of the same data by a resident (BTaylor, communication to NRAB), which weights the more recent data points, suggests a possible loss of clarity. A loss of clarity could be due to increased nutrients, leading to increased production of phytoplankton, or to shoreline erosion. The catchment areas for both Duck and Dyer Ponds are very narrow, as the ponds sit near the crest of the Chequessett lens. Also, there are very few dwellings along the shores of either of these ponds.

We are therefore concerned that erosion issues may be the more likely explanation for any water quality degradation in these ponds. (This may also be the case at Gull Pond.) Shoreline erosion can directly lead to increased silting in a pond or can supply soil based nutrients. It is also possible that subtle changes in pond water chemistry may help dissolve P (as phosphate) geologically trapped in bottom sediments. Further science is needed to clarify the possibilities.

CROWELL, SQUIRES and PERCH PONDS

These three ponds are located outside of the CCNS boundaries. Perch Pond is located near Route 6. The shoreline, except that adjacent to Route 6, is private. Perch Pond was originally part of the Herring

River system and may eventually be affected by the salt marsh restoration of that river. In the meantime, it is subject to road run-off from Route 6: catchment basins along that road need to be maintained.

Crowell Pond is a small, shallow pond off Paine Hollow Road. It is eutrophying, almost certainly due to natural causes. There is a small Town landing at the pond used by fishermen; this should be maintained.

Squires Pond is located near the Town center at the end of the short road which bears its name. The pond is also eutrophying, in this case probably accelerated by the high nutrients found in the central district. It would be worthwhile collecting water samples to verify this assumption. This pond is artificially connected to the Herring River estuary (Upper Pole Dike Creek sub-basin) via a drainage ditch under Briar Lane. The Town needs to decide how to treat this situation when tides and seawater are restored to Herring River. True habitat restoration would re-isolate Squire's Pond as a naturally land-locked kettle pond. This would also restore its natural hydrology, including increased seasonal water-level fluctuations which are currently dampened by the man-made drainage system. Squires Pond is a place of quiet beauty, remarkable for a pond in the Town center. There is a small Town landing, currently overgrown with willows. Clearing the willows and installing a bench could provide a great walking destination near the Town center.

PMP REFERENCES

1. Kettle Pond Data Atlas for Cape Cod National Seashore: Paleoecology and Modern Water Chemistry, JPortnoy, et al, 2001
 - An excellent review of ponds geological history and current status. Restricted to ponds lying within CCNS. Can be found on the CCNS (<http://www.nps.gov/caco/naturescience/upload/Pondatlasfinal.pdf>) and GUPACA (see below) web-sites
2. Ponds and Lakes Atlas, EEichner, TCambereri, et al, Cape Cod Commission, 2003
 - Covers water quality and human impact issues for ponds across Cape Cod. Part of the “Ponds and Lakes Stewards” (PALS) program. Can be found on the web under www.capecodgroundwater.org/PALS.html
3. Gull Pond Area Conservation Organization (GUPACA).
 - A Gull Pond owners organization, proactive in concerns to preserve the character and integrity of the Gull Pond chain of lakes. The web-site has a number of useful items posted: see www.gupaca.org
4. Chapter 91 Overview FAQs:
<http://www.mass.gov/dep/water/resources/faqs03.htm>
5. A Management Plan for Gull Pond, Thomas, Suzanne, 2008: see www.gupaca.org
 - Excellent overview of Gull Pond issues and recommendations for management
6. Responses of Periphyton to Artificial Nutrient Enrichment in Freshwater Kettle Ponds, Smith S., Lee, K., Hydrobiologia 571: 201-211 (2006)
 - Important paper on important possible role of N for ponds water quality. See www.nps.gov/caco/naturescience/upload/Smith&Lee_2006.pdf
7. Monitoring Ground Water Quality in Coastal Ecosystems, Coleman, J.A., Masterson, J.P., USGS 2007-1149; also, Masterson, J.P., USGS 2004-5014
 - Research report includes location of ponds relative to groundwater lens

and contributing area/recharge mapping. See:

<http://pubs.usgs.gov/of/2007/1149/>

8. Physical Hydrology of Selected Vernal Pools and Kettle Hole Ponds in the Cape Cod National Seashore Massachusetts, Sobczak, R.V., Camberari, T.C., Portnoy, J.W., Cape Cod Commission/CCNS, 2003 (not on line)
9. Silent Spring web-site: www.silentspring.org
10. S.Smith, CCNS, report to GUPACA (2006) and references therein; available at www.gupaca.org

ACKNOWLEDGEMENTS

A number of individuals have given of their time to meet with NRAB and its members about ponds issues. These names are listed below. We thank all of them for their thoughts and interest in the ponds.

Herb Gstalder, Dorothy Altman, John Partridge, David & Ben Garrison, Lezli Rowell, John Portnoy, Shelley Hall, Sophia Fox, Steve Smith, Holly Bayley, Marjory Winkler, Barbara Taylor, Suzanne Thomas.

Terry Gips helped immeasurably with the editing of this plan.