

**A Citizen's Guide
to Protecting
Nantucket Waters**

**NANTUCKET
BLUE PAGES**

WELCOME TO THE BLUE PAGES

Working together, the Harbor Plan Implementation Committee, along with local writer, guide and naturalist Peter Brace, as lead writer and editor, and graphic designer Rob Johnson, have written, edited and produced the Nantucket Blue Pages. It is designed to educate the public about our wetland resources and the methods we can use to protect our water quality and our fisheries. The impetus for the Blue Pages came from action Item Number 23 in the “Update to the Nantucket and Madaket Harbors Action Plan”; namely, to “seek funding to develop a “Guide to Protecting Nantucket’s Waters” – referred to as the “Blue Pages”. We have made this a living document, specific to the rules and regulations, unique geography and habitats, and flora and fauna of Nantucket. The Nantucket Shellfish Association provided much needed funding to wrap up the project and the Nantucket Land Council funded the publishing and distribution of the final physical and digital copies.

The Nantucket Blue Pages is an adaptation of the original *Puget Soundbook* designed to be easily understood by all ages. The educational goal is to help residents and visitors

understand how best to operate and care for their homes, cars, boats, lawns and gardens in an environmentally responsible way that minimizes pollution into our harbors, groundwater, and many freshwater ponds. Once people understand that simple actions can make a big difference in keeping our island habitats and water clean, we are confident that everyone will act in an environmentally responsible way. We all love Nantucket and value its beaches and clean harbors, so we hope that our children and grandchildren will have plenty of time to enjoy the results of our stewardship.

We dedicate the Nantucket Blue Pages to Whiting “Whitey” Russell Willauer and Bancel “Bam” La Farge who devoted energy and time to the creation of the Blue Pages. We would also like to remember Marina Finch, a Nantucket scalloper who loved the harbor, encouraged the creation of the Blue Pages, and served on the Nantucket Harbor & Shellfish Advisory Board. Our thanks go also to all the members of the Harbor Plan Implementation Committee who helped to create this document.



Photograph courtesy of Peter Brace

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The *Puget Soundbook*, originally produced in 1991 is a water quality awareness publication, funded by the Puget Sound Water Quality Authority to educate individuals regarding their impacts on the Puget Sound ecosystem. *Puget Soundbook* author James A. Kolb and illustrator Diane Bressler have graciously granted permission for us to use text and illustrations from their publication in the *Nantucket Blue Pages*. To learn more about the original project and the inspiration for the Blue Pages, visit www.forsea.org.

We believe our Nantucket version of the *Puget Soundbook* remains true to the authors' original intent of environmental stewardship and that all of the existing publications' creators along with the Nantucket public will see the *Nantucket Blue Pages* as worthy and helpful outreach for protecting and enhancing the quality of Nantucket's water in its harbors, ponds and aquifer.

Primary funding for the *Nantucket Blue Pages* project came from UMass Boston Nantucket Field Station, the Nantucket Land Council, the Friends of the Nantucket Field Station, the Nantucket Shellfish Association, and Sarah Oktay. Additional donations were received from David Berry, Peter Boyce, Jeffrey C. Clayton, Jennifer Flanagan, Cinda Gaynor, Mary-Adair Macaire, Tom McGlenn, Georgia Raysman, and Jack Weinhold. We are also grateful for supporting funds and in-kind services provided by the following.

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Sincerely,

The Harbor Plan Implementation Committee:

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Bam LaFarge, Carl Sjolund, Diane Coombs, Whitey Willauer
Rick Atherton

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PROTECTING THE WATERS OF NANTUCKET

TOGETHER, WE
CAN MAKE A DIFFERENCE

Nantucket, Tuckernuck and Muskeget are made of water in both solid and liquid forms.

During the Wisconsin Glacial Stage, the last glacier bulldozed sand, gravel, and boulders down from Canada and through New England, into a long east-west ridge high enough for the rising ocean to sculpt islands. Stranded ice chunks formed kettle hole ponds including Sesachacha, Gibbs, and the Pout ponds in the northern half of Nantucket. Melted glacial ice flowing out over the coastal plain gouged wide, shallow riverbeds in the landmass that would become Nantucket. When the ocean rose high enough from melted glacial ice, the coastal ends of these streams were eventually plugged with sand. Miacomet, Hummock and Long ponds were formed this way.

Sand, eroding along Nantucket's east shore carried north by longshore currents 2,000 to 3,000 years ago, connected Wauwinet to a small island (now Coskata) and, continuing northward, built the sand spit that became Great Point. A current flowing southwest built Coatue, forming Nantucket Harbor. Smith's and Eel Point grew westward during this period to form Madaket Harbor.

Nantucket's sole source aquifer, recharged by precipitation, on top of remnant glacial melt water, is held in place by the ocean around the island.

Although we have more than a trillion gallons in our aquifer, it would not be potable without our diligent protection efforts. Since Nantucket's livelihood is directly connected to the high quality of all types of water around, on, and beneath the island, ensuring our waters' health is a necessity of equal importance to that of breathable air and reliable ferry services.

Clean harbor water means healthy eelgrass beds. This is where fish and shellfish spawn and hunt for food, where scallopers and fishermen can fish, and where people can swim, water ski, paddleboard, kayak, and grow oysters. Clean harbor water equals a healthy marine ecosystem and translates into a prosperous year-round economy for Nantucketers and a unique, quality experience for our visitors.

Clean ponds, bogs, swamps, salt marshes, and vernal

ponds provide vital habitats for animals and plants, which we strive so ardently to protect, strengthening and adding to the biodiversity of Nantucket's natural world. Water, fresh and salt, is Nantucket's true lifeblood, essential to all forms of life.

Clean water then, especially on an island with finite water resources should be non-negotiable. Instead they are constantly threatened by saltwater intrusion, faulty septic systems, toxic road runoff, and overuse of lawn and garden fertilizers. All Nantucket residents and visitors should do everything they can to protect this precious liquid commodity.

Unfortunately, a lot of us take our good water quality for granted, not fully realizing how the impacts of our actions affect our water. With around 45 percent of the island held in conservation, development of the rest continues. Consequently, as more structures and people are added to the island, more fertilizer is used, more septic systems are installed, and more impervious surfaces are created.

Despite increasing regulation on over-fertilized lawns and septic systems, we still have problems with harbor water quality.

We continue to see a decline in eelgrass growth in Nantucket Harbor, lackluster commercial scallop harvests and regular summer algal blooms in the Head of the Harbor, all exacerbated by a steady rise in harbor and land-based uses.

So where do we begin? Read the Nantucket Blue Pages for ideas on how to keep our waters, salt and fresh, clean. Read and reread Chapter 1 on how the water cycle works and how we feed into it. From there, you will quickly begin to see how simple and effortless it is to do your part at home, with your boat, and around the island in general.

The Nantucket Blue Pages belongs in plain sight for anyone to access, in your home, guest house, inn, hotel, restaurant, or any place of business, in the schools and at the Nantucket Atheneum. Pass copies of it out to your tenants and or seasonal renters, and give them to your landscaper or gardener.

It is an island water manual you cannot live without!

A Water Primer

OUR BEAUTIFUL BLUE ISLAND

From the air, Nantucket's dependence on and coexistence with water is immediately obvious. Surrounded by the Atlantic Ocean and littered with ponds, salt and fresh, all manner of wetlands, three harbors and sitting atop a pile of sand over its sole-source aquifer, our

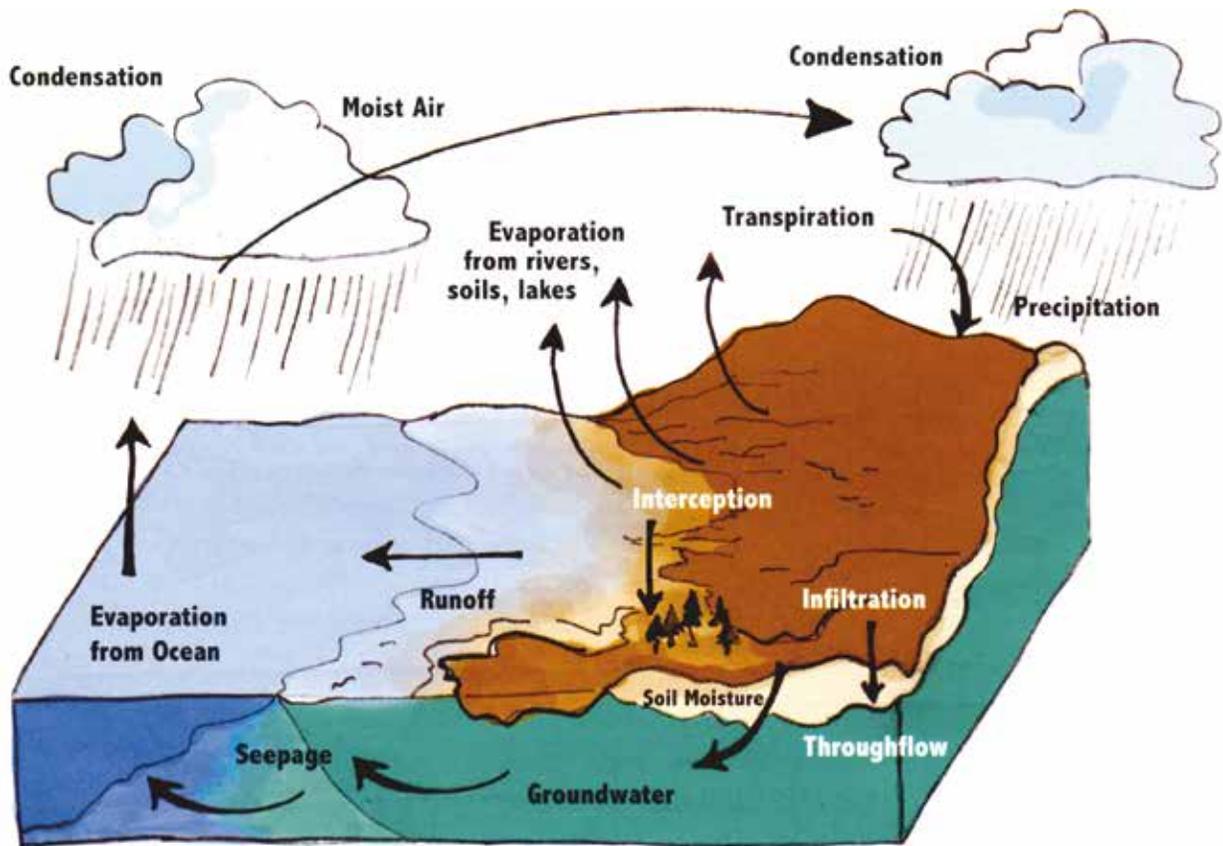
island is at one with water. As islanders, we embody the global reality that the planet is three quarters water. It is a universal solvent that just about every other element can mix with or dissolve in. Constantly moved by currents around the earth and from liquid to vapor to

solid and back to liquid form, dissolving everything in its path, water is the lifeblood of our planet. This vast cycling and recycling process is called the water cycle.

THE WATER CYCLE: WHAT GOES AROUND COMES AROUND!

If five gallons represented all the water in the world, all of it, except for two cups, would be found in the oceans. The remaining two cups break down as follows:

- Glaciers:**1 ½ cups
- Groundwater:** Slightly under a ½ cup
- Inland seas:**½ teaspoon
- Freshwater lakes:** ½ teaspoon
- Rivers:**Less than one drop
- Water vapor:**Less than one drop



NANTUCKET'S AQUIFER

The meaning of the EPA term “sole-source aquifer” simply means the water we have beneath us is all we’ve got. There is no subterranean connection between our aquifer and the mainland’s water supply. So there is no back-up supply of water. What we have is what we have.

The public Wannacomet Water Company draws large quantities of groundwater from three public wellfields. They tap into Nantucket’s aquifer in Wyers Valley and the State Forest for the town water district, and beneath Sconset and its surrounding area supplying residential and commercial drinking water needs. The drawdown areas for each of these wellfields extend far beyond where the actual pumping occurs with Wannacomet’s encompassing 4,600 acres. Areas of land that potentially contribute and replenish groundwater to these public wellfields are called Zone II’s or Zones of Contribution.

Residential areas and farms lying outside of town and Siasconset village, including Tuckernuck and Muskeget Islands, are serviced by private wells. A private well draws a small amount of water, sufficient to meet the needs of

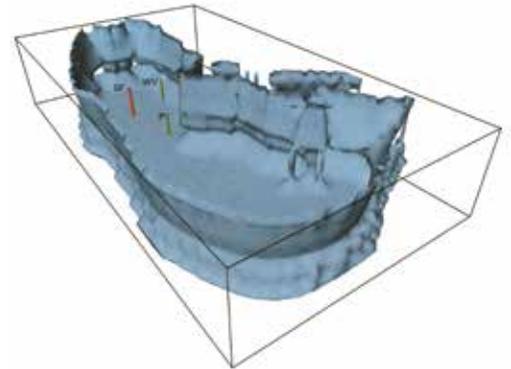
Nantucket’s aquifer is three zones 0 to 60-70 feet below the surface down to around 300 feet. Most private wells tap into the top 60-70 feet zone of water that’s 3,000-4,000-year-old water recharged by precipitation. The town’s three public wells reach 150 feet into the middle layer, which is 11,000-year-old glacial water from the last glacier. The third zone contains glacial water more than 14,000 years old.

the individual property owner, and the drawdown area is localized.

These public and private wells tap into the island’s freshwater aquifer, which, because it’s less dense, sits on top of the saltwater beneath and surrounding Nantucket. Between the bottom of Nantucket’s freshwater and the salt water connected with the ocean is a transition zone of a saltwater-freshwater mix.

The aquifer starts at the water table and extends down about 150 feet at the center of the island, and then it grows thinner and thinner as it rises to the shores. Also, our groundwater extends a short distance out under the ocean floor.

Tuckernuck and Muskeget islands have their water supplies separate from Nantucket’s in the form of smaller aquifers beneath each island. As there are no



Nantucket Aquifer in 3-D

A three-dimensional view of Nantucket’s sole source aquifer. The fresh water beneath the island is floating on the salt water beneath it, because the fresh water is lighter. The aquifer is roughly in the shape of a squat, oval-shaped ball with its sides spread out at shallow angles. The red and green lines at the top are the wells Wannacomet Water Co. uses to supply the island with water.

KNOW YOUR WATER WORDS

Aquifer – Underground sediments saturated with water.

Sole-Source Aquifer – An aquifer that is the only source of potable water for a given area such as an island.

Watershed – An area of land in which all water, above and below ground, is constantly moving downhill toward the same body of surface water. Watersheds may encompass thousands of acres and water may travel many miles from the highest elevation point to the body of water at or near sea level.

Runoff - Movement of precipitation in liquid form over impervious surfaces into bodies of water and wetlands.

Groundwater - Water that’s seeped through the soil, on its way to the aquifer and eventually running through the aquifer.

Recharge – Replenishment of the aquifer via precipitation reaching the ground and percolating down through the soil into the groundwater.

public water pumping and distribution entities on Tuckernuck and Muskeget, property owners draw water from private wells on their land by hand pumps and generator-powered pumps. Tuckernuck’s aquifer is around 40 to 50 feet down from the surface, with the water table only a few feet down in the low hollows. Muskeget’s is similarly less than 40 feet down and Nantucket’s is 60 to 70 feet down.

With the aquifer so close to the surface of Nantucket, saltwater intrusion is not the only contaminant the town worries about. Because of the constant threat of toxic runoff from impervious surfaces such as roads, leaching of

fertilizers into the ground, petroleum drippings from vehicles and an ocean of other potential contaminants, Nantucket Town Meeting voters adopted a bylaw in 1995 establishing wellhead protection districts for the Wyers Valley and State Forest wellfields, and the 'Sconset wellfield. And then in 1997, Town Meeting voters adopted standards of proper use for these wellhead protection districts. These bylaws contain prohibitions on uses within these protection districts that could potentially contaminate our drinking water supply. Three revisions of these bylaws followed in 2004, 2006 and 2012 to recognize updated engineering standards and best management practices for stormwater treatment and recharge.

WATERSHEDS: PATHWAYS TO OUR HARBORS AND PONDS

In the water cycle, a watershed is an

area of land where water flows from high elevations to low elevations, and eventually discharges into a pond, estuary, salt marsh, swamp or harbor. Water may flow as surface runoff, in streams, or seep into the soil and flow as groundwater. Nantucket's 47.8 square miles has 10 watersheds, Tuckernuck likely has three and Muskeget, one or two. Gravity pulls water down from the surface into groundwater seeping into water bodies or via short streams, as the island has no continuously flowing waterways except short brooks and streams between wetlands and ponds, and some running into the harbors.

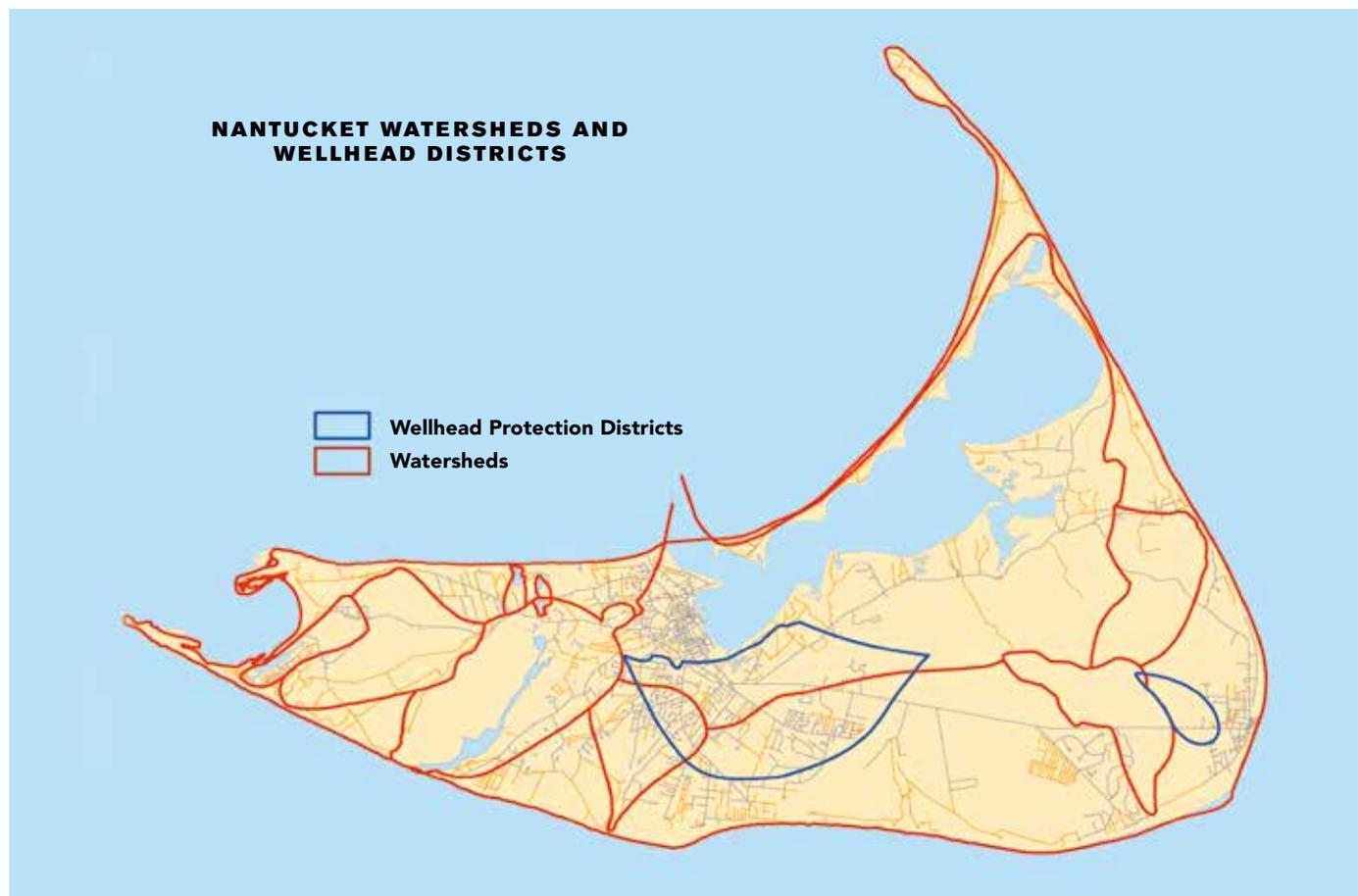
Every Nantucket property owner's land and buildings lie within one or more of the 10 watersheds that were mapped out by the town in 1990. Since groundwater eventually discharges to a pond or harbor, it has tremendous influence on water level in ponds and water

quality in ponds and harbors.

Nantucket has three types of ponds: tidal, kettle hole and outwash plain ponds, the latter two at the mercy of groundwater levels and ultimately, what water their watersheds collect, to keep them full. Our three islands have six tidal ponds; one each on Great Point and Muskeget, North and East ponds on Tuckernuck, and Coskata and Haulover ponds.

Tidal ponds are of special significance because they are direct outlets to our harbors and the ocean, meaning groundwater in their watersheds gets into salt water much faster than from land-locked freshwater ponds.

We have around 53 kettle holes — ponds formed by enormous ice chunks left behind by the last glacier, which stopped on the coastal plain area that became Nantucket 21,000 years ago and began melting. The ice chunks



Courtesy of the Town of Nantucket

dented the land allowing water to collect in them — including Almanac, Sesachacha, Gibbs, Squam, Capaum, Washing, No-Bottom Pond, Wigwam, Reedy, Shimmo, Pest House, Maxcy, Waqu-tuquaib, Head of Hummock and Saul's ponds. Altogether, there are 13 outwash valley ponds and/ or freshwater marsh areas that include Tom Nevers, We-weeder, Miacomet, Hummock, Clark Cove, Long and Sheep ponds, and Madaquecham, Forked Pond and Toup-

shue valleys.

Five of these ponds are classified as great ponds on the island — ponds 20 acres or larger — including Hummock, Long, North Head of Long, Miacomet and Sesachacha ponds. Combined, these great ponds total 413 acres.

Add to this list the thousands of acres of salt marsh and freshwater marsh, swamps and other wetlands, and altogether, Nantucket's ponds and wetlands encompass several thousand acres.

There are at least 9.5 combined square miles of saltwater in Nantucket, Polpis and Madaket harbors with Nantucket Harbor encompassing Coskata Pond, Haulover Pond, the Pocomo Marshes, and Polpis Harbor totaling 7.4 square miles and 2.5 square miles encompassing Madaket Harbor and Hither Creek. Nantucket's watersheds are equally enormous. The Nantucket Harbor Watershed is 18.5 square miles.

TO KNOW YOUR ISLAND WATERSHEDS IS TO PROTECT THEM



Nantucket Harbor

(Includes Coskata and Haulover ponds and Polpis Harbor) Encompassing the island's northeast section, Nantucket Harbor is almost enclosed, its main channel connecting the harbor with Nantucket Sound. Circulation is moderately restricted in the Head of the Harbor, which takes approximately four days to completely flush and in Polpis Harbor, which takes around ten.

The watershed's west end is heavily developed with commercial and residential developments, and is serviced by public water and a public sewer collection system. In the center and east end of the Harbor, land uses include residential homes with individual septic systems, wells, highly maintained landscapes, and conservation land. Water uses include swimming, fishing, boating, transportation and shoreside services to support those industries. The waters around Nantucket extending three miles out from shore were designated a Federal No Discharge Zone in 1993, with the same protection designated for Nantucket Sound in 2012. This prohibits boats from emptying their sewage holding tanks into these areas. Regrettably, direct discharge of storm drain runoff still occurs, carrying sediments and pollutants that contribute to the degradation of harbor water quality and eelgrass.



Photograph courtesy of Peter B. Brace

Madaket Harbor

Shaped by post-glacial deposits 2,000 to 3,000 years ago gradually extending the west end of Nantucket to build Smith's Point and Eel Point, Madaket Harbor, with Hither Creek behind it to the east, is wide open to Nantucket Sound and the ocean.

Hither Creek then connects to Long Pond via the Madaket Ditch. Eel Point's south side is lined with salt marsh cut with a network of mosquito ditches while sandy beaches rim the rest of the harbor. Mostly seasonal residential structures with septic systems and tight tanks fill the Madaket Harbor Watershed along with three commercial uses: Madaket Marine, Millie's Restaurant and the West End Market. Town water extends out Madaket Road terminating at the Madaket Firehouse.

This watershed includes six areas: Eel Point and Smith points, Hither Creek/Madaket Village, Long Pond East, Long Pond West and North Head of Long Pond.

Despite the swift tidal currents coursing between Madaket Harbor and Tuckernuck Island just two miles west, the town usually closes this harbor to shellfishing, except scallops, July 1 through Dec. 31 due to high fecal coliform counts. However, thick eelgrass beds still blanket much of Madaket Harbor's bottom.



Hither Creek

Hither Creek is a semi-confined body of salt water connected to Madaket Harbor and is the primary watershed feeding in to Madaket Harbor. Though tidally influenced, its long and narrow features limit water circulation. During the summer, a high concentration of boats is moored in the Creek. Land uses include a commercial boatyard, small residential lots with individual septic systems and water wells, and a restaurant. A shallow separation from groundwater increases the potential of saltwater intrusion to drinking water wells and pollutants reaching the Creek.



Long Pond

Long Pond stretches from the southwest shoreline almost to the north shore of the island. It's connected to Hither Creek via the Madaket Ditch. The steady tidal flow between the pond and Madaket Harbor through this ditch is constricted now because of the lack of regular cleaning exacerbating already polluted conditions.

Land uses include closely settled residential lots with individual septic systems and private wells, and the town's landfill. Nutrient and sediment loading to the pond, in addition to its constricted physical features, may contribute to the rapid growth of common reeds and cattails that consume the open water. This watershed includes a significant amount of conservation land helping to buffer some of the potential impacts.



Capaum Pond and Washing Pond

Capaum and Washing are small watersheds supporting fresh-water ponds. Recreational use of the ponds is negligible due to their small size and restricted access. Residences with individual septic systems dominate these small watersheds, and a rapid infusion of new homes and lawns occurred between 2008 and 2013. Capaum Pond was Nantucket's original harbor until silting along a sand bar closed it to navigation.



Miacomet

Miacomet Pond is recharged by a land area 26 times larger than the pond itself extending to First Way. A tremendous volume of groundwater, stream flow and surface runoff floods the pond to excessive levels during seasons of high precipitation. The water level rises into yards, basements and roads constructed within the pond's flood plain.

This is one of the more heavily developed watersheds. Land use includes residences, many connected to public sewer, varied commercial uses, Miacomet Golf Course and a portion of the public wellfield recharge area. Intensive family beach activity occurs during the summer at the ocean end of the pond. The level of developed land use, recreational activity and water withdrawal within this watershed poses multiple variables for determining pond management strategies.



Hummock Pond

(Includes No-Bottom, Head of Hummock, Waqutuquai, Maxcy ponds and Clark Cove). Hummock Pond stretches from the South Shore northward halfway into the western side of Nantucket. Conservation land abuts the shorelines of Head of Hummock, Hummock Pond and Clark Cove. The watershed's land area is 12 times larger than the pond and uses within it include residential homes with septic systems and wells, food crops and horse pastures. Hummock Pond was originally 'J' shaped, until the Blizzard of '78 drove the dune northward, separating the two segments and creating Clark Cove.

Pond water samples have shown that the north end of Hummock Pond is fresh water while the south end is brackish water. Each April and October, the town digs a channel through the barrier beach to drain the pond of its nutrient/pollutant-heavy water and to replenish it with cleaner salt water. This temporarily lowers the pond to improve water quality for fisheries and to allow passage of several fish species. The beach rebuilds within a week blocking the pond from draining further and the pond quickly refills with fresh water from the watershed's uplands.



Tom Nevers Pond

(Includes Gibbs Pond and Milestone Cranberry Bogs). Phillips Run connects Gibbs Pond and the Milestone Cranberry Bogs with Tom Nevers Pond. Agriculture and residential land uses, the western portion of the Nantucket Golf Club, the former Siasconset Dump and open grasslands and scrub

oak thickets dominate this watershed. Most of the extensive wetland system is an actively managed commercial cranberry bog. The watershed recharge area is close to 100 times larger than the pond itself. Nutrient loading and pesticide runoff are pollutant risks to Tom Nevers Pond.



Sesachacha Pond

(Includes Jewel Pond). Most impaired of Nantucket's water bodies, as with Hummock Pond, the town opens Sesachacha Pond to the ocean in April and October to allow anadromous fish such as blueback herring in to spawn and catadromous fish, American eels, out to spawn in the ocean, and to flush accumulated pollutants and boost salinity. Undeveloped grassland and maritime heathlands are the dominant land types with pockets of residential areas using private septic systems.



Atlantic Ocean

Portions of the ocean watershed are located on each side of the island. This simply means that groundwater and surface flow discharge directly to the ocean rather than first passing through a pond or harbor. A mix of residential land use and grassland are scattered throughout this watershed. The Surfside Wastewater Treatment Facility, Siasconset Wastewater Treatment Facility, the airport and the industrial park on Bunker Road with its asphalt plant, gravel piles, concrete plant and propane gas storage facility are industrial land uses discharging runoff into the ocean.

WATERSHEDS INSIDE AND OUT: SOILS AND TOPOGRAPHY

Our islands' sandy soils allow water to rapidly infiltrate the water table and to store large amounts of groundwater in the aquifer. Coarse-grained soils also allow rapid downward movement of nutrients and chemicals to the groundwater and waterways. The flow rate through this permeable soil can be a few feet per day. Clay and other fine-grained soils are less permeable, which sounds like good news for our aquifer, ponds and harbors, but it isn't. Wherever layers of clay slope steeply toward bodies of water, groundwater flows quickly over the clay, rather than percolating through it. Thus, groundwater runs to other more permeable soils or, in many locations around Nantucket and Tuckernuck, right out of coastal banks and bluffs into harbors, salt marshes and the ocean.

Nantucket's soil composition is not uniform. Layers of sand, gravel, and organic matter are intermixed with clays in varying thicknesses all over the islands. Thicker clay deposits are found in Wauwinet, Pocomo, Squam, Quidnet, the Polpis Harbor area, and between Siasconset and the south side of Sesachacha Pond. Generally sandy soils are found on the southern and western parts of Nantucket, most of Tuckernuck and all of Muskeget.

Water moves through the island's soils in a matter of days, months, years and up to decades, but gravity always wins. All the low points on our islands are the collectors of surface runoff or groundwater flow within the watersheds, and some of them collect an enormous amount of toxic pollutants. Consue Springs (also known as Goose

Pond) at the sharp bend on Union Street collects surface runoff and groundwater flowing down from the high school and neighborhoods between Pleasant, Orange and Fair streets. The groundwater then seeps into the Creeks and eventually out into Nantucket Harbor. Most of Quidnet Village drains its water into Sesachacha Pond. Gibbs Pond collects surface and groundwater from the surrounding hills in the moors and its water is pumped into the bogs. Miacomet Pond's watershed collects water from the densely developed mid-island area and Long Pond is filled from the landfill and much of the eastern side of Madaket. All of the water running into and over our islands ultimately finds its way into the Atlantic Ocean.

NANTUCKET ISLAND: TOTAL AREA: 30,000 ACRES; 47.8 SQUARE MILES

*Hither Creek

Total area of watershed:	419 acres
Area of creek:	40 acres
Area of other water:	N/A
Area of wetland:	162 acres
Area of upland:	217 acres

Long Pond

Total area of watershed:	1,620 acres
Area of pond:	131 acres
Area of other water:	N/A
Area of wetland:	354 acres
Area of upland:	1,134 acres

Hummock Pond

Total area of watershed:	2,600 acres
Area of pond:	200 acres
Area of other water:	26 acres
Area of wetland:	680 acres
Area of upland:	1,694

Capaum Pond

Total area of watershed:	82 acres
Area of pond:	20 acres
Area of other water:	N/A
Area of wetland:	N/A
Area of upland:	62 acres

Miacomet Pond

Total area of watershed:	1,009 acres
Area of pond:	37 acres
Area of other water:	N/A
Area of wetland:	36 acres
Area of upland:	936 acres

*Madaket Harbor not delineated. It includes Hither Creek, Long Pond and portions of other areas too.

Tom Nevers Pond

Total area of watershed:	1,107 acres
Area of pond:	11 acres
Area of other water:	33 acres
Area of wetland:	471 acres
Area of upland:	592 acres

Sesachacha Pond

Total area of watershed:	1,039 acres
Area of pond:	271 acres
Area of other water:	N/A
Area of wetland:	471 acres
Area of upland:	592 acres

Nantucket Harbor

Total area of watershed:	11,875 acres
Area of harbor:	4,626 acres
Area of other water:	N/A
Area of wetland:	1,545 acres
Area of upland:	5,704 acres

Atlantic Ocean

Portions of the Atlantic Ocean watershed are located on each side of the island. This simply means that groundwater and surface flow discharge directly into the ocean rather than first passing through a pond or harbor. A mix of residential land use and grassland are scattered throughout this watershed. The Surfside Wastewater Treatment Facility, the Siasconset sewer beds, the asphalt and concrete plants on Bunker Road, and the airport are industrial uses discharging to the ocean. —Sources: "Selected Resources of the Island of Nantucket", Massachusetts Estuaries Project, Massachusetts Department of Environmental Protection

HOW DOES A WATERSHED AFFECT HARBORS AND COASTAL PONDS?

Water, the universal solvent dissolving essential minerals and making them available to the microscopic life, forms the base of the food chain. However, water also dissolves and carries pollutants into the groundwater, aquifer, ponds, harbors and the ocean. These pollutants range from the now-banned fuel additive MBTE to pesticides, petroleum products, nitrogen and phosphate in fertilizers and sewage to name just a few.

In coastal ponds and harbors, marine plants require nitrates, along with sunlight and other nutrients, to grow and reproduce. When a watershed leaches too much nitrogen in the form of nitrates into a saltwater body, algae and plant growth explode.

- Microscopic phytoplankton increases exponentially, clouding the water, sometimes darkening in shades of blue, green, red and rust, which blocks sunlight from reaching plants that require it for energy,
- Slime algae increases on the surfaces of pilings, rocks and eelgrass blades blocking sunlight from the latter,
- Drifting macro algae populations multiply exponentially, piling up on shore and swarming onto eelgrass beds,
- The so-called rust tide appears, a reddish algae known as *Cochlodium polykrikoides*, which blooms in late July into early August in the Head of the Harbor clogging the gills of shellfish that filter food and oxygen out of the water with their gills and stunting their growth,
- When Nantucket Bay Scallops are exposed to the rust tide, biologists believe they don't get enough food and oxygen. This reduces the size of their adductor muscles, the only edible part of the

scallop, and ultimately impacts the local scallop industry,

- Oysters being raised in cages in the Head of the Harbor thrive in poor water quality conditions. However, they too are susceptible to algae blooms,
- The high turbidity of the water from algal blooms not only blocks sunlight from reaching plants, but it also makes it tough for osprey to see fish in the water,
- When these algae die, their decomposition uses up oxygen in the water, denying fish, shellfish and other organisms the oxygen they need to survive.

EELGRASS

Eelgrass is a rooted marine plant that provides habitat for bay scallops, blue crabs, juvenile winter flounder, tautog, black sea bass, tomcod, shrimp and snails. It is the sole source of food for a goose species called brant. It is essentially the life-sustaining habitat of the harbor on which marine life directly or

indirectly depends. Eelgrass also serves as a collector of plankton and other microscopic foods for shellfish, finfish and the rest of the harbor marine ecosystem. At the same time, it prevents sediments from washing around in the harbors, thus boosting water clarity and decreasing turbidity. Eelgrass removes and uses various nutrients from shore sediments, inland sources and the atmosphere, although high levels of these nutrients are toxic to this sea grass.

Because eelgrass is very sensitive to poor water quality, its decline is a warning that must be heeded. In the 1930s, eelgrass blight, a wasting-disease slime mold called *Labryrinthula zosterae* wiped out 90 percent of eelgrass beds on the East Coast by covering its fronds with black-brown spots. Quickly spreading through the water to other fronds of the plants, this blight blocked sunlight from reaching the blades, thereby halting the process of photosynthesis from which all plants extract energy from the sun.

Although bay scallops didn't disappear altogether, they were extremely



Photograph courtesy of Dr. Peter Boyce

scarce because their larva had far fewer marine plants to attach to. As a result, scallop seasons during this blight period barely lasted through November. Nantucket's eelgrass beds didn't fully recover and return to the harbors until the 1960s.

In 2015, the Nantucket Eelgrass Mapping Project found that Nantucket Harbor lost an average of 29 percent of its eelgrass since 1995 and Madaket Harbor lost 24 percent. Excess nitrogen from lawn fertilizers and leaky septic systems are known to be two of the main culprits of eelgrass decline in our harbors.

WHERE DO NITRATES COME FROM? US!

Shellfish, specifically oysters, improve water quality as they feed by filtering microscopic particles from the water with their gills. One study calculated that 100,000 rapidly growing oysters could process the nitrogen in the form of nitrate pollution of 27 people living in the watershed. But that's if there are 100,000 oysters growing in the harbor. While Nantucket boasts 45 acres of its 4,626-acre harbor allotted for aquaculture with eight island residents growing oysters in cages suspended beneath the surface or anchored to the bottom, it's neither practical nor fair to rely on these oyster farmers to clean up our land-based mess.

Roughly 72 percent of the nitrogen entering Nantucket harbor is particulate matter from the atmosphere or, atmospheric deposition, in the form of emissions from power and industrial plants, and automobiles collected by the jet stream from as far away as the West Coast and as near as downtown Nantucket. The rest of the pollution entering our harbors and ponds comes from land-based sources. There is no way oysters alone can filter out all that pollution. We have to help too.

Of the remaining nitrate pollution, the greatest potential source of nitrogen is wastewater from human waste.

Despite the town's sewer expansion and ongoing effort to inspect every septic system and require owners of failing systems to replace them, there's always going to be some sewage seeping into our harbors and ponds. You should know that while your septic system removes around a third of the nitrogen found in urine, the wastewater that leaves your leaching field is still highly concentrated with nutrients — 10,000 times more concentrated than the desired levels of nitrogen in a harbor or pond. This is why a good septic system is surrounded by enough land to provide filtration for final treatment of the effluent.

For nearby harbors, tidal ponds and saltwater marshes, despite the 2005 town-mandated septic-system inspection/repair protocol, faulty septic systems leaking sewage remains the second primary source of annual nitrogen input; third is lawn and garden fertilizers. To address the septic issue, the town has required septic system inspections and mandated denitrifying systems for all areas of the Nantucket Harbor Watershed that are not slated for sewer

expansion. The main enemy of good saltwater water quality is fertilizer. Fertilizers used on lawns, gardens, farms and the cranberry bogs are also sources of nitrogen. If too much is applied or the ground is heavily irrigated after being fertilized, the nitrogen quickly dissolves in the water and travels beyond the reach of plants' roots into the groundwater. You will learn everything you need to know about its application in Chapter 9, Growing a Natural Lawn on page 44.

Runoff water is another source of nitrogen. It can carry animal droppings, street litter and petroleum products, heavy metals, bacteria, sediments and myriad chemical residues used in construction, cleaning and landscaping projects. Fortunately for Nantucket Harbor the town's department of public works is working with local organizations like the Nantucket Land Council to investigate the status of several outfall pipes and is looking into which portions of downtown stormwater infrastructure can be upgraded to improve water quality.



Nantucket Neighbors: Shellfish

If you have taken a walk on the beach, you've noticed the incredible diversity of shells that wash up on the shores. Those shells are the remains of many species of bivalve mollusks that populate the shallows of our salt ponds, harbors and bays. These species include

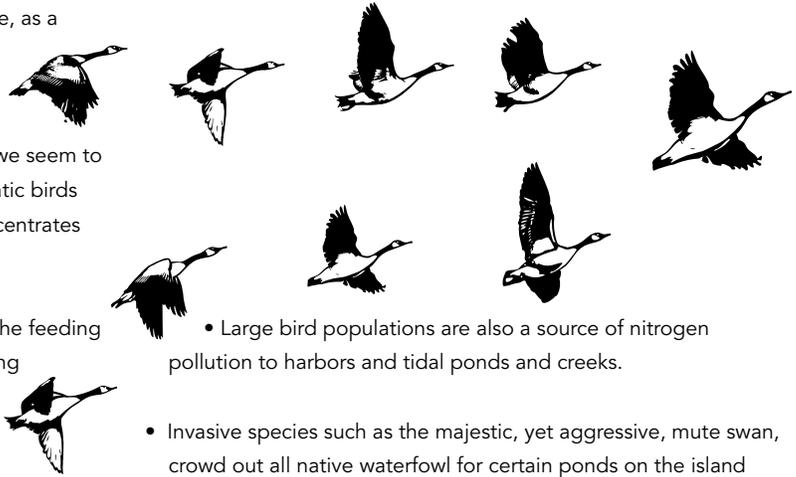
oysters, quahogs, soft shell clams or steamers, bay scallops, mussels, and razor clams. Shellfish harvesting can be traced back to Nantucket's Native Americans including the Wampanoags.

NITROGEN ON THE WING: WHY WE SHOULD NOT FEED OUR WATERFOWL

Ever wonder why we have such large flocks of ducks, Canada geese and swans in some of our harbors and ponds? We, as a species, love to feed the birds and on Nantucket.

Goose Pond/Consue Springs, certain backyards in the mid-island area and at the landing on Hummock Pond and at First Bridge along the Madaket Road are where we seem to be doing it. Trouble is, attracting large numbers of aquatic birds together in one place near or on water bodies also concentrates their nitrogen-rich droppings there as well.

- Regular feeding causes waterfowl to congregate at the feeding spot interrupting their migration patterns and fostering non-migratory, permanent flocks.
- The overpopulation of wild waterfowl may cause the closure of shellfish beds and swimming areas due to bacterial pollution from their droppings.



- Large bird populations are also a source of nitrogen pollution to harbors and tidal ponds and creeks.
- Invasive species such as the majestic, yet aggressive, mute swan, crowd out all native waterfowl for certain ponds on the island forcing the other birds to gather in large groups elsewhere.

PHOSPHORUS, ANOTHER NUTRIENT THAT AFFECTS OUR PONDS

Nitrogen and phosphorous are important nutrients required for primary production in fresh and salt water systems, however freshwater species are typically limited by phosphorous whereas marine and coastal species are typically limited by Nitrogen. Many Nantucket soils already contain enough phosphate to support plant growth, thus additional phosphate can become a contaminant. To control the growth of freshwater algae and the spread of invasive freshwater plant species such as common reeds and purple loosestrife, phosphorus inputs into freshwater ponds should be restricted. Phosphorus is also a concern in salt ponds that are over-supplied with nitrogen.

Sources of phosphorus include wastewater, acid rain, street runoff, outdoor showers and the erosion of soil from residential and agricultural lands. Although phosphorus has been re-

moved from laundry detergents, it's still found in most automatic dishwasher detergents. It's usually the failing septic systems within a few hundred feet of a pond or even those properly functioning ones installed too closely that are major phosphorus sources.

There are several simple things you can do to stem the flow of phosphorus from your property into a nearby pond.

- If you have or are building an outdoor shower consider connecting the shower drain to your septic system or at least piping the shower gray water into a gravel-filled pit to allow the runoff enough time to slowly percolate into the ground instead of running directly into a pond.
- Use only biodegradable, phosphate-free body soaps and shampoos in your showers, indoor and out, your dishwasher and on your pots and pans. See the Chapter Reference Materials section on page 58 for pond friendly products.

- Only wash your car and boat with phosphate-free soaps.

Our harbors and ponds are in our hands. Although around 45 percent of Nantucket is in conservation, we have to continue to protect our clean water. The water around Nantucket is well known as some of the cleanest on the East Coast and the harbors as containing the last commercially viable bay scallop population. Without your continued help, it's far too easy for us to lose our good water quality.

Making small changes in your habits can make a huge difference in protecting our harbors and ponds from pollution and may save your well and the island's sole source aquifer from contamination.

Please spend some time reading this guide to learn how to become a responsible watershed citizen, and then take the first step.

A Quick Start for the Water-Wise

CHANGING OUR BEHAVIOR IS TOUGH

Start slowly; begin by incorporating three new actions into your daily life. Don't expect miracles overnight, but do expect miraculous change over time.

NINE SIMPLE THINGS YOU CAN DO RIGHT NOW TO BEGIN CARING FOR NANTUCKET'S WATERS

If you think changing your water use and protection behavior is challenging, imagine our water supply too contaminated to drink or too low to fight a fire or serve our needs. Imagine our precious beaches closed because of toxic algal blooms. Try gradually working these 9 changes into your daily island life:

1. Realize that all of our islands' water comes from sole-source aquifers beneath Nantucket, Tuckernuck and Muskeget and learn how to conserve water and protect it in Chapters 3 and 4.



Harbor outflow drain pipe

Photograph courtesy of Peter B. Brace



Hydrocoleum algae smothering harbor eelgrass

Photograph courtesy of Dr. Peter Boyce

2. Remember that when you spill waste oil, paint and other toxic substances on the ground, you're not just spilling them on the ground, you're spilling them into the harbor, our ponds and our aquifer. Safely dispose of your waste at one of the town's hazardous waste collection days at 188 Madaket Road. Learn what to bring on the town's hazardous waste days information page on the town's web site. The link to this page is under Chapter 2 in the Chapter Reference Materials section. **Hazardous Waste Collection on Nantucket:** <http://ma-nantucket.civicplus.com/242/Recycling>

3. When you can, walk, ride your bike, use The WAVE, car-pool or combine your errands into one trip. Automobile use is one of the biggest contributors to water pollution, including petroleum products leaking from vehicles onto impervious surfaces, running into drains and into the harbors.

4. We can't emphasize this enough: if you change your own oil, collect it in an appropriate container and either return it to where you bought it (with your receipt), or bring it to one of the town's hazardous waste collection days.



Cutway model of a domestic compost bin

5. Embrace Rethink-Reuse-Recycle, the mantra of Chapter 6, as your guiding light when you're purchasing food and disposing of trash. As a matter of course, use reusable shopping and produce bags, buy products with the least amount of packaging and or in glass or aluminum containers. Collect your organic waste and add it to your compost pile. Less trash and garbage going to the landfill means less runoff is created from our trash.

6. Talk to your landscaper about how to protect existing trees on your property, and what drought-resistant native Nantucket plants requiring no fertilizers you can plant. More trees and shrubs mean that rainwater not used by lawns and plants filters into the soil and, eventually, the aquifer, more slowly.

7. Runoff from lawns can be reduced by cutting your lawn no lower than three inches. This ensures deep grass roots and a thicker density of grass roots. Healthy turf holds rainwater, filters sediments and chemicals, and requires less frequent waterings.



An algae bloom in the Head of the Harbor

8. You do not need fertilizers and pesticides to have a beautiful lawn and garden. In addition to reading Chapters 8 and 9 on landscaping, lawn care and pesticide advice, consult *Nantucket's Best Management Practices for Landscape Fertilizer Use on Nantucket*. Find a link for downloading under Chapter 2 in the Chapter Reference Materials Section, to find out how much and what kind of fertilizers to use, and when to apply them, erring on the low side. **Best Management Practices for Landscape Fertilizer Use on Nantucket:** www.nantucket-ma.gov/documentcenter/view/438

9. Consider your boat a pipeline into the harbors and ponds: what you put on it will run or wash off into these precious bodies of water. Rinse and scrub boat decks and hulls with brushes and water only. If you have to use soap, make sure it is phosphate-free and biodegradable. Navigate over to Chapter 10 on water-friendly clean boating practices.



Reduce runoff by cutting your lawn no lower than three inches

Water Water Everywhere

SOUND WATER USE

One percent of the earth's water is at our disposal in groundwater, ponds, rivers and streams. Lacking the latter two, Nantucket and its two outer islands must largely rely on its aquifer, since its ponds, unfortunately, are no longer a good source of clean water.

CONSERVING OUR WATER IS AS IMPORTANT AS KEEPING IT CLEAN

We can conserve all the water we'll ever need, but if we contaminate it, it doesn't matter how much we've saved once the damage is done. We know from Chapter One that Nantucket's aquifer, while not boundless, has much more water than we'll ever use, so with that in mind, protection of its cleanliness is slightly more important than conservation.

Still, the more water we have, the less impact contaminants will have on it. This couldn't be truer for an island with its aquifer in such close proximity to the saltwater of the ocean as Nantucket's is. Saltwater is kept out of the aquifer because of the hydrostatic pressure of the fresh water against the salt. Likewise, the pressure of the salt water on the aquifer keeps it from leaking out into the sea.

The more water we pump out of our aquifer, the more vulnerable it becomes to salt-water intrusion. This is where water conservation becomes nearly as vital as keeping the aquifer squeaky clean. Intrinsically, both of these mantras should be part of our daily, subconscious, water-related actions because of the reliance on our sole-source aquifer, but we all need reminding.

Water conservation, especially on an island, is also vital to adequate fire protection, as we cannot tap into other towns' water supplies during fire emergencies. Protecting our historic structures is just as important as keeping our residential and commercial structures safe. So, to meet people's water needs and keep up a good head of pressure for firefighting, the town's two water towers have to provide around 3,000 gallons per minute for three hours downtown for firefighting needs. For 'Sconset,

750 gallons per minute for one hour is required.

In addition to preserving the integrity of our aquifer and providing adequate firefighting pressure while preventing saltwater intrusion into our wells and water supply, using less water saves you and the town money.

Many of us own rental properties and lodging establishments for which we pay the water bills in addition to our own. It behooves us to be extra frugal with our water and urge our tenants and guests to do the same. Since Nantucketers pay for sewage treatment based on water use, whether septic system or wastewater facility operation, water conservation on an island becomes an imperative. And when we pump less water from our aquifer, we're also using less energy to do so — your hot water heater can account for up to 20 percent of your energy cost. We're



Washing Pond Water Tower

Photograph courtesy of Peter B. Brace

prolonging the life of our wastewater treatment plants and we're discharging less sewage into the septic systems and, ultimately, reducing the potential for groundwater, harbor and pond pollution.

Less than one percent of the earth's water is available for drinking. Yet each of us uses around 60 gallons of water a day. It makes you wonder how much of that amount you're actually drinking. Think about how little water humans use in third world countries and you'll realize how easily you can cut your water consumption by 15 to 20 percent without much discomfort or expense. Forming good water-use habits is all it takes.

More than one-third of all counties in the lower 48 states face higher risks of water shortages by mid-century.

Here are some tips to get you started...

In the Bathroom

- 1. Check for leaks.** Check your water meter or your well pump while no water is being used. If the dial moves, or if the pump comes on, you have a leak. A hole in your water line 1/32 of an inch in size wastes 750 gallons of water per day.
- 2. Install low-flow faucet aerators.** Your water pressure will seem stronger, but you'll actually be saving water while reducing flow as much as 50 percent.
- 3. Check toilets for leaks.** Add food coloring to the tank. If that color appears in the bowl, there is a leak. Leaky toilets can silently waste 200 gallons of water a day.
- 4. For Nantucket's "historic toilets",** of which there are probably many, replacement of the seven-gallon dinosaur with a new, low-flow model that only uses 1.5 gallons per flush is the most efficient way to go. On the cheap? Try placing one or two filled half-gallon plastic bottles in the tank.

Eelgrass: Lean and Mean

Eelgrass is often mistaken for a seaweed. Unlike seaweed, it has roots and even flowers underwater.

One of the most important roles of eelgrass is to provide underwater shelter for species of fish and shellfish, especially bay scallops. Young scallops that attach themselves to the eelgrass fronds are less vulnerable to bottom predators like crabs and starfish. When eelgrass washes up on the beach, its brown piles provide cover for the small invertebrates that nourish wandering shorebirds. Decreased scallop populations followed the decline of eelgrass beds in the 1930s. While eelgrass populations have increased since then, they are now in jeopardy again due to poor water quality.



- 5. Dry flushing.** As Nantucket has many smaller, seasonal cottages, consider installing a composting toilet, which uses no water and turn your waste into usable compost.
- 6. End the endless urinal waterfall.** Restaurants, bars, public facilities and other commercial entities should consider installing waterless urinals, which save at least two to seven gallons per flush.
- 7. Lying down or standing up?** Only the shortest shower saves more water than a partially filled tub. A full tub, however, can use 30 to 50 gallons of water, more than a short shower. Consider bathing small children together.
- 8. Outdoor-shower basics.** Practice the outdoor shower's original purpose of short showers to wash off beach sand. Longer open air showers with hair and body washing wastes water and

energy, and sends phosphorous, the primary pollutant of freshwater ponds, directly into the ground. Most such showers aren't connected to septic systems or sewage collection pipes.

- 9. Hot tubbin' & Jacuzzi wisdom.** Keep hot tubs and Jacuzzis covered when not in use to avoid evaporation and heat loss. Avoid heavy, prolonged splashing and frequent draining, changing your tub's water at the most every three months.
- 10. Like faucet like showerhead.** Think low-flow showerhead and realize water conservation with lower water bills. Flow restrictors are another option as are heads with on/off valves both permitting flow control without losing desired temperature.
- 11. Running water = higher water bill.** Face lathering, washing, shaving and brushing your teeth don't require a

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In 1984, the Environmental Protection Agency designated our water supply as a sole-source aquifer, basing its determination on the fact that no existing alternative drinking water source or combination of sources exist to provide 50 percent or more drinking water to Nantucket.

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running faucet, but will lead to a higher energy bill if you're running the faucet for hot water. Boil water for tea and coffee.

In the Kitchen and Laundry

1. Fill your dishwasher. Run it only when it's completely full and on the cycle with the fewest number of washes and rinses.

2. One for suds, one for rinse. Wash dishes once a day and if you don't have two sinks to fill with hot soapy water and rinse water, use a dishpan for either. But definitely don't run the water while washing or rinsing, as it wastes both water and energy.

3. Let them pile up. There is absolutely no need to do your dishes several times a day or even every day. See #1 and then do the dishes at the very most once a day.

4. Electricity or water? Yes, you're making a choice between which resource warrants more conservation, but if you're trying to save water, let your fridge cool your water itself in a bottle or water filter container instead of running the tap to get the cold water.

5. Washing Machine 101. Most top-loading washing machines use about 40 gallons of water per wash, so buy/use a front-loading machine, which uses 20-25 gallons per wash. Also, do the largest load possible in the normal wash cycle. Avoid permanent press, as it can use nearly twice the amount of

water and pre-treat tough stains rather than using the pre-soak and super-wash cycles, which can use even more water.

6. Trash the garbage disposal. Garbage disposals are unnecessary kitchen appliances, as they use up to 10 gallons of water per minute. They are also bad for septic systems. Instead, collect your organic waste and create a compost pile in your yard.

Outdoors

1. Water lawns with harbors and ponds in mind. Whatever liquid or organic material we put on the ground or down a street drain will eventually find its way into a nearby water body. Since our lawns and gardens can require a substantial amount of water to remain lush, green and colorful, choose native and drought-resistant plants requiring minimal watering. Leave grass cuttings in place as mulch; mulching mowers can help.

2. Water as if drought conditions exist. Avoid quick evaporation by watering only at night or the early morning, but try to avoid 2-5 a.m. when automatic sprinklers typically turn on. Never use water to clean driveways, the sidewalk or street; always use a broom.

3. Free water from the sky. Consider collecting rainwater in barrels and or with your gutters, and installing a filtered cistern to augment your sprinkler system's water use. Around half a gallon of rainwater per square foot of collecting area per inch of rain can be saved

for watering use. But make sure that you use it and don't let the rain barrels become a home to mosquito larvae; organic larvacides work well.

4. Water root areas of your plants.

Drip hose irrigation can save up to 60 percent over watering from sprinklers and the hose.

5. Does it really need a wash every week?

If you absolutely have to wash your car on a weekly schedule, use a bucket of warm water and a hose with a shut-off nozzle at the end of a high pressure, low volume hose.

6. Know where the kill switch is.

Be able to easily locate and shut off your main water supply valve in case of major leaks or a broken pipe. Consider turning off your water and hot water heater while gone on a trip depending on its length.

7. Make sure that lawn irrigation systems are controlled by a soil-moisture gauge and not a clock.

Don't be watering your lawn in a rain-storm!

Nantucket's water Department, Wannacomet Water Company, provides free water conservation information at its offices at 1 Milestone Road and at its website. Also, Chapters 8 and 9 contain essential water conservation pointers for landscaping and lawns.

Out of Sight, Out of Mind

A WASTEWATER PRIMER

Human fecal matter, urine, and even vomit are wastes that can contain viruses, bacteria, and nutrients harmful to our ponds, harbors, and aquifer, and must be disposed of safely. Although fecal coliform bacteria are not able to survive outside of human and animal bodies for long, viruses and nutrients can wreak havoc on the island's water environments. If we don't dispose of these wastes in either properly functioning septic systems or Nantucket's two wastewater treatment facilities, they can contaminate our drinking water, cause algal blooms in our harbors and ponds, and eventually wipe out eelgrass, shellfish, and other marine and freshwater life.

If you have a septic system, never pour toxic household materials such as petroleum products, poison and other hazardous waste into your toilet because they may seep into the groundwater contaminating the aquifer and eventually, ponds, wetlands and the harbors, and all life within them. And don't rely on the Surfside or Siasconset wastewater treatment plants to process your haz-

ardous chemicals; take them to the next hazardous waste day at the DPW.

WASTEWATER TREATMENT: A BRIEF HISTORY

Treatment of wastewater aims for the removal of disease-causing pathogens and the dissolving of solids to the point of creating a stream of solids and a stream of liquids, both of which are then deemed safe for release into the environment.

Historically, we always disposed of our human waste in the ground, taking wastes from outhouses, composting them, and then using them as a fertilizer, but that only worked for small populations living in large areas. We concentrated body wastes in one area, allowing chemical and biological processes to break down fecal matter and urine, and destroy the pathogens. This crude method began to fail as our populations grew. Because of our permeable soils and proximity to so many ponds and harbors, our island was negatively affected sooner than the

mainland. The situation got worse when islanders began using fresh water to wash their bathroom wastes into cess-pools, essentially large open, unlined collecting pits for human wastes from which they would quickly leach viruses, nutrients and bacteria into the ground and eventually, harbors, ponds and the groundwater posing a threat to drinking water.

Modern public wastewater treatment systems and septic systems operate with two key components: the tank and the soil absorption or, leaching field. Instead of an open pit in the ground, solids are pumped into a water-tight tank, settle and slowly are digested, liquids are separated, and then both streams are disposed of via the slow releasing of the liquids into the absorption field to filter gradually down into the ground. This separation of solids from liquids is called *primary treatment*. This helps prolong the functional life of the leaching field by removing the grease and solids that once clogged the soil

Photograph courtesy of Peter B. Brace



Siasconset wastewater treatment plant



Surfside wastewater treatment plant

Photographs courtesy of the Town of Nantucket

around cesspools.

Large-volume wastewater collection and treatment solved the problem of inadequate room.

Eventually, our collective health and aesthetics in densely settled areas demanded that wastewater collection and treatment facilities be constructed. Buildings were connected to sewage lines, which ran out of cities and towns to a treatment plant that separated solids from liquids, digested by bacteria to further break down the waste to release a clear watery liquid called effluent into the ground. This is called primary treatment. Where there is insufficient acreage to provide for final filtration of the wastewater by in-ground filtration on leaching fields, public wastewater treatment plants will take the liquid effluent and continue to filter it and treat it until it reaches drinking water standards.

The first of Nantucket's two wastewater treatment facilities, the Surfside plant, came online in April 1991.

Before that date, the town pumped raw sewage directly into the leaching beds between the plant and the ocean. This plant was originally built to handle an average of 2.24 million gallons of sewage per day and a peak flow of 6.68 million gallons per day (GPD), but was permitted by the state's Department of Environmental Protection for only 1.8 million GPD. It began as a primary treatment-only plant, meaning that like a residential septic system, liquids, separated from the solids in a tank, were pumped out onto the leaching fields.

The Surfside plant reached its capacity in 2004. At the following year's Town Meeting, voters approved a GPD increase to 3.5 million along with upgrading the plant's primary treatment with secondary treatment.

After the primary clarifiers remove much of the solids from the sewage, it's pumped into secondary treatment called sequencing batch reactors. This is an activated-sludge biological treatment

process that uses bacteria and aeration to further cleanse the sewage water before it is pumped out into the leaching fields. These improvements for which were completed in 2009.

The Surfside plant's permitted GPD limit was increased again to four million GPD in 2016. Further evolution came again in 2016 with the addition of an advanced treatment system that includes membrane technology with ultraviolet filtration and ultraviolet disinfection. In November 2004, the Siasconset Wastewater Treatment Facility came online. Year-round, on average, it treats 47,000 gallons of sewage per day, but is designed to handle a maximum capacity of 432,000 gallons per day. During the slowest part of winter, February and March, the plant averages 17,500 gallons per day in treatment of sewage and up to an average of 122,500 during the busiest months of the year, July and August.

BACKYARD DISPOSAL: THE SEPTIC SYSTEM AND HOW IT WORKS

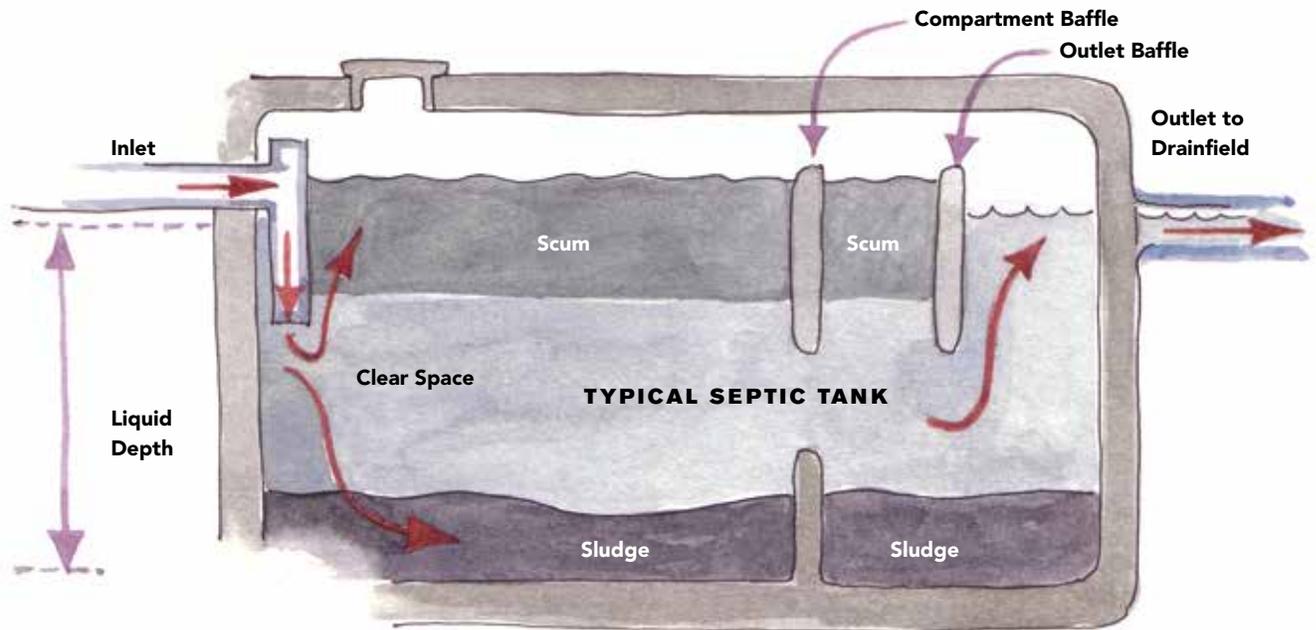
Septic systems work best in low-density areas where there aren't a lot of houses and businesses close together, preferably where the zoning is at least three acres per lot and buildings are well away from ponds and harbors. The parts of Nantucket fitting this zoning description include Polpis, Wauwinet, Squam, Quidnet, Tom Nevers, Cisco, Madaket and Smith's Point. Unfortunately several of these neighborhoods are in close proximity to water bodies.

Massachusetts' Title V regulations, 310 CMR 15, control how septic systems are designed and where they are located, both horizontally as far as feasible from water resources like wetlands, harbors, ponds, bogs and the ocean, and vertically above the groundwater table. Because we have a sole-source aquifer and extremely sandy soils, local Nantucket regulations are more restrictive than the mainland,

requiring septic systems to be at least 100 feet from well water pumps and 100 feet from wetland resources and in harbor watersheds six feet above the groundwater instead of the state's minimum of five feet.

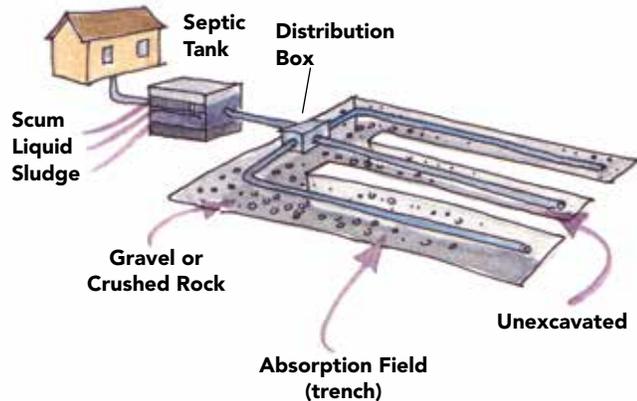
Septic systems consist of a fiberglass or concrete tank to contain the solid (sludge) waste, with a T-shaped inlet pipe that keeps the floating grease layer in the tank, containment baffles to corral the grease and scum, an outlet pipe leading out to a soil absorption system of perforated plastic PVC pipes buried in gravel that allows the liquid wastes to infiltrate into the ground. Nantucket's Board of Health and Health Department administer the town's septic regulations and inspect all new and old systems. Currently, the town is working toward making inspections of septic systems within the watersheds of Nantucket and Madaket harbors mandatory every two years. If found to be faulty property owners would be required to replace their broken septic system. For now, the Health Department and Board of Health requires, resold, new and properties with failing systems to replace them with alternative septic systems. These entities operate with the guidance of Title V, the town's Septic Management Plan and the Comprehensive Wastewater Management Plan.

Nantucket holds its residents to Title V's standard of having septic systems be five feet above groundwater except within the Nantucket and Madaket harbors, and Hummock Pond watersheds where the minimum distance is six feet. This is an attempt at effectively eliminating almost all bacteria and many viruses and nutrients out of the effluent. But harmful nutrients, specifically nitrates, are not removed effectively enough during their descent through our sandy soil. Since Nantucket's foundation contains areas of impenetrable-clay layers, it's easy to see how polluted groundwater can run off the clay into the harbor and from gradual under-



ground slopes into ponds.

While some nitrogen remains behind to help plants grow, the soil does not “trap” the nitrates to make them available for plants over time. Instead, much of it runs right into our groundwater and eventually into Nantucket’s harbors, ponds and aquifer, overloading them with nutrients. The septic system of a family of three releases enough nitrogen to contaminate nearly four million gallons of salt water. Even a well-designed septic system only removes 1/3 of the nitrogen.



Excess nitrogen entering a harbor, tidal pond or salt marsh in the form of nitrate leads to:

- Phytoplankton blooms, causing cloudy or greenish coloring,
- Excess growth of macro algae,
- Decline and eventual loss of eelgrass beds,
- Decreases in bay scallop, soft-shell clam and quahog populations,
- Decreased oxygen levels,
- Odors from decay of excess vegetation,
- Loss of income for fishermen,
- Closure of swimming beaches.

Excess phosphorous entering a freshwater pond, a brackish pond opened to the ocean, a kettle pond or coastal pond in the form of phosphate leads to:

- Blue-green algae blooms, which can be toxic to humans and pets at elevated levels,
- Decreased oxygen levels,
- Excess growth of invasive aquatic vegetation including phragmites (common reeds),
- Bird and fish die-offs,

Fortunately, Nantucket is ahead of the

curve enough to have gotten a handle on faulty septic systems. Between 2005 and 2012, the town’s Board of Health and health inspector wrote and adopted septic system inspection regulations recommended by Nantucket’s Septic Management Plan. The regulations required that all property owners within the Nantucket and Madaket Harbor watersheds, and within the Hummock Pond Watershed get their septic systems inspected. Septic systems found to be failing had to be replaced within 18 months of failing their inspection.

TAKE CARE OF YOUR SEPTIC SYSTEM

- **Pump it out regularly:** Pump out your septic system regularly to remove the sludge and the floating scum. The frequency depends on how you use your system and what you put into it. All systems should be pumped every three to five years to avoid septic system failure.
- **Conserve water:** Reducing the flow through your system will reduce the movement of solids and scum into the absorption system.
- **Don't overload the system:** A dripping faucet or leaking toilet can add hundreds of gallons of water to the system each week. If you're planning a large gathering, rent a portable toilet to reduce demand on your septic system. Stagger your use of washing machine and dishwasher to spread out the flow.
- **Prepare your septic system for winter:** Unless your septic system is in an area that is prone to flooding, such as Hither Creek, Hummock and Sesachacha ponds and Polpis Harbor, do nothing. But if you're property regularly floods, have your septic tanks pumped when closing up the house for the winter to keep your full tank from overflowing and contaminating nearby wetlands, ponds, harbors and the aquifer.
- **Don't install or use a garbage disposal:** Garbage disposals add large amounts of grease and organic matter to the system and can reducing the useful life of your septic system by as much as 50 percent.

- **Don't kill the bugs:** Flushing chemicals down the drain will kill the bacteria in your septic tank. When those bacteria stop working, the sludge accumulates and is more likely to escape the tank and clog your leaching system. Read the labels of your cleaning products to make sure they're septic-system safe.

- **Don't flood the soil absorption system:** Roof drains and stormwater runoff should be diverted away from your system to prevent periodic flooding.

- **Don't compact the soil absorption area:** Don't park your car on or drive over the system. Compaction of its soil from the weight of a vehicle will reduce the system's capacity.

- **Compost it:** Compost what organic matter you can and dispose of greasy waste in your regular trash.

- **Don't flood the system with hot tub water:** Releasing a large volume of hot, chlorinated water into the septic system will kill the bacteria that are busily breaking down the sludge. If you must drain your Hot Tub, do it over a period of three days. This allows the water temperature and the chlorine levels to drop, and the abrupt passage of hundreds of gallons of water won't flush solids out into your leaching field.

Signs of septic system failure:

- The toilet flushes slowly or backs up,
- The lawn is bright green over the leaching field,
- The lawn over the soil absorption

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Of the 11,000 structures on Nantucket using either septic systems or one of the town's two sewage treatment plants, approximately 5,800 are tied into the town sewer collection system with other 5,200 using their own septic systems.

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system floods after you do laundry or during other activities that generate a lot of wastewater,

- Water and foul odor appear over the drainage area.

Alternatives to reduce your impact on the environment:

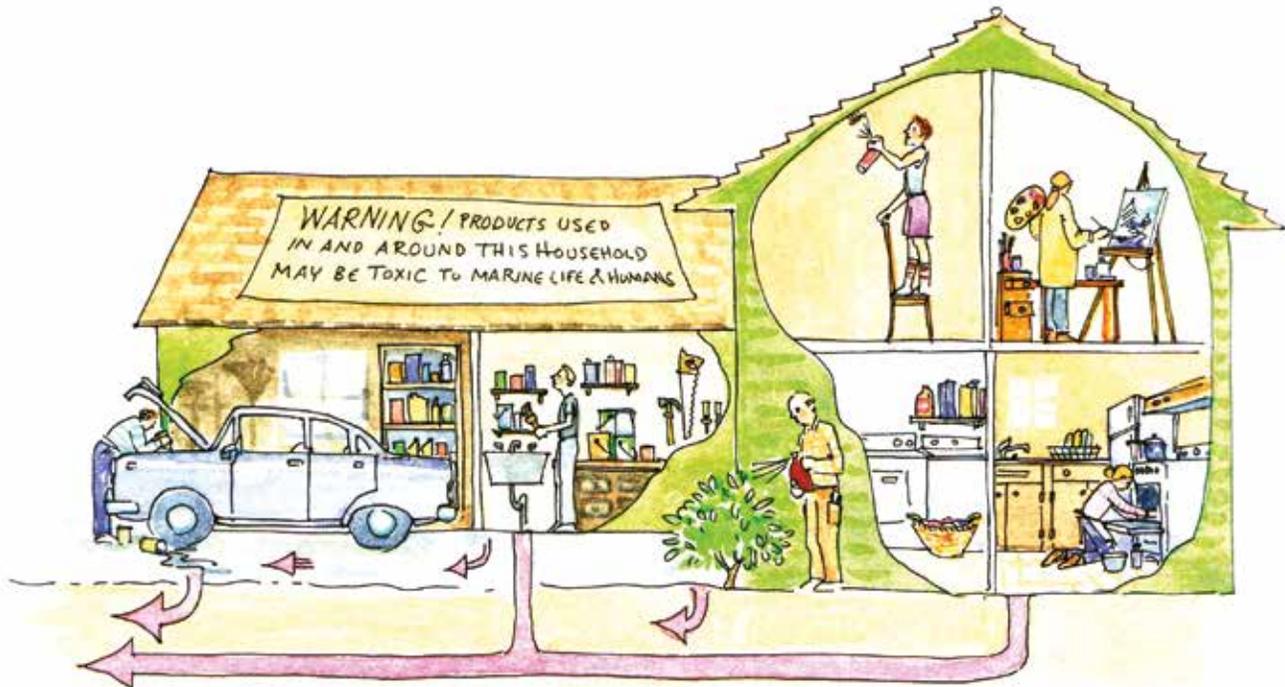
Consider alternate septic systems to the typical backyard septic system. These include systems that don't produce wastewater, such as composting toilets that reduce nitrogen output by over 90 percent, and units that treat wastewater before it goes into the ground by encouraging bacterial breakdown, removing up to 60 percent of nitrogen.

Also consider black water/gray water systems, which separate your sewage and kitchen/bathroom wash water into two underground tanks, which are periodically pumped out.

For more information on alternative septic systems, contact Nantucket's Health Department and check out the web sites for the EPA, the Alternative Septic System Test Center or the National Small Flows Clearinghouse, links for which are in the chapter reference material pages at the end or in the resources chapter on page 56.

Hazardous Waste?

NOT IN MY HOUSE!



Thousands of common household cleaning, lubrication, paint, pesticide and herbicide products contain toxic compounds that should be kept out of our waters. If we bring hazardous products into our homes, it is our responsibility to use, store and dispose of them safely.

When it comes to disposal of these toxic products and their containers, always act with our harbors, ponds, ocean and aquifer in mind by imagining the consequences of their contamination. *Never* pour toxic materials down your drain or empty them into storm drains in your street. Whether there is a septic system, tank or sewer system connection, these noxious compounds can end up in our groundwater and find their way to island sewage treatment plants where they can kill essential treatment bacteria. They can also eventually flow into our harbors and ponds, killing marine and freshwater life, and causing algae blooms. Not only is it thoughtless to dispose of toxic materials into our drains, it is illegal under the Clean Water Act. Be responsible; be compliant.

Luckily, Nantucket's Department of Public Works holds six residential hazardous waste collection days during the year in April, June, July, August, October, and December, and four commercial collection days in April, June, August, and December. A certified hazardous waste handler hauls all of

the waste off island to state-approved processing and disposal sites. Check out the Town's DPW web page for specific collection dates and times along with a listing of what materials you should bring out there.



Hazardous waste collection day

Photograph courtesy of Peter B. Brace

HOUSEHOLD CLEANERS



Some soaps and detergents are designed to biodegrade when washed down the drain, try to buy those when possible. However, there is a whole category of household cleaners that don't go away so easily and should either be avoided or used sparingly, and their containers taken to a hazardous waste collection day. These include drain openers, oven cleaners, toilet bowl cleaners and bleach products, which are all poisonous. Furniture polish and spot removers are flammable, and ammonia-based cleaners and disinfectants contain strong chemicals, which may also be harmful.

Identify the cleaning products in your home that may contain hazardous ingredients by reading the labels. You've got some of the dangerous ones in your home, if they contain such toxic compounds as lye, phenols, petroleum distillates, chloride dichlorobenzene. If cleaning products bear the words, "danger," "warning," "toxic," "corrosive," "flammable," or "poison," these too might contain hazardous materials.

Use and store these substances carefully. Keep them in their original containers. Do not remove their labels. Never mix them with other products because incompatible products might react, ignite or explode. Products containing corrosive materials — acid or lye — require special handling. Call the Nantucket Health or Fire Departments for special instructions on how to transport these materials to a hazardous waste collection day at the landfill.

Chlorine is such a common ingredient in household cleaners that many people are surprised to learn that it is highly toxic, corrosive, and a strong irritant to the lungs and mucous mem-

branes. Chlorine-based cleaning products can also destroy essential bacteria in septic tanks, eventually causing system failures. Chlorine can also combine with other materials present in your house and environment to form new toxic substances. NEVER mix chlorine (or products containing chlorine) with ammonia products because the resulting reaction creates a poisonous chlorine gas that can be fatal.

Phosphates can degrade freshwater bodies. Acting as a fertilizer, excessive phosphates stimulate growth of invasive plant species such as common reeds (also called phragmites), which grow along many of the South Shore ponds and have tall reeds topped with furry seed spicules. Phosphates also cause algae blooms, which deplete ponds of oxygen required by other freshwater life forms. Laundry detergents are now required to be phosphate-free, but dishwasher detergents are not. When you shop, read the labels and try to buy only low-phosphate or phosphate-free products.

Fluorescent whitening agents Also known as optical brighteners, these clothing detergent ingredients are ultraviolet dyes that make fabrics seem brighter and whiter. But view this additive with skepticism and an eye toward pond and marine life because it is known to be toxic to fish and other pond and ocean life. These whitening agents are slow to degrade and their toxicity is doubled. Because laundry products aren't required to list individual ingredients, don't buy those that boast a brightener.

Buying advice

Read the labels of household cleaners before you buy them, avoiding those with phosphates. Always choose earth-friendly products from companies such as Simple Green, Seventh Generation, Mrs. Meyers, Shalkee and Earth Friendly Products. Look for product descriptions which include biodegradable, plant-derived, hypoallergenic, Paraben-free, no phosphates, no chlorine, recycled content in packaging and recyclable packaging, reduced or no added dyes or fragrances, no skin irritants and no VOCs (volatile organic compounds). Also, look for green certification logos from such green identification labels as EcoLogo, Green Seal and Designed for the Environment – U.S. EPA.

When in doubt, think about how household cleaning products you use may impact your drinking water, pond and ocean life.

Disposal

Dispose of any remaining non-green cleaning products in the following manner. Whenever possible, avoid dumping cleaners or wash water down drains. Instead, try diluting the dirty wash water with water and then spread it over a gravel

driveway or around deep-rooted plants to percolate and be absorbed slowly into the ground. If drain dumping is unavoidable, run the tap as you slowly empty your dirty water down the drain. Now, start fresh by only buying green-certified cleaning products.

SOLVENTS AND PAINTS

Oil-based paints and preservatives, paint thinners and removers, rust removers, furniture strippers, nail polish remover and polish remover; every one of these can contaminate groundwater and is extremely toxic to pond and ocean life.

Disposal

Regard most solvents and paints as you do non-green cleaning products: with fear and caution, and never pour any of them down the drain, into sewers, septic systems or storm drains. Never incinerate them because their pollutant compounds will become airborne and ultimately pollute our air and water with particulates. If your aim is to stop using oil-based paints, either take what you have to the next hazardous waste collection day at the Nantucket landfill or use it up on basement and closet walls.

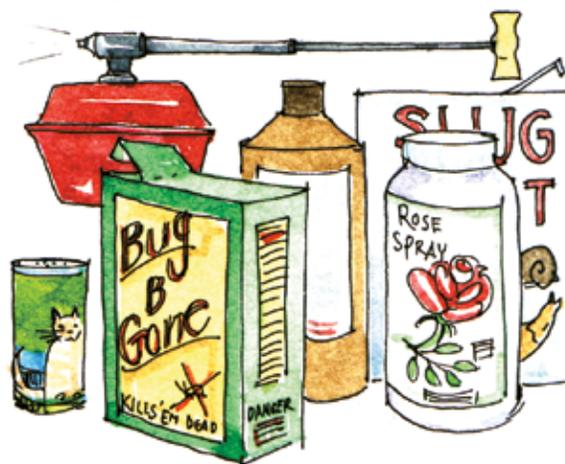
For unwanted latex paints, a non-hazardous paint not accepted at the hazardous waste collection site, remove the lid to let it evaporate or mix in some cat litter until the paint is dried out. Scoop out the litter/paint material and dispose of it in your regular trash. If the paint can is metal, it can go in the metal pile at the landfill. Paint thinner can be used several times before disposal. Put used thinner in a closed, clear jar to settle out the paint particles, so that you can pour off the remaining clear liquid to reuse. Transport the paint sludge to the hazardous waste collection site.

USE WITH SPECIAL CARE!

- Mothballs • Flea powders • Pet shampoos
- Slug bait • Wood preservatives • Weed killers

Alternatives

When shopping for paints, choose those with low VOC content and remember that latex paints are nontoxic. Latex paint cleans up with soap and water, and does not require thinner. For covering fences, barns and basements, try whitewash, a nontoxic combination of limestone, milk and linseed oil. Buy unused paints from garage sales and use a citrus-based solvent to clean up oil paint and brushes. Try to use citrus-based paint removers, which don't produce fumes and don't need to be taken to hazardous waste sites.



HERBICIDES AND PESTICIDES

As with household cleaning products, read the labels of the pesticides and herbicides before you buy them. Look for EPA-certified organic pesticides. Those with synthetic compounds are especially harmful to scallop larvae and other marine and freshwater species. They can also kill the natural predators of the pests you are trying to kill. Buy traps instead of sprays for household insects, plant insect-resistant flowers and plants around your property, and use environmentally friendly pet care products. More information on disposal and pesticide/herbicide alternatives is in Chapter 8 on landscaping on page 39.

Photograph courtesy of Peter B. Brace





CAR CARE PRODUCTS

Your car or truck runs because of the many petroleum-based products used in it for lubrication and combustion. When these liquids find their way into our harbors and ponds, they first float on the surface. Then they find their way down to the lower levels of the water column where their hydrocarbons kill the shellfish larvae such as those of Nantucket bay scallops. There is much more on this topic in Chapter 10: Best Boating Practices.

Unfortunately, nontoxic alternatives to these products—minus all-electric vehicles, which require no gasoline and motor oil, aren't available yet. So, never dispose of any of your vehicle's fuels and lubricants yourself. One gallon of oil can contaminate a million gallons of salt or fresh water. One undrained oil filter can contain up to 12 ounces of motor oil and the oil from a car engine can produce an eight-acre oil slick.

Maintain your vehicle and other motorized equipment in running order. Fix leaks promptly. When washing or servicing your vehicle, do it on grass or a gravel parking lot far away from ponds, harbors and the ocean. Use biodegradable, green-certified soap and water rather than detergents, and use a bucket or pistol-grip nozzle to minimize runoff into storm drains. Return your used car battery to the store you bought it from.

Disposal

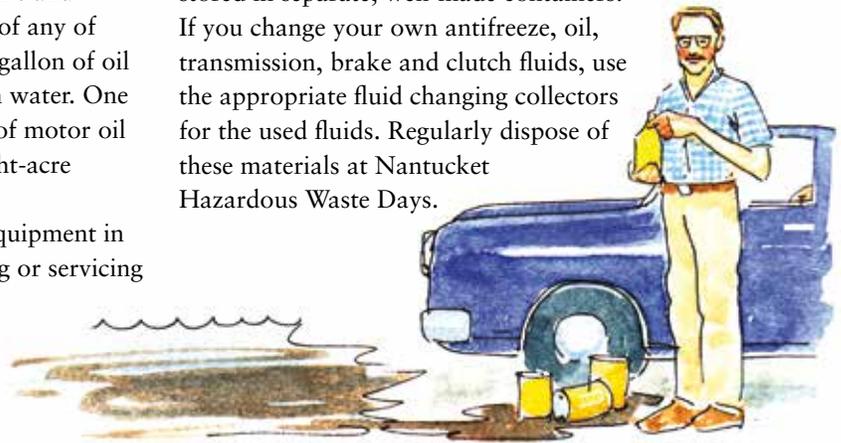
All your car care products should be stored separately in sturdy containers with their lids firmly attached and out of the reach of children. Dispose of them at one of Nantucket's Hazardous Waste Days along with motor oil collected in a container. By law, retailers and auto repair shops from which you purchase your motor oil are required to take back an equal amount of used motor oil sold free with your receipt

for recycling. Call the state EPA motor oil information line: 617-556-1022, to report dealers that refuse to take your used oil back.

Other Car Care Products

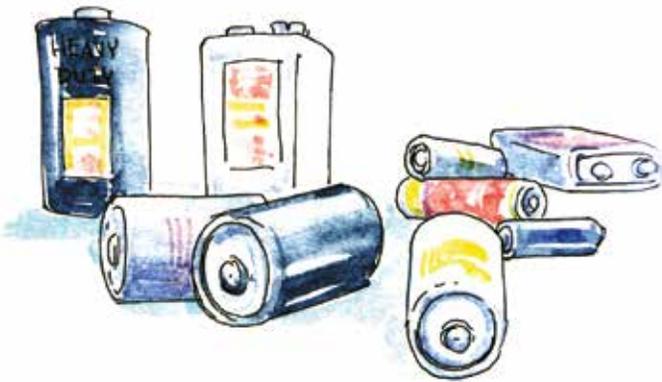
These include, antifreeze, whose primary active ingredient is ethylene glycol and is poisonous to wildlife, dogs and cats; all transmission fluid, batteries and battery acid; brake fluid, degreasers, engine cleaners, gasoline and diesel fuel, liquid car wax, motor oil, radiator flushes and rust preventatives. All of these products should be treated as hazardous waste and be stored in separate, well-made containers.

If you change your own antifreeze, oil, transmission, brake and clutch fluids, use the appropriate fluid changing collectors for the used fluids. Regularly dispose of these materials at Nantucket Hazardous Waste Days.



DID YOU KNOW?

One gallon of oil can contaminate up to a million gallons of salt or fresh water. The oil from one engine can produce an eight acre oil slick.



ITEMS THAT CONTAIN HEAVY METALS

Many household items that we don't regularly recycle on a short-term basis contain heavy metals such as mercury, cadmium, arsenic, barium, chromium, selenium, and lead, as well as the organic toxin, dioxin. Equally dangerous to fetuses and children as they are to our island water bodies and the environment in general, they too should be considered hazardous waste. Alkaline batteries can go in your regular trash, but not rechargeable or small button-type batteries. The latter two are collected at Hazardous Waste Days. Printer ink cartridges can be disposed of by using prepaid envelopes available at the post office.

Above-ground oil tanks are also a threat to groundwater because they rust from the inside out, eventually leaking their contents into the ground. Contamination to groundwater can be devastating and take many years for recovery, not to mention the staggering costs of cleanup. If your tank is showing signs of corrosion or is more than 20 years old, it should be replaced with a new safer stainless steel tank.

USE SPECIAL CARE FOR DISPOSAL!

- Computers • Home thermostats • Computer monitors
- Smoke detectors • Televisions • Compact fluorescent light bulbs
- Mercury thermometers • Rechargeable batteries

Taking Action

Nantucket's households can have a serious impact on our island's water quality if we let them. Now that you know what products are hazardous to the health of our water and us, here are some progressive steps to take toward protecting our groundwater.

- Get informed by checking out the links for **Chapter Five** in the Chapter Reference Material on Page 58,
- Read labels so you know what you are buying and what the potential hazards are,
- Follow the directions on the label,
- Use the least toxic product available,
- Never use more of the product than recommended,
- Learn when Nantucket's Hazardous Waste Days are and dispose of your products there,
- At least try the alternative cleaners on the next page.

And Lastly....

Consider walking, bicycling, car pooling, or taking Nantucket's public transportation system, The WAVE.



Nantucket Regional Transit Authority Bus

Photograph courtesy of Peter B. Brace

WATER-KIND CLEANERS FOR YOUR HOME

With a little creativity, you can make your own household cleaners with products easy on groundwater, humans and pets. Secure and clean several spray bottles and glass mason jars. Most of the ingredients should already be in your home, including baking soda, white vinegar, borax, washing soda, citrus solvent, lemon juice, lemon oil, tea tree oil. All of these ingredients are safe to mix together. Label your concoctions clearly and store them out of children's reach. Remember that you can buy commercial cleaners made of these ingredients at the store.

All-purpose cleaner

Mix ¼ c. white vinegar, 2 tsp. borax and 1-2 tsp. tea tree or lemon oil in a quart spray bottle of very hot water. Shake vigorously. Add more borax for disinfecting.

Bleach

Use oxygen bleaches, borax or hang your clothes out in the sun. Also, try an old fashioned bluing product to whiten whites such as Mrs. Stewart's Bluing.

Carpet Stains

Try equal parts white vinegar and water or club soda immediately applied and then blotted dry. Repeat if necessary and then clean with warm soapy water using a brush or sponge. Fresh wine stains can be treated with a thick layer of table salt.

Deodorizers

You know about putting an open box of baking soda in your fridge, but it also works in other closed spaces such as closets and bathrooms. Sprinkle it on upholstery and carpets, wait 15 minutes and vacuum. For fresh, clean air, simmer cinnamon and cloves, or put white vinegar in open dishes.

Drain Cleaners

Plungers and plumber's snakes work much more efficiently than chemical drain cleaners. After using one of these, add a ¼ c. baking soda and then a ¼ c. of vinegar. Wait 15 minutes and flush with 2 qt. boiling water. *Caution: do not use this method after trying a commercial drain cleaner because the vinegar can react with the chemicals to produce dangerous fumes.*

Dusting

Mix ¼ c. white vinegar per quart of water and dust with a slightly wrung out soft cloth. Or use a micro-fiber dusting cloth.

Floor Cleaner

Mix ¼ c. baking soda and ¼ c. borax with hot mop water. Rinse with ½ c. white vinegar in clear water. For vinyl floors, add 1 c. vinegar to mop water.

Glass Cleaner

Mix 2 Tbsp. vinegar, 2 tsp. lemon juice and 1 tsp. liquid soap 1 qt. warm water. Shake well, spray on and buff with crumpled newspapers.

Metal Polish

Silver; line a pan with aluminum foil and fill with water, 2 tsp. of baking soda and salt. Bring mixture to a boil and dunk silver, polishing it with a soft cloth. *Brass or bronze*; polish with a soft cloth dipped in lemon juice and baking soda solution. *Copper*; Add 1 tsp. of salt and 1 c. white vinegar to a pint of boiling water. Immerse cotton cloth, remove and wrap around copper while hot. Once cool, wipe down.

Mildew Remover

Mix ½ c. vinegar, ½ c. borax and 1 qt. very hot water. Spray on. Wipe up after 10 minutes. Alternately, add 2 tsp. tea tree oil to 2 c. hot water in a spray bottle. Shake up and spray on. Do not rinse, just wipe up. For grout, mix one part hydrogen peroxide (3%) with two parts water in a spray bottle and spray on mold. Wait at least one hour before rinsing.

Paint Brush Cleaner

For oil-based paints, use citrus-based solvents available commercially.

Scouring Powder

Make a paste of baking soda and vinegar. Rub gently.

Toilet Bowl Cleaner

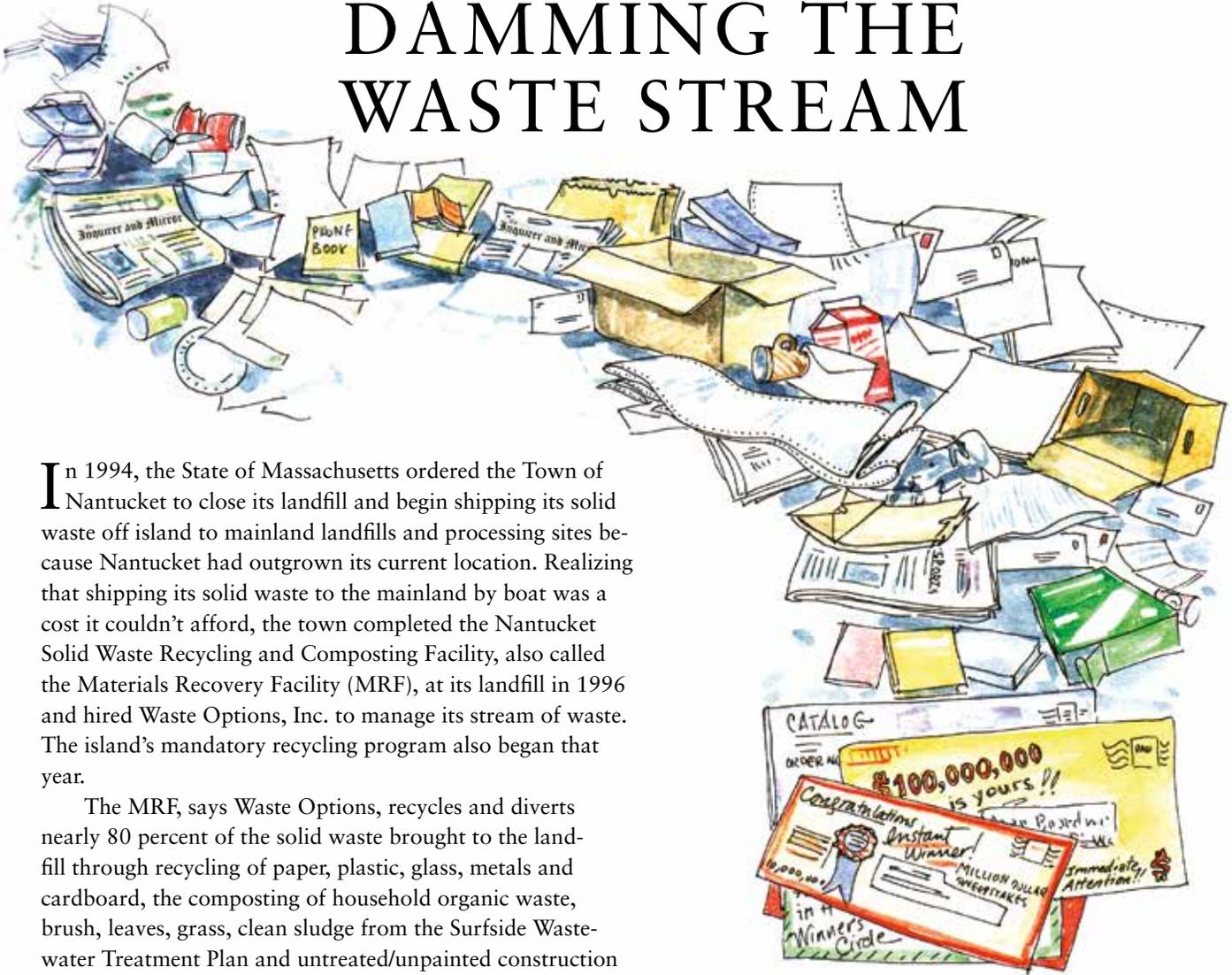
Mix ¼ c. baking soda with ½ c. vinegar and pour into bowl. Let stand and brush well.

Wood Polish

Rub with 1 tbsp. lemon oil mixed with one pint of olive oil. Buff with soft cloth.

Rethink/Reuse/Recycle

DAMMING THE WASTE STREAM



In 1994, the State of Massachusetts ordered the Town of Nantucket to close its landfill and begin shipping its solid waste off island to mainland landfills and processing sites because Nantucket had outgrown its current location. Realizing that shipping its solid waste to the mainland by boat was a cost it couldn't afford, the town completed the Nantucket Solid Waste Recycling and Composting Facility, also called the Materials Recovery Facility (MRF), at its landfill in 1996 and hired Waste Options, Inc. to manage its stream of waste. The island's mandatory recycling program also began that year.

The MRF, says Waste Options, recycles and diverts nearly 80 percent of the solid waste brought to the landfill through recycling of paper, plastic, glass, metals and cardboard, the composting of household organic waste, brush, leaves, grass, clean sludge from the Surfside Wastewater Treatment Plant and untreated/unpainted construction wood. And it also collects many of our hard-to-recycle items including refrigerators, dishwashers, computers, televisions,

mattresses, tires, stoves, sofas and computer monitors.

Unfortunately, many islanders avoid the landfill when disposing of their brush, leaves, grass clippings, scallop shells, vehicle batteries, tires, furniture and major appliances. Then they dump these unwanted items out in the moors to avoid paying landfill fees. If you ever witness illegal dumping, discretely take a photo, note the location and if you can identify the landowners, let them know. If the dumping occurs on town land, let the Department of Public Works know about it by calling them at 508-228-7244. Also, know that many household items such as furniture, mattresses, large appliances and hazardous waste can be dropped off free of charge at the landfill or during Hazardous Waste Days, www.nantucket-ma.gov/237/Public-Works.



Nantucket's Materials Recovery Facility

Photograph courtesy of Peter B. Brace

Paper and Cardboard

Did you know that paper and cardboard make up one third of our trash stream and that the average household receives 41 pounds of junk mail a year?

The EPA considers producers of paper and cardboard to be among the largest polluters of water in the U.S. If, however, you use recycled paper, you are helping to reduce water pollution by up to a third of what standard pulp-product producers pump into our water and to decrease air pollution by more than half. These facts alone should motivate you to sort your paper waste into the categories accepted at Nantucket's recycling center including:

- Newspaper,
- Cardboard and brown paper bags,
- Books and magazines,
- Mixed paper, which includes egg cartons, computer and copy paper and clean food packaging.

Paper not taken as recyclable at the MRF includes food-contaminated paper, waxed paper, waxed cardboard juice and milk containers, oil-soaked paper, carbon paper, tissues and sanitary products, thermal fax paper, stickers and plastic laminated paper.

Simple decisions made at home can significantly reduce your use of paper. Sign up for paperless statements from your bank and billed services, don't accept credit card offers. If your favorite magazine subscriptions offer digital versions, consider receiving them on your tablet device, and cut the flow of catalogs to your mailbox by signing up for the 41 Pounds service found in the Chapter Reference Materials section on page 59. You'll find a complete list of all recyclable waste materials at the town's web site for the landfill in this section and in the Nantucket Phone Book's green pages as well. **Junk mail reducer:** www.41pounds.org. **Landfill, MRF and Take It or Leave It days and hours:** www.nantucket-ma.gov/237/Public-Works

Plant Debris and Food Waste

Around 20 percent of our waste is plant debris, including leaves, grass clippings, flowers and brush. Although large branches should go to the landfill, consider composting most of your organic wastes in your backyard. See Chapter 8 on landscaping for guidelines on turning these wastes into a natural fertilizer for your plants.

If composting organic waste is beyond your time and abilities, Waste Options grinds up your brush, all discarded clean building wood, mixes it with grass clippings, leaves and other plant wastes along with treated sludge from the Surfside Wastewater Treatment, and composts it into usable humus and bark mulch at the landfill.

Metals

Since nine percent of our waste is metal, it is easy to see how much of it can be returned to service through recycled metals, especially since the remanufacturing process consumes far less water and energy, causing far less water and air pollution than the extraction and processing of raw mined materials. The MRF accepts both ferrous metals (those containing iron) and nonferrous metals (such as aluminum cans).

If you already redeem your beer and soda cans at island stores, consider donating them to Boy Scout Troop 97, which maintains a collection shed at the MRF. Otherwise, tin, steel and aluminum cans, and all lids, aluminum foil and pie plates are also collected at the recycling center. Cans should be rinsed. There is a waste metal dumpster for larger and hard-to-recycle metal items including wire. The MRF does not take paint or aerosol cans, except paint cans containing latex paint and empty aerosol cans, which can be put into the metal dumpster. All cans containing hazardous wastes should be brought to Hazardous Waste Days. See the Chapter Material Reference section on page 60 for all hazardous waste collection day information.

Glass

The MRF takes almost all forms of glass, including green, blue, brown and clear bottles and all kinds of jars (all rinsed and all metal or plastic lids and collars removed, corks discarded), and mirrors (frames removed). Non-recyclable glasses and ceramics such as dishes, plates, cups, Pyrex and ceramics go either into household or Bulky Waste, depending upon their nature. Incandescent light bulbs go into glass and fluorescent bulbs, including the new CFLs, go into a special bin by the landfill's monitors' shack.



Nantucket Clean Team
founder Bill Connell

Photograph courtesy of Peter B. Brace

SIX SIMPLE ACTIONS

To help improve water quality by recycling and reusing...

Recycle

When you shop, buy products with limited or reusable packaging. If you can, use reusable bags or containers to buy your produce in, your juice concentrates, coffee beans, fish and all bulk food items. Also, be on the look out for foods sold in recyclable or reusable containers.

Use Cloth Diapers

The average baby uses nearly 4,500 diapers before being toilet trained. Unrinsed and improperly disposed of plastic diapers can contaminate our surface and groundwaters. A week's worth of cloth diapers adds just one to two extra loads of laundry a week. If you take a baby to the beach, ensure that its diapers are leak proof and that, when used, they are disposed correctly on land and not into the water.

Avoid Disposable Beverage Containers

By using your own lidded travel mugs for caffeinated drinks and BPA-free plastic water bottles for your daily water supply, you'll avoid adding to the infinite number of foam and plastic cups that end up all over our island and on our beaches. Also avoid using disposable plates and utensils.



Memo. If you read a lot of books, purchase and download them through Apple's iBooks or Amazon's Kindle software onto your tablet.

Shop with reusable bags

The brown paper grocery bags that Stop & Shop gives out require highly concentrated amounts of tree pulp to manufacture, and although they're recyclable, more water is used to make them than regular paper. Find sturdy, reusable, preferably cloth bags to carry your groceries and other household needs home from the store.

Reuse Writing and Printer Paper

Use both sides of paper sheets, make two-sided copies and save printer paper copies to use blank sides for printing. Buy and use paper products made of recycled paper.

Go Paperless

If you own an iPad or other tablet, consider loading your documents onto it using Dropbox and taking them with you rather than printing them out. Try taking notes on your tablet using one of many such apps including Evernote, Penultimate and



Buy Smart

Choose quality products that stand up and do their jobs over a long period of time and that don't have to be replaced or thrown out frequently. Spend \$20 and subscribe to Consumer Reports to get best value for your money and our island's environment or check out this publication at the Nantucket Atheneum



Spare That Shrub!

CONTROLLING SURFACE RUNOFF AND EROSION

Unlike on the mainland, Nantucket's soil structure is more porous and loose. Our topsoil, the dark organic humus-rich material good for planting trees, shrubs and flowers, is thin. In most of our native soils, it is only a few inches thick. Because of the relatively flat terrain of the island, only about 2 percent of annual precipitation becomes surface runoff. The rest runs quickly through our highly permeable soils down to the groundwater aquifer and into the various bodies of surface water. Beneath the topsoil are varying layers of sand, gravel and clay, and mixtures of these three. In a normal mainland setting, the organic soil may be several feet thick or more. On Nantucket, as on the mainland, the roots of trees and other plants hold the soil in place preventing its erosion by rain, wind and waves. On our shores, American beach grass, beach rose (a non-native plant), Eastern red cedar and other salt-resistant plants help stabilize our beaches and dunes. Our natural, native vegetation is our best defense against rain runoff and coastal erosion. All of those roots also act to allow the slow, gradual percolation of water from the surface down to the groundwater and ultimately, into



our aquifer, ponds, swamps, harbors and the ocean. But the forces of development are working against us. As more land is cleared for new buildings, parking lots, roads, and driveways, more rainwater is carried straight into our harbors and ponds. These new impermeable surfaces prevent the natural percolation of water down into the ground.

Various storm drains that drain into the harbor were marked with this decal.

We need to preserve this natural process of slowly delivering water into the ground because of the sometimes toxic compounds carried in the water.

Under normal ecological conditions, these pollutants, including heavy metals, paints, oils, petroleum products, grease, nitrates from lawn fertilizers, phosphates from detergents and animal waste, are filtered out by the soil and vegetation before reaching the various forms of water bodies on the island. So, too, are the harmful bacteria associated with animal wastes. These natural filters also trap sediments that would otherwise be swept along with runoff into the harbors, smothering eelgrass beds where bay scallops, other shellfish and finfish spawn and live, as well as aquatic habitats in freshwater bodies.

DEALING WITH SURFACE RUNOFF

The Power of Plants and Shrubs

Because we have a thin layer of topsoil over sand, gravel and clay, many of the native trees, shrubs, grasses and wildflowers growing on Nantucket today are those that thrive in nutrient-deficient conditions, and at the same time, endure a near constant misting of salt spray from the ocean. These plant species are holding our island together and at the same time filtering out harmful pollutants, which they convert to food for their own survival, and trapping sediments before they flow into ponds and harbors.

Salt marshes in such island locales as the Creeks, Medouie Creek, Pocomo Meadows, Folger's Creek, Hither Creek, Polpis Harbor, Shimmo and Eel Point, and swamps in Wauwinet, Squam and Quidnet are nature's sponges. They mop up excess runoff flowing toward ponds and harbors, and cleanse it of its toxins. Freshwater marshes in the island's great ponds perform the same function. Nantucket's salt-marshes also act as buffers protecting the island's upland areas from storm surge and waves.

Protection of these natural habitats, then, is crucial to

our island environment's good health.

At home, you can help stem the flow of runoff into ponds and harbors by increasing your property's level of absorption. You can decrease the size of your lawn and asphalt/concrete surfaces, leaving more of your land in a natural landscape. If you're building a new house, you can work with your land-

scaper and gardener to plant more native species and keep your lawn size down to a minimum. For existing properties, it's not too late to add more native vegetation where there is lawn today.

You can install filter-equipped catch basins that strain out toxins from runoff before it reaches groundwater.

TEN TIPS FOR DECREASING HOUSEHOLD SURFACE RUNOFF



Photograph courtesy of Peter Brace

1. Wherever possible, install vegetative swales, berms and basins to collect runoff during heavy rain events and allow that water to infiltrate the ground at a measured pace.
2. Collect rainwater from roofs in barrels to use on plants around your home.
3. Retain existing trees, shrubs and wildflowers, removing invasive species and adding native, drought-resistant, butterfly-and bee-friendly species to aid in the slowing of water percolation down into groundwater. Plant and maintain vegetative buffers at the base of steep slopes and along wetlands.
4. Design your yard with less lawn and

more natural vegetation.

5. Discontinue the old Nantucket practice of dumping Christmas trees and wreaths over eroding bluffs and banks because these dead evergreens can actually smother the vegetation doing the real work of holding the shoreline in place, that is, the beach grass, bayberry and rosa rugosa.
6. Reduce impervious surface area by avoiding concrete and asphalt. Many Nantucketers use Belgian blocks for driveway aprons, which slow driveway runoff into the street, and gravel or crushed quahog and scallop shells on their driveway, which allows rain to trickle into the ground. Lawn pavers

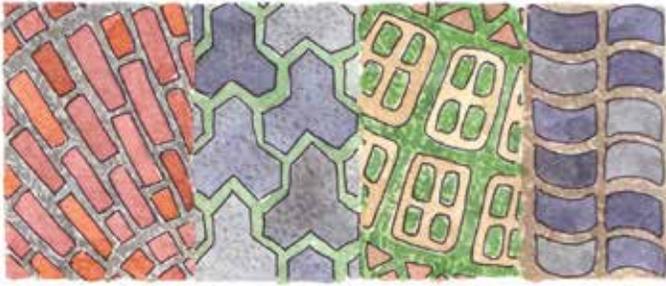
that are hollow in the center allow water to enter the ground while preventing tire rutting. Try groundcover instead of grass.

7. Don't use excess amounts of fertilizer, pick up litter and animal waste, and regularly maintain your vehicle to prevent leaks.
8. Gravel trenches along driveways and around patios can collect water and allow it to seep gradually into the ground.
9. Pipe rainwater from driveways, patios, roofs and other impermeable surfaces, into gravel-packed infiltration wells underground to allow slow percolation into the ground..

10. When building a new structure, work with your builder to leave as much of the existing vegetation on your land as possible and before construction begins, surround the site with hay bales and silt fencing to prevent any sediments from washing off of your lot and to control erosion.



Photograph courtesy of Peter Brace



DISCOVER “SOFT” PAVING SURFACES

Durable as it is, concrete as a driveway material, is outdated and largely no longer used. Asphalt is always an option, and porous asphalt pavement is the better of the two. But Nantucketers’ sensitivity to our interior wetlands, ponds, harbors and the ocean, enforced by the Conservation Commission, is such that alternatives to these two impermeable surfaces are now the norm. Bricks, porous or hollow paving blocks and flat stones make for durable driveways, and if placed on a bed of sand and/or gravel on top of well-drained soil, let rainwater filter into the ground.

Although there are many types of flat stones for pathways and walks, a great alternative is North American red cedar decking low to the ground, but high enough to prevent rot. Because of the spacing of the planks at about a nail’s width, rainwater can easily drip onto the ground below and we can therefore benefit from a slow absorption process.

Ask your landscape designer or architect about innovations in porous surfacing materials and check the Chapter Reference Material pages starting on page 58 for useful links to finding these paving materials.

POND, BLUFF AND SHORELINE EROSION

Remember Chapter One’s discussion about watersheds, which drain some of the water they collect into ponds, harbors and the ocean? Well, surface runoff is the quick and deadly way to



Photograph courtesy of Peter Brace

speed up that process because the water flows easily over impermeable surfaces carrying with it pollutants and sediments. In 1993, Nantucket’s waters from shore to three miles outward were designated a federal no-discharge zone, as is Nantucket Sound, meaning vessels are prohibited from emptying their holding tanks within this area. Similar local protections exist on land within the Nantucket Harbor Watershed so that toxic chemicals don’t get into the ground and out to water bodies. However, there is really nothing but a few storm drains with filters in them preventing excess sediments from smothering aquatic and marine life, clogging fish and shellfish gills and clouding out sunlight needed by fresh and saltwater plants.

Vegetation, both existing and planted, is crucial to the stability of shorelines and the health of water bodies. The roots of trees, shrubs and grasses hold the soil in place and help to keep it from eroding away. Likewise, marine and wetland vegetation, such as salt marsh cord grass, groundsel trees, and swamp maples, also hold soil in place and provide habitat for fresh and saltwater species.

Living with a pond, swamp or other freshwater wetland on your property or on a harbor, Nantucket Sound or the ocean carries with it special responsibilities. You should never do large-scale removal of natural vegetation surrounding these water bodies nor remove vegetation from coastal banks, bluffs and dunes. Buffers of native vegetation at waters edge and just inland are vital to holding soils in place and maintaining healthy salt and fresh water habitats.

But just to make sure, Nantucket’s Conservation Commission enforces the town’s Wetlands Bylaw and Massachusetts Wetlands Protection Act with a jurisdiction from 100 feet of a wetland, and requires a mandatory 25-foot no-disturb buffer zone around all wetlands.

Photograph courtesy of Peter Brace

CONTROLLING WATERFRONT EROSION

Nantucket's future lifespan is expected to be less than 400 years as the result of coastal erosion by waves and wind, and ultimately, sea level rise. While erosion is the natural geological process of eroding sediments from one beach and replenishing those down current, we don't have to hasten the process by weakening the island's defenses. Plants including beach grass, rosa rugosa, bayberry and Eastern red cedar bind the sand and gravel together.

Strive to leave these plant species in place and add to them if you can, leave fresh and salt water marshes intact. Don't build too close to any shoreline because digging a foundation hole and removing topsoil loosens soils and exposes sand and gravel to the erosive action of surface runoff and wind.



Photograph courtesy of Peter Brace

These sand bags could not save this house

Our Conservation Commission takes a hard line against armoring coastal properties with rock walls, jetties, bulkheads, riprap, geo-tubes and giant sand bags. That is because, generally, any sort of hard structure meant to prevent erosion of a given beach has the unintended consequence of depriving neighboring untreated beaches of their flow of sediments.

The ConCom, as islanders call it, always recommends the preservation and planting of native beach plant species as a natural solution to controlling erosion, along with snow fencing. The roots of beach grass go deep down into the beach and then horizontally within the dunes, sprouting new stems from which the plant's blades grow. On top, they trap blowing sand, which gradually builds up the height, width and length of the dunes, into which more beach grass grows. Rosa rugosa, beach roses, and beach plums have similar deep roots and they thrive in salty conditions.

So, leave them alone. Don't walk on them and don't remove them!

EROSION FACTS

- When water and land wrestle, the water always wins.
- Walking on coastal dunes or sliding down them kills vegetation and coastal bluffs by accelerating their erosion.

The right types of plants which help to stabilize coastal banks, bluffs and dunes already exist on Nantucket. They include American beach grass, Eastern red cedar, beach plum, bayberry, rosa rugosa, highbush and low bush blueberry, seaside goldenrod, bearberry and winterberry. They are salt-tolerant, have deep, strong root systems and help absorb surface runoff.

In addition to not removing these plants from your waterfront property and planting more of them, you should also

- Contact Nantucket's Conservation Commission before you design your landscaping plan for permits you may need and advice on where and what to plant,
- Join your island neighborhood association regardless of whether your land abuts a pond or salt water body,
- Learn about what harbor or ocean watershed your property sits in,
- Urge the town to use less asphalt on town roads and pervious surfaces.



Nantucket Neighbors: Blue Crabs

The scientific name of the blue crab, *Callinectes sapidus*, means beautiful swimmer. This name comes from its two paddlelike back appendages that help the blue crab glide gracefully through the water. They are a common denizen of our saltmarshes, saltwater creeks and the harbor. Nantucket is at the northernmost edge of the blue crab's East Coast habitat.

Landscaping Techniques

HOW TO PROMOTE HEALTHY WATERSHEDS



Photograph courtesy of Peter Brace

It is estimated that roughly 72 percent of the nitrogen entering Nantucket's harbors comes from precipitation. The island receives an average annual rainfall of 43 inches or, 36.1 billion gallons. Of that, 10.8 billion gallons percolates directly into our sole-source aquifer through sandy soils. Another 506 million gallons flows directly into our harbors and ponds. The rest evaporates.

Nantucket's freshwater supply, known as its sole-source aquifer because it isn't fed by underground rivers, is the island's only source of potable fresh water. Only a small portion of our aquifer near the bottom comes from original glacial meltwater. The majority of Nantucket's aquifer, estimated at about a trillion gallons by the Wannacomet Water Company, is recharged exclusively from precipitation. This water

contains all the contaminants found in precipitation plus whatever septic outfall, fertilizers, compost, pesticides, herbicides and road runoff we add ourselves.

Think of the plants on your property, the grass, shrubs, flowers, trees, even vegetable gardens as a giant living, growing filter, a safety net of sorts, that holds onto water long enough to allow harmful compounds to be absorbed into the soil before they reach the harbors and the ponds. However, when the soil reaches its absorption capacity, contaminants head directly into the groundwater. Selecting native plants with our harbors and ponds in mind can strengthen this safety net, but choosing the wrong ones can exacerbate the situation.

GETTING STARTED

If you are developing a new residential or commercial lot, regardless of its island location, get to know the native plants on your property and take an inventory before breaking ground. Save as many of these plants as you can, because in addition to curbing runoff and pollution, they will already be in the ground, saving you money on a smaller landscaping plan. Consult *Nantucket's Best Management Practices for Landscape Fertilizer Use on Nantucket Island*, specifically, Section 2; Site Assessment and Planning. Also, speak with Nantucket's Conservation Commission administrator or any of its members to learn about the bylaws governing landscaping in your neighborhood.

Nantucket's wetlands bylaw requires no-disturbance buffer zones of 25

feet around all wetlands. Additionally, disturbances and structures are regulated in the 50 and 100 foot buffer zones. This will tell you that lawns shouldn't be planted near wetlands and that cutting and removal of vegetation surrounding ponds and other wet areas within 25 feet is prohibited. These plants absorb excessive runoff and prevent soil erosion. Without this vegetative buffer, nutrients transported from the land flow directly into ponds, swamps, bogs and harbors, stimulating the overgrowth of algae blooms and unwanted seaweeds. When alive, an overabundance of algae stunts or kills shellfish by clogging their gills, which filter food and oxygen from the water and when decomposing, these plants deplete dissolved oxygen from water bodies. They also smother eelgrass, which is a habitat for the delectable Nantucket bay scallop. Vegetative buffers also provide natural habitat for native insects and animals. See the Chapter Reference Material section on page 60 for a link to Nantucket's Wetlands Protection Regulations. **Nantucket Wetlands By-Law: www.nantucket-ma.gov/DocumentCenter/View/1008**.

Well-planned landscaping can also reduce heating and cooling costs by up to 30 percent. Certain trees, shrubs and groundcover also attract birds, which eat harmful insects including mosquitoes; these plants require much less maintenance, fertilizers and pesticides than a grass lawn.

APPROPRIATE PLANTS FOR NANTUCKET LANDSCAPES

After you've fully assessed the growing conditions of your property, including soil, wind, foot traffic, sunlight availability, nutrient input, exposure to

salt spray and plant-eating wildlife. Plant-shopping at island nurseries should be one of your last steps. Determining your soil type and its needs is of paramount importance; make sure that you or your landscaper are sampling your soil in accordance with Nantucket Fertilizer Best Management Practices. This should be done frequently and the results kept on file for comparison with later years.

Certain parts of Nantucket have layers of clay beneath the soils, most notably the Polpis, Pocomo, Wauwinet, Squam, Quidnet and Sankaty areas. Plants that like constant moisture will thrive in clay soils. Plants requiring less water and therefore good drainage, do well in the sandy soils of the rest of the island. In general, Nantucket's topsoil-soil can be just a few inches to a foot thick, laid over sand and/or clay. Plants that thrive in such barren conditions are preferable to those requiring frequent watering and feeding with fertilizers.

Get a soil test done to determine your type, pH (acidity), nutrient availability and mineral content. Check the Resources chapter for information on soil test labs.

How to Choose? Go Native!

Nantucket is noted for its spectacular gardens populated by perennials, shrubs and trees that are unique to the island. Not only do these gardens complement the landscape, they provide habitat for nesting and feeding for resident and migratory birds. The first step to designing your own Nantucket garden is to understand the purpose of each type of plant. Given the new knowledge of your soil conditions and what is already growing on your land should help you see what plants work best at your island location.

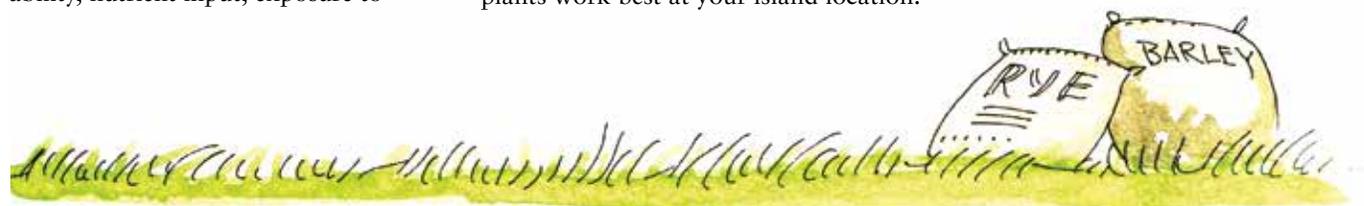
For more specific advice, consult the Nantucket Garden Club, the Nantucket Landscape Association, The Nantucket Invasive Plant Species Committee (IPSC), a standing committee of the Nantucket Biodiversity Initiative (please refer to Chapter 13) and talk to your landscaper or gardener.

Since the main idea is to protect our islands' water supply, ponds, harbors and groundwater, from harmful contaminants, native plants, requiring minimal watering, and little, if any fertilizers and pesticides, are the species of choice. More importantly, native plant species are critically linked to native wildlife. Our local insects, birds and small wildlife have evolved alongside native plants. These long-standing relationships allow our ecosystem to function at its best.

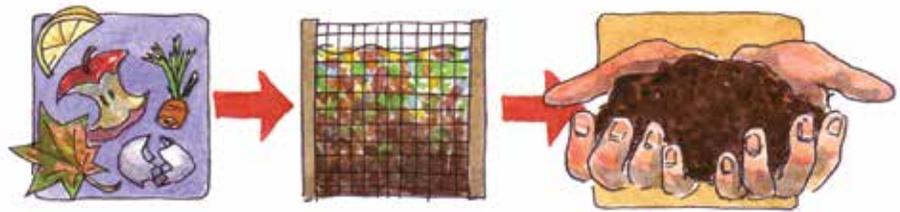
Native trees include Eastern red cedar, winterberry, American holly, red chokeberry, black cherry, black tupelo, black oak, white oak, American beech and red maple. And some native flowering plants are goldenrod, cardinal or bellflowers, asters, bear berry and blueberry. Also consider such woody shrubs as sweet pepper bush, Eastern shadbush, beach plum and high bush blueberry.

Plants to Avoid

Invasive plant species, which deprive native plants of water and nutrients, and crowd out these more resilient, low maintenance species by spreading quickly, should be avoided. On Nantucket, these include bamboo, common reeds (phragmites), Japanese knotweed, Scotchbroom, Asian bittersweet, Japanese honeysuckle, garlic mustard, purple loosestrife, Norway maple and



common buckthorn. For a complete list of invasive plant species on Nantucket, check out the Maria Mitchell Association's Electronic Field Guide for Invasive Plant Species in the References chapter.



GARDENING

Gardening for ornamental plants or vegetables presents some special problems for protection of the groundwater on Nantucket. Garden beds are usually kept bare, that is weeded, except for the plants of interest. This means that there is not the same root mat as is found under a lawn to capture fertilizer nutrients. Overdoing fertilizer in a garden may result in more harm to the water than overdoing it on a lawn.

As fast growing flowers and vegetables need a lot of nutrients as they are blooming, good practice is to wait to fertilize until after the seeds have germinated, because the seeds contain enough nutrients for the first few days or weeks of the young plants' lives. The weather should be watched with care because it is not wise to put down fertilizer when the soil temperature is below 55 degrees F, or when a major rain storm is expected. If necessary, small, frequent applications to the area above the plants' roots are preferred to a single large application spread broadly across the garden bed. Refer often to the BMP for fertilizer application on Nantucket and don't forget to take soil samples of the beds to determine overall fertilizer needs.

Then enjoy your Nantucket flowers and vegetables.

MULCHING

All of Nantucket's home and garden centers sell some form of mulch, which can add nutrients, make the soil more pliable, increase rainwater penetration, help control weeds, minimize loss of nutrients and topsoil, and help increase

moisture-retaining capacity of the soil near the roots. But you can easily make your own protective covering of compost, straw, grass clippings or leaves. Or dead, dried eelgrass collected from the beaches such those at Warren's Landing, in front of Wauwinet and on the west side of the Galls can also be used. It is important not to pile mulch up around plant stems, particularly for shrubs and trees, for it can bring fungus and mold to the plant and also deprive the stem of air and sun.

Try to avoid using landscaping plastic beneath decorative rock or bark. The plastic prevents water from entering the soil. Instead, use woven materials, often called geotextiles that accomplish the task of weed control while permitting water penetration.

COMPOSTING

Compost is the end result of decomposed organic yard, kitchen and garden wastes. It is typically dark and humus-like in consistency, with an earthy smell

to it. It may be beneficial for mulching vegetable and flower gardens because it naturally enriches the soil and improves plant growth. However, compost can also be very high in nutrients, especially phosphorous, so be sure to consult the results of a soil test prior to applying. Vegetable-based composts can be made at home out of leaves, twigs, lawn and garden clippings, and vegetable-based food.

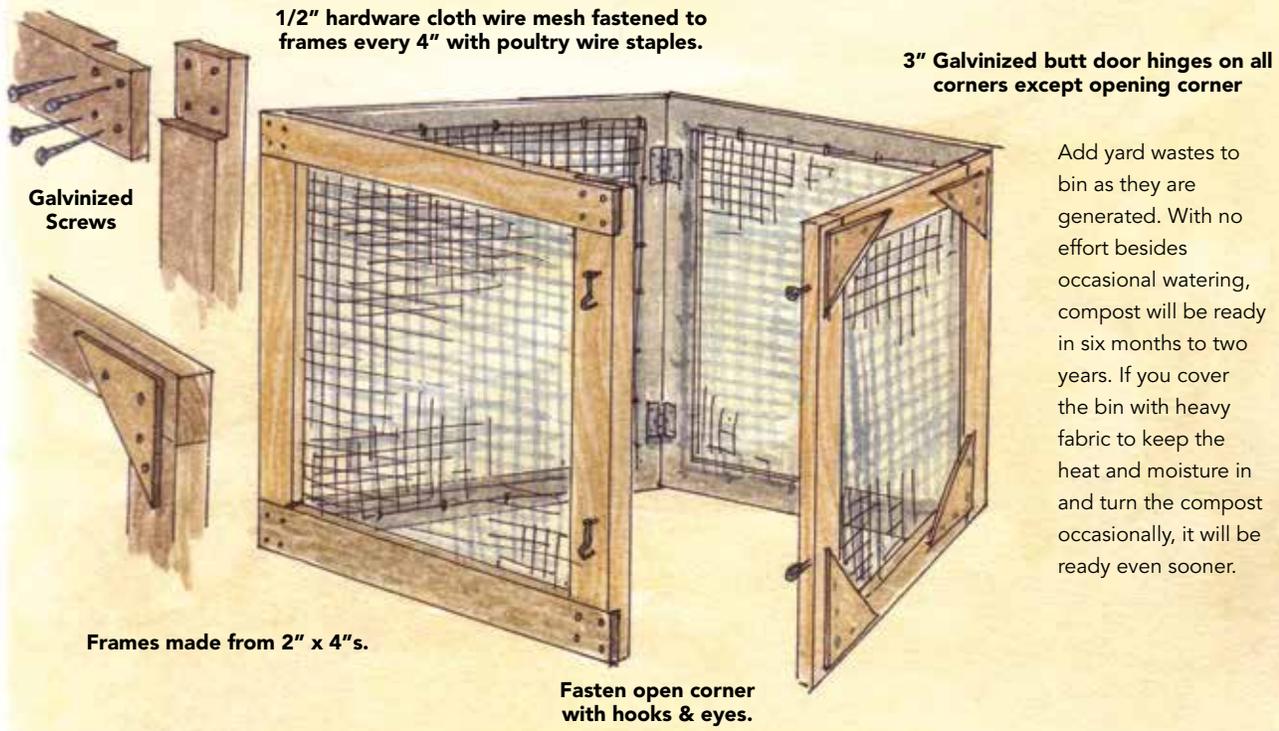
All of the above adds up to around 10 percent of the waste we haul to the Materials Recovery Facility out at the Nantucket Landfill. Rather than dump your organic waste in the moors, why not turn it into useful compost because decomposing plant material in ponds and harbors not only deprives marine animals of oxygen, but in many cases your grass clippings, leaves and garden trimmings have residue of fertilizers and pesticides on them.

There are two ways to go about using the organic material your home and yard produces. Nantucket's Materials Recovery Facility at its landfill



Photographs courtesy of Meg Glidden

A SIMPLE PORTABLE COMPOSTING BIN



mixes all plant debris hauled to the dump with mixed paper, household waste, along with wood chips ground up from its clean wood pile, and the end result of the Surfside Wastewater Treatment Plant to produce an inexpensive compost. However, although the town deems it safe for flower and vegetable gardens, this compost may not be acceptable to everyone. It is also not tested for nutrient content and may be too rich for heavy applications on home gardens.

The other option is to start your own compost pile using all of the ingredients mentioned at the top of this section. This is a way to control what goes into your compost. With a ready source of leaves, grass, dead plants and protein-free household garbage, the

only other challenge is where to establish your pile and how to contain it.

A portable composting bin is the easiest way to go and some lightweight units can be taken apart and easily moved. These units can be removed from an existing heap and transferred to an adjacent location. The heap is then turned back over into the unit, mixing and aerating materials. Portable units can be purchased (usually plastic) or constructed from circles of wire fencing or hardware cloth, snow fencing, or wire framed in wood.

If you are building your own wooden composting container, don't use lumber treated with wood preservatives of copper arsenate (CCA), creosote, and penta. Also, avoid using this treated lumber for all other applications near your gardens, as the CCA, creosote and penta compounds are harmful to humans and pets. They have been

COMPOSTING TIPS:

Many composting efforts, both large and small, are improved by using red worms that consume nitrogen. For more information on other compost designs or where to purchase worms, see the Resources Chapter.

shown to cause cancer and skin and eye irritations. Use wood that is naturally resistant to decay such as cedar.

Check the Chapter references pages for links to portable composting bins for sale and plans for making your own. You should also avoid using these treated lumbers around vegetable gardens.

Find more composting information in Chapter 9 on page 46.

PEST MANAGEMENT

You may recall that pest control in between the late 1930s and 1960s meant spraying the entire island with a 12% water solution of dichlorodiphenyltrichloroethane (DDT). This not only killed the various targeted moths and mosquitoes, but pretty much any other creature exposed to this now banned pesticide. DDT also poisoned our water and soil and thinned the eggs of ospreys and other birds eating fish from island harbors and ponds.

After planting as many native species as work for your property, providing them with only the necessary moisture and nutrients, and adhering to the Best Management Practices for Landscape Fertilizer Use on Nantucket Island (see References Chapter for link), strive to use minimal pest control chemicals. The Extension Service at the University of Massachusetts has excellent guidance on integrated pest management. With this in mind, you need to decide the threshold level of weeds or insect damage you are willing to accept.

Setting your pest tolerance too low results in unnecessary treatments and possible environmental damage; toxic chemicals can ultimately find their way into our groundwater and eventually, ponds and harbors. Besides, most pests are not life-threatening to the plant and merely cause aesthetic damage, but not permanent problems.

When considering treatment, the goal is not to eradicate the pest, but to use the least toxic treatment that will drop the pest level below whatever threshold you have established.

Here are some simple things we can do:

- Encourage natural pest predators including the lacewing fly, ladybug, praying mantis, dark ground beetle, dragonflies and spiders,
- Prune out infested areas,
- Use water spray to physically remove some pests from plants,
- Set out pans of beer to attract slugs and snails,
- Remove old tires and other collectors of standing water to decrease mosquitoes,
- Avoid planting and harvesting when insects are most abundant and damaging,
- Buy native plants known to thrive on Nantucket that are drought-resistant and free of pests and diseases,
- Provide plants with the growing conditions that they like best. This helps them resist pests and diseases,
- Plant your property with a variety of plants, making it less susceptible to insect damage,
- Use organic pest killers if possible, consistent with guidance from the Integrated Pest Management Program. Local suppliers or your gardener or landscaper can suggest such useful products,
- Encourage insect-eating birds by providing birdhouses and baths,
- Check out the Resources Chapter on page 56 for links to and numbers to call for more nontoxic pest control alternatives.

What else can I do?

- When possible, buy only local organically grown food and frequent island grocers that sell it and restaurants that serve it,
- Support and frequent the Nantucket Farmers & Artisans Market,
- Find out how town land, the cranberry bogs and golf courses are treated for pests and how often,
- Research alternatives and suggest improvements through the Conservation Commission, Department of Public Works, Parks & Recreation Department and the Nantucket Land Council.



Nantucket Neighbors: Great Blue Heron

That large graceful bird that you see walking among the marsh grass is undoubtedly a Great Blue Heron. Note its long legs and beak, grayish blue color, and its S-shaped neck. In flight, the heron's wingspan exceeds six feet from tip to tip. The great blue catches fish by standing quietly and then spearing them with its sharp beak. The survival of this beautiful bird relies on healthy wetlands.

Recovery From Perfect Lawn Disorder

GROWING A NATURAL NANTUCKET LAWN

As we fly over Nantucket, even in winter, we can see those neon-green lawns on finely landscaped properties.

The perfect Nantucket lawn seems to be an obsession with many islanders, year-round and seasonal alike, making those who regularly fertilize, dependent on nitrogen-and phosphate-rich fertilizers, and pesticides and herbicides. While envy of the perfect, lush green lawn next door is generally everyone's first reaction, it is critical that your next thought be one of concern for the island's sole-source aquifer, its freshwater ponds, harbors and salt marshes.

Excessively applied lawn and garden growth enhancement, and pest and weed control products easily find their way into our various water bodies through Nantucket's porous sandy soils. They can't hold back water long enough to sequester and dilute these harmful chemicals before they contaminate our drinking water and cause algae blooms



harmful to marine and fresh water pond life. Over-fertilized lawns are also usually drenched with automatic sprinkler systems. Too much water means the grass doesn't develop deep enough roots to survive a drought. It also washes fertilizers into water bodies when your plants aren't ready to absorb nitrogen and phosphorous.

The solution to having a healthy green lawn while keeping our waters

clean is all around us. By getting your landscaper and gardener to plant native grasses, shrubs, wildflowers and trees, you'll not only have a beautiful property, but you'll have plants that are already adapted to Nantucket's poor soil profile. It consists of a thin layer of organic material over sand and gravel requiring minimal sprinkler water and little, if any, fertilizer. Check the Chapter Reference Material on Page 58 for the names and contact information for island landscapers and gardeners specializing in native plants and their care.

As of Jan. 1, 2014, it's against the law to apply too much fertilizer and the town must license those who do spread fertilizers commercially. Over a three-year period, Nantucket's Article 68 Workgroup researched and wrote the "*Best Management Practices for Landscape Fertilizer Use on Nantucket Island*" (BMP), a 65-page document adopted by Nantucket's Board of Selectmen as the resource reference for a new health regulation (75.00) that controls the application of fertilizer on our island. Nantucket's Department of Natural Resources in collaboration with the Health Department enforces the regulations with guidance from the Board of Health.

Turn to the Chapter Reference Material on Page 58 for a link to the BMP. It is worth a read if you care about Nantucket's water, salt and fresh. **Best Management Practices for Landscape Fertilizer Use on Nantucket Island:** www.nantucket-ma.gov/document-center/view/438



TEN-STEP PROGRAM FOR DREAM LAWN ADDICTS

Step 1 – OBEY NANTUCKET'S FERTILIZER USE REGULATION

Although there's really no need to use fertilizer on Nantucket to maintain beautiful lawns and gardens, plenty of property owners are still using it. So, if you simply must pump up your green lawn with fertilizer, embrace moderation as a yard maxim. Read through and make sure you understand Section 6 of the BMP, "Guidelines for Timing and Rate for Application of Turfgrass Fertilizer", before getting out your spreader or having your landscaper do the work, and insist that your landscaper read this section along with the rest of the BMP. The following items are the key points to fertilizer application in the town's new regulations and must be adhered to:

- Apply fertilizer only between April 15 and Oct. 15. Plants do not efficiently use nitrogen or phosphorus found in fertilizers below a ground temperature of 55 degrees Fahrenheit. Application outside of this window when plants aren't absorbing these nutrients means greater concentrations of them are washed into nearby water bodies and seep down into our aquifer.
- Ideally, homeowners and landscapers should purchase an inexpensive soil temperature probe and begin the annual program when the soil temperature at a depth of 2" reaches 55 degrees. The date this occurs varies from year to year. The result is both a more cost effective and environmentally sensitive program to maintain a beautiful lawn.
- Space applications two weeks or more apart. Keep an eye on the weather and do not fertilize the day of or immediately after a rain storm.

- No application may contain more than 1 pound of nitrogen per 1,000 square feet. A 1/2 pound is recommended.

- Do not apply more than three pounds of nitrogen-based fertilizer per 1,000 square feet annually.

- Do not apply any phosphorus unless a soil test of your land reveals that it is needed. Most Nantucket soils are rich in phosphorus, and need no further phosphorus applied via fertilizer.

- Either organic or synthetic fertilizer can be used.

- Cut lawns no shorter than 3 inches; it improves root systems, drastically improves lawn growth, and protects lawn for stress during dry periods.

- Only town-licensed landscapers and gardeners may apply nitrogen-and/or phosphorus-based fertilizers commercially on Nantucket.

- Up to 1/4 of a pound per thousand square feet of quick-release fertilizer may be used in an application during a period of rapid growth and fertilizer uptake.

Step 2 – FERTILIZE WITH COMPOST IF YOU CAN

Do this, but in moderation. Your household organic waste including produce leaves, stems and fruits, eggshells and most other unprocessed leftovers, leaves, grass clippings and other yard waste can contain higher levels of nitrogen, phosphorus and potassium.

Nantucket's BMP actually treats compost as fertilizer because of its varying amounts of these chemicals, so you should definitely read Section 5 of the BMP, "The Role of Compost", starting on Page 22, before spreading your compost material on your lawn and gardens.

Not all composts of organic matter are equal in their content and some should be avoided unless your soil test results call for that intensity of fertilizer. For Nantucket, compost made of decomposed leaves and small twigs is usually lowest in phosphorus and nitrogen, and is therefore best for Nantucket. Compost containing any farm animal waste, poultry, pig, cow or horse manure, holds considerably more concentrated amounts of these chemicals with poultry manure also containing extreme amounts of soluble salt. The BMP warns that manure-based composts should not be applied on Nantucket except where a soil test prescribes it. If you are considering using composted organic waste instead of commercially produced fertilizers, start by learning the percentages of nitrogen and phosphorus in these commonly used composting materials. And then read the BMP again.

Leaf Litter; nitrogen: 0.1%, phosphorus: 0.05-0.2%, **Horse Manure;** nitrogen: 0.5-1.5%, phosphorus: 0.5-1.5%, **Lawn, Garden and Food Waste;** nitrogen: 1.0-1.5% phosphorus: 1.0-1.5%, **Dairy Manure;** nitrogen: 1.0-1.5%/phosphorus: 1.0-1.5%, **Feedlot Manure;** nitrogen: 1.0-1.5%, phosphorus: 1.0-1.5%, **Poultry Manure;** nitrogen: 1.5-2.0%, phosphorus: 1.5-2.5%.

Step 3 – JUST SAY NO TO PESTICIDES AND HERBICIDES

By now you have probably learned that the organic approach is the wholesome route when considering the protection and continued longevity of the health of our sole-source aquifer, ponds, harbors and ocean. So, if planting native, pest-resistant, beneficial-insect attracting plants isn't enough to repel all of your property's pests and the weeds aren't going away, go organic with pesticides and herbicides.



Your first step should be dispose of all of your old pesticides and herbicides at the next Hazardous Waste collection days. Next, find and use pesticides that are registered with the Environmental Protection Agency which lists their potential side effects, and decide for yourself whether they're right for your needs. Or, find pesticides that the EPA considers "Minimum Risk Pesticides" as outlined at the corresponding EPA Web page, http://www.epa.gov/opbpd1/biopesticides/regtools/25b_list.htm.

For information on herbicides, which are used to control weeds, check out the EPA Web page, http://www.epa.gov/caddis/ssr_herb_int.html and then make your own decision on whether to use them or not.

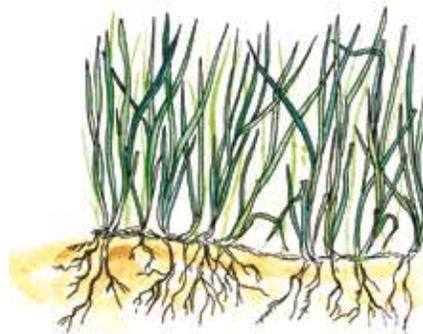
Pesticides and herbicides can kill shellfish, finfish and invertebrates if high enough concentrations find their way into our water. The risk of canine malignant lymphoma doubles with the use of herbicide 2,4-D on a dog owner's lawn. Under state law, Nantucket schools must restrict pesticide use to protect students. You can carry lawn pesticides and herbicides into your home on your shoes and bare feet where they can persist for months.

Step 4 – BE PATIENT, POISONED SOILS NEED TIME TO HEAL

Stop using toxic chemicals to grow your lawn because, the sooner you do this the faster your lawn can regain its natural health. Right after halting the use

of lawn growth chemicals, learn your soil content by getting a soil test done to see what organic sources of food such as compost you can use sparingly on your lawn. Your landscaper or gardener can do this for you easily, and they can recommend non-toxic herbicides and pesticides for your lawn. Or you can check the Chapter Reference Materials for Chapter 9 on Page 58 for three useful books that can help guide you in the non-toxic direction.

After three or four years of following the chemical-free lawn and garden protocol, get a follow-up soil check to assess the state of your soil so you can adjust your program as needed.



Step 5 – REDUCE THE SIZE OF YOUR LAWN

The cure for Perfect Lawn Disorder is in this step alone: don't have one. It sounds simple, doesn't it. Think about the time and effort put into cutting your lawn with a power mower. If it takes an hour to cut your lawn, you are putting as much pollution into the air as in a 200-mile car trip.

Set a goal of reducing your lawn down to a size you can reasonably cut with a hand-push reel mower. In the newly uncut areas and around the perimeter of your property, plant native grasses such as little bluestem grass, flowers such as goldenrod, milkweed, thistle, New England blazing star, pasture rose and native shrubs, which all attract helpful insects including butterflies, dragonflies, bees and lightning

bugs.

Mow your native meadow once annually in May to stymie invading woody plants. Add native bushes and trees such as bayberry, winterberry, black tupelo, sassafras and white oaks. Plant a vegetable garden in the ground or do raised beds, create fern and moss beds in the shadier sections of your yard. For fun, plant beach grass on steep slopes, where mowing can be dangerous, to hold the soil in place and add to native species use.

Contact organic gardeners and landscapers on Nantucket and ask them to show you some of their clients' properties to get a sense of how this alternative approach might work for your yard.

Step 6 – LET THE CLIPPINGS FALL WHERE THEY MAY

If you cut your lawn by human power or fossil fuel, keep your mower's blades sharp. Either follow the one-third rule of never cutting off more than a third of the total blade length or cut down to a height of no less than three inches depending on the height of your grass. There is no need to clean up your grass clippings because they provide more than a third of the nutrients the grass needs. Earthworms and other detritivores, including bacteria, snails, slugs, millipedes, isopods and springtails help break down the clippings into useful nutrients quickly. The clippings also help conserve water by shading the soil from the sun and reducing the moisture loss from evaporation. Extra grass clippings can always be mixed into your compost pile.

Step 7 – LEAVE WATERING TO THE CLOUDS

Did you know that 30 percent of the water consumed on the East Coast is used to water lawns and gardens? Perfect Lawn Disorder is certainly the culprit here and the reason why the afflicted people feel they need to water all summer long. Take heed, summer dor-

mancy of your grass, when it appears to die and go golden-brown because of the hot, dry weather is a natural part of its life. Fear not! Your lawn will not only recover when the rain returns in the fall, but the grass will grow deeper roots in search of water and be better prepared for the next drought period.

While Nantucket's sole-source aquifer contains trillions of gallons of water replenished by precipitation all year long, the island's water use peaks during the summer. So use it sparingly and only on your favorite garden places in your yard. Consider installing a rainwater collection system that utilizes your gutters. Rainwater can be collected in barrels for hand watering, or you can connect your sprinkler system to the barrels to cut down on the aquifer water you use. Remember to keep the water flowing so as not to provide standing water in which mosquitoes can lay their eggs.

Step 8 – MIX THOSE SEEDS

Once you let your lawn fend for itself during the annual summer drought, you're ready to accept a hardier mix of lawn cover with bluegrasses. Mix up a batch of rye, fescue and clover, spreading this resilient, drought-resistant seed blend over your lawn in the fall. This is the best time to plant a lawn because wetter, cooler conditions are ideal for germination and the growth of deep roots. Clover doesn't require heavy watering or any fertilizer at all. Clover is a nitrogen fixer, meaning that it pulls nitrogen from the atmosphere and releases what it doesn't use into your soil, thereby providing nitrogen to other lawn plants.

Step 9 – DETHATCH AND AERATE ONLY WHEN NECESSARY

Dethatching is the removal of dead grass from your lawn and aerating: the punching of air holes in the ground. This loosens compacted soils, increases microbial activity, aids in gas exchange

and water infiltration and should be used only as needed. Aeration, which should be done in the fall when lower temperatures help in the grass' recovery, can also help remove excess thatch. However, leave a small amount of thatch behind to cushion the crown of the grass plant and offer water-and nutrient-holding capacity. But, removing too little thatch then demands increased water use, lowers fertilizer efficiency, causes shorter roots and greater insect and disease susceptibility. The right amount of dethatching helps decrease heavy water use, can increase the efficiency of fertilizer uptake, and reduce the number and intensity of turf diseases.

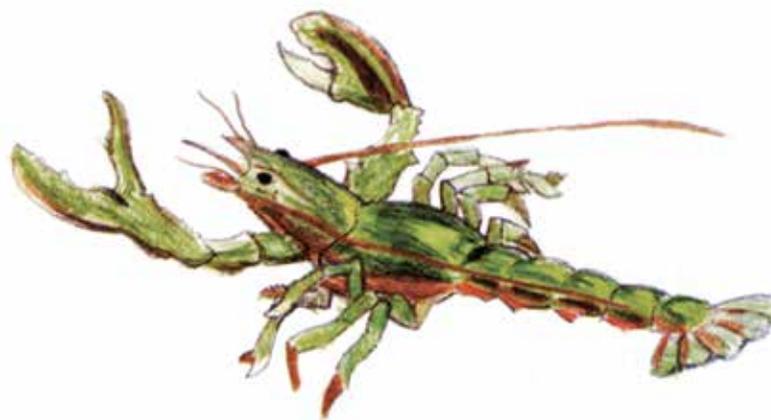
Step 10 – CELEBRATE DIVERSITY!

Once you achieve a natural, native and organic lawn on Nantucket, you will become proficient at spotting grasses and flowers — up to 50 species on a lawn untreated with herbicide — whose mosaic of colors, shapes and adaptabil-

ity makes your lawn something much more pleasing to look at and easier to care for. With Nantucket's soils naturally acidic enough, you'll learn to welcome mosses and lichens, which remain green all summer and need no care at all, daisies that adjust their growth and bloom below the height of your lawnmower along with other flowers including clover and yellow wood sorrel. Even dandelions, buttercups, and wild strawberry on your lawn, and pasture thistle around the edges can add color to your yard. If you have to weed, do it on your knees, pulling the plants you deem to be weeds by hand.



Nantucket Neighbors: Lobsters



Once known as poor man's food, lobster has made a comeback at dinner tables. Nearly 90% of legal-sized adult inshore lobsters are harvested every season. Nocturnal scavengers, lobsters eat almost anything they can find by crushing and ripping food with their large claws. Most lobstering in New England occurs during the spring, summer, and fall.

Getting Out on the Water

GOOD BOATING PRACTICES



Photograph courtesy of Peter Brace

Next to automobiles, boats are the most popular and numerous form of transportation for Nantucketers. As with cars, trucks and motorcycles, fueling, cleaning and maintenance of boats can mean pollution of the harbor and ocean environment.

The School for Marine Science and Technology of the University of Massachusetts at Dartmouth said in its “Water Quality Monitoring and Assessment of the Nantucket Island-Wide Estuaries and Salt Ponds Update 2012” of the three harbors on Nantucket, Nantucket Harbor is the cleanest. This is surprising when you consider the number of boats using this harbor.

According to the Harbormater, roughly 3,200 recreational vessels are moored and using the harbor during the

summer. This includes 30 fast ferry trips per day, 24 passenger/freight ferry trips a day and six freight barges a week. With the additional activities of sport fisherman and boat renters and regular visits by a fuel barge, the potential for contamination of Nantucket Harbor alone is immense.

The raising and rebuilding of the jetties, which began in 2016 is expected to help increase the intensity of tidal currents for flushing pollutants out of our main harbor. Practicing clean boating — from fueling to cleaning to painting to general operating and dealing with sewage and bilge water — goes a long way toward preventing toxic materials from ever entering the harbor. It takes approximately 2 weeks for Nantucket Harbor to flush out its contents. Ma-

daket Harbor is open to the ocean and flushes out relatively quickly. We can’t rely on the new jetties to solve all of our harbor-cleaning problems.

MAINTAINING YOUR BOAT

We already know that our sea levels are rising and our ocean temperatures increasing. Let’s not add any more stresses to the saltwater ecosystem around us. Think of the bay scallops, quahogs and other shellfish Nantucketers make a living from; realize that our harbors’ primary habitat of eelgrass is disappearing from our waters faster than we can rein in our pollution of them, and make the right choice when maintaining your boat. The following methods are the most environmentally responsible way to maintain your boat.

Bottom Paints

Avoid the traditional bottom paints of copper, tin and tributyltin (TBT), which are all used to prevent fouling, or the attachment of algae, barnacles, zebra mussels and other marine organisms to boat hulls. They can negatively affect the boats' performance. Proven extremely toxic to shellfish and banned nationwide, TBT must be avoided, as should all bottom paints marked "toxic". There are alternative, environmentally safe bottom paints sanctioned by the Environmental Protection Agency. These include such brands as ePaint Antifouling paint, which produces peroxides that break down into water and oxygen after killing fouling organisms at their earliest stages, Aquaguard, ablative bottom paint that gradually wears away making it difficult for fouling organisms to get a start and Maxiglide Bottom Paints, which employ patented, EPA-approved organic growth repellents.

In preparation for scraping your boat's bottom before painting it, plan to do the work indoors or outdoors well away from the water. Spread a tarp that's much wider and longer than your boat beneath it.

Use sanders with vacuum attachments and when cleaning up, use a Shop-Vac to vacuum up any dust that may escape your drop cloth, thus collecting and storing the scrapings that you can haul to the next DPW Hazard-

ous Waste Day.

If you don't think you can provide a safe hull-scraping and painting waste collection set-up for your boat, please take it to one of Nantucket's boatyards with town-approved cleaning stations. There, boats are scraped, cleaned and painted on a special impervious cleaning pad with all scrapings and waste liquids collected in a tank beneath the pad, and stored for proper treatment and disposal in a tank on the premises.

Cleaning Your Boat

You're going to have to clean your boat at some point during boating season. Preferably, you should clean it on land where any phosphate-free cleansers or detergents you use will have the time to biodegrade before reaching the harbor. Instead of using soap, try rinsing your boat and scrubbing it with a brush or using a power washer, but make sure you have a good way to collect dirty power washer water before using one. For boats that are too large to remove for regular cleaning, remember that detergents are surfactants, which both break up and loosen dirt, and are soluble in water. This means that when the suds hit the surface, they break up any petroleum products such as fuel and oil, carrying them down to the bottom where their toxicity kills shellfish in their larval stage along with other marine life. Only use environmentally safe

boat cleaning detergents such as Triton Marine Products. Avoid those with the word "toxic" on their labels

Bilge Wastes

Nantucket's waters, which extend three miles out from shore in a halo around its three islands, were designated a federal no-discharge zone in 1993 as part of the 1993 Nantucket & Madaket Harbors Action Plan. And in 2012, all of Nantucket Sound received the same designation.

Bilge water, contains all the petroleum wastes a boat can produce and other toxic materials. A common practice has been to mix it with detergent and dump it all overboard. Read Cleaning Your Boat above to see why oil, soap and salt water don't mix, not to mention risking a \$10,000 fine for doing so.

Today, the common remedy is a bilge sock, which looks like a giant tube sock stitched up at both ends. Inside are biodegradable pellets that absorb the wastes and then safely break them down into their original organic compounds. The beauty of the bilge sock is that, once completely dirty and full of bilge pollutants, it can be tossed in a dumpster or taken out to the trash bins at the MRF.

If your bilge water is too much for bilge socks to soak up, the water can be pumped into five-gallon buckets and taken to Hazardous Waste Day.



Photographs courtesy of Peter Brace

Fuel

Most boaters operate power boats with portable gas tanks. Refueling should be done at an island gas station where any spills can be contained and cleaned up well away from the water. For those with internal, onboard tanks, the outdated and environmentally dangerous method for determining a full tank by watching for fuel spilling from the tank over-flow vent unfortunately still does occur. If you do so, you will be subject to federal fines of up to \$5,000 per spill.

Be smart about fueling your boat on the water. Know your tank(s) capacity and pay attention when you're filling it to not overfill it and cause a spill. Use oil and gas absorbent cloths when refueling to catch all the drips. All marine fuel stations are supposed to provide them when you refuel. Ask for the absorbent cloths if the attendant does not supply them. As an extra precaution, marine supply stores sell containers that attach to overflow vents designed to catch extra fuel. These chandleries also sell vent surge protectors that automatically shut off fuel flow when your tank is full or those that make a gurgling sound when your tank is full, alerting you that it's time to stop fueling.

Sewage

Human waste contains disease-causing bacteria and viruses that jeopardize safe public swimming and contami-

nate shellfish beds. Sewage is also a source of nutrient overload in our tidal ponds, salt marshes, inlets and harbors around our three islands. Water bodies overloaded with nutrients from human waste, as you learned in Chapter Four, can explode with algae blooms that block sunlight from reaching eelgrass beds, clog shellfish gills and deplete the water's oxygen levels, killing other marine life.

All boats with toilets on board must be equipped with a marine sanitation device. Those without onboard toilets should consider getting a portable toilet that can be pumped out.

Nantucket, with the help of the Federal Government, in this case, the crew of U.S. Coast Guard Station Brant Point, does not tolerate boats pumping sewage, gray water from onboard showers, dish sinks, dishwashers and washing machines into the surrounding waters.

Nantucket's Marine Department provides a free boat holding tanks pump-out service in two forms. Pull up to the end of the town pier and the staff will pump out your boat's tank(s) or call them on VHF Channel 14 and they will come out to your moored vessel with the town's special pump-out boat, the Head Hunter. If you're in the Nantucket Boat Basin, their staff can pump out your tanks wherever your boat is moored. Both the town and the Nantucket Boat Basin's pumps are con-

nected to the town's sewage collection system, which pumps the sewage out to the Surfside Wastewater Treatment Facility.

In 2017, Nantucket's Marine Department pumped 25,403 gallons of sewage and gray water from holding tanks of 604 boats in Nantucket Harbor. The Nantucket Boat Basin pumped 94,500 gallons from boats into the town sewer system.

Trash

Beer cans, Styrofoam cups, plastic bags, fishing line and net fragments, balloons and their strings and take-out food containers can trap, injure and kill mammals, fish and birds.

Much of this trash, if it doesn't wash up on our beaches, can foul propellers, clog engine cooling water intakes and continue to kill wildlife for years. Call the U.S. Coast Guard at Station Brant Point at 508-228-0388 if you see any boat, commercial or recreational, dumping trash overboard.

The seawater around Nantucket and in its harbors is arguably the cleanest salt water near a developed coastal area along the East Coast, and we have the eelgrass and the bay scallops to prove it. It's probably one of the main reasons why you're here and why you love being out on and in the water.

Imagine what Nantucket's waters would be like littered with trash, the



Photographs courtesy of Peter Brace



Photographs courtesy of Peter Brace

water itself polluted beyond recovery. So keep your trash on board or take it with you when you leave the beach.

Prop Scouring

Nantucket’s harbors, creeks and tidal ponds are shallow and teeming with sensitive marine life. This marine life is dependent upon eelgrass, which is in a state of decline in our harbors.

When boating through shallow water or embarking from shore, do so with the least amount of power necessary. If your boat’s engine and propeller or Jet-Ski’s water jet are powerful enough to push your boat loaded with people and gear quickly through the water, imagine how badly it can scour the bottom. It can gouge out trenches and holes, shredding eelgrass and other marine vegetation vital to the survival of marine life, and killing fish and shellfish. Eelgrass is the life-sustaining marine plant in the harbors, forming dense underwater forests; serving as nurseries, living habitat and hunting areas for many of the species of life in the harbors.

When setting off from shore, wait until the water is deep enough to power up and move out onto the water. Heed the “No-Wake” buoys in the Harbor. Do not operate your powerboat at high speeds in shallow water or through eelgrass beds. Remember that Jet-Skis, Wet Bikes, Wave-Runners and all other personal watercraft are prohibited from

Nantucket Harbor, Madaket Harbor and the island’s ponds, and must be operated at least 500 feet from shore.

Anchoring and Mooring

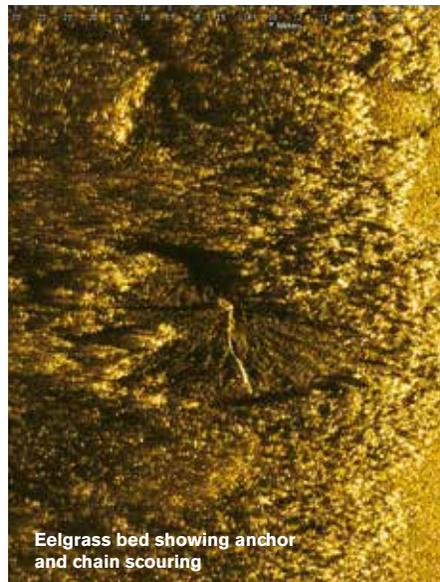
When anchoring your boat, choose an area of the harbor devoid of eelgrass so your anchor chain and rope won’t damage eelgrass. And when choosing mooring tackle, instead of chain between your mooring and pennant line, try a floating line that won’t scour the bottom.

Docks and Piers

These marine structures were once constructed of pilings and building

materials treated with substances toxic to the marine harbor environment. Such pilings were coated with creosote and piers and wharves were made of pressure-treated lumber. In addition, docks shade and kill eelgrass. Because of these adverse impacts, new docks, piers and wharves cannot be constructed in Nantucket or Madaket Harbor. Public and governmental properties are exempt from this moratorium

This prohibition does not preclude existing dock, pier and wharf owners from maintaining and repairing their marine access structures. If you own any of these structures or work for an entity that does, please use only environment-friendly building materials and waterproofing substances. Today’s pressure-treated lumber no longer contains environmentally harmful arsenic and so, is much more suitable for marine construction projects.



Eelgrass bed showing anchor and chain scouring

Photograph courtesy of Dr. Mark Borrelli, Center for Coastal Studies at Provincetown

Getting Our Kids Involved

NOT JUST FOR ADULTS

Responsible care of our aquifer, ponds, harbors and the ocean really starts with our children. These young islanders will assume the task of maintaining high water quality on and around our islands. The learning should happen in our island schools at the hands of science teachers, but in case it doesn't, here are some suggestions for helping your children understand the importance of clean water in the ground and all around their island.

Students of Water

Outside of school, there are ample opportunities for our children to learn about water-dependent island life. During the summer season, the Maria Mitchell Association runs its Summer Discovery Camps Program replete with harbor, wetland and pond classes in camp programs for children 5 through 12. The Nantucket Land Council offers its vernal pools hike into Squam Swamp

every spring, along with field trips dealing with our island's groundwater quality and quantity. Also, encourage your young island discoverers to go on school field trips involving pond, harbor and ocean ecology.

The Field Station

The UMass Boston Nantucket Field Station is a great place to show your kids how island wildlife depends on and interacts with the salt and fresh water ecosystems. The property contains Folger's Marsh, which is a salt marsh, a freshwater pond, and the harbor. Explore this marvelous property at 180 Polpis Road and make sure you stop off at the lab opposite the parking area to see what scientist's are doing inside.

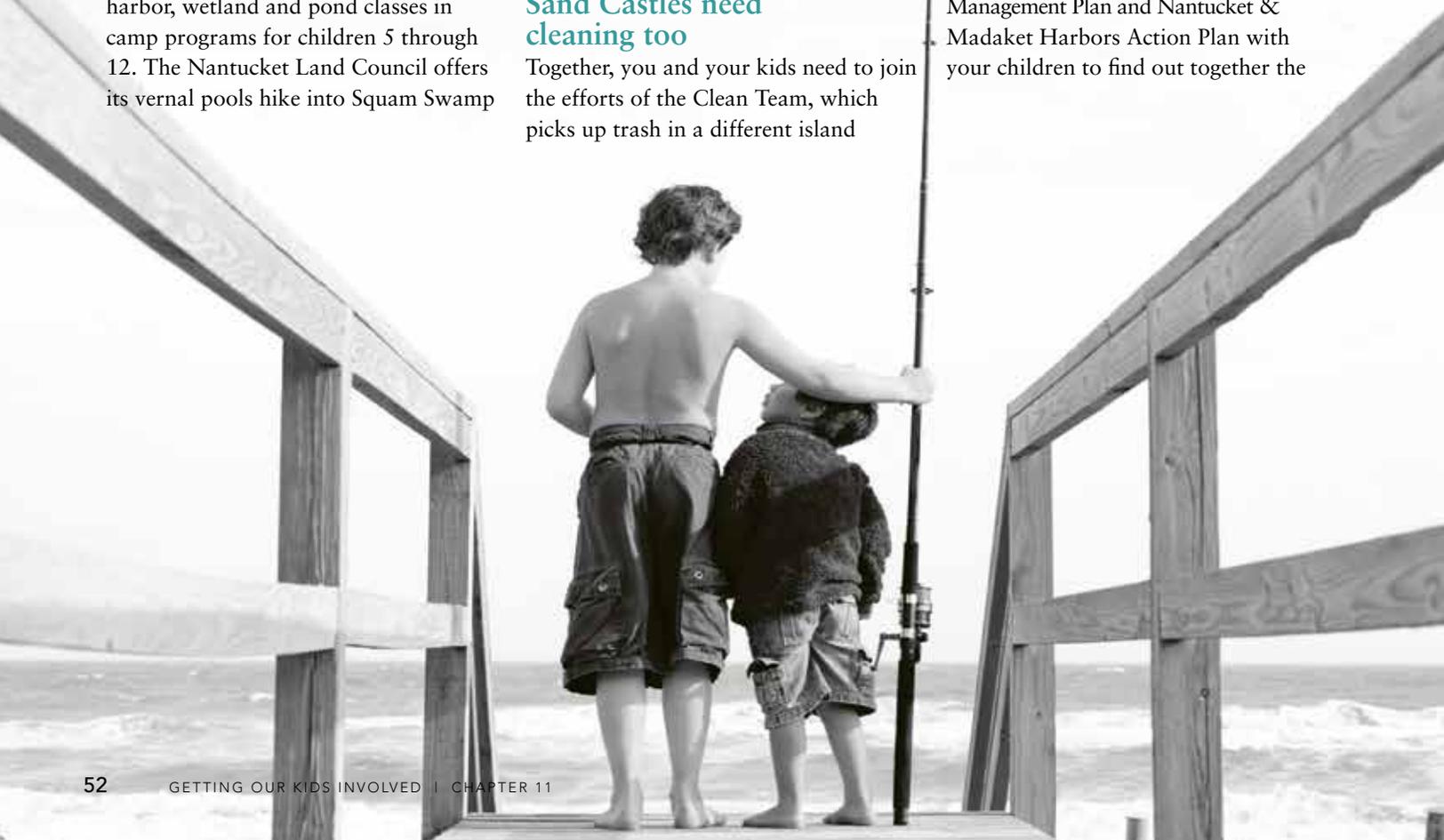
Sand Castles need cleaning too

Together, you and your kids need to join the efforts of the Clean Team, which picks up trash in a different island

location every Saturday, 8-9 a.m. and is frequently cleaning up island beaches. See the Chapter 11 list in the Chapter Reference Material section of this Blue Pages on page 61 for a link to the Clean Team's main page for the ever-growing seasonal schedule. After you've enjoyed your day at the beach, please pick up trash, including uneaten food and throw it away in the correct trash barrels.

Make Water World Discoveries

Discover which watershed your house is in. Look at the watershed map on page 8 and determine how close you live to an open body of water, whether you're within the wellhead protection district, and where the rain flows when it hits your property. Read the town's Shellfish Management Plan and Nantucket & Madaket Harbors Action Plan with your children to find out together the



importance of keeping our ground, fresh and salt water clean. Go on a whale watch cruise out of Nantucket Harbor or take a charter fishing trip; on both of them you'll glean from their captains the role a clean ocean plays in the survival of fish, marine mammals and vegetation.

Find out from the town's Natural Resources Department when it plans to open Sesachacha and Hummock Ponds to the ocean in April and October. You can use these events to teach your children about replenishing these ponds with fresh oxygen and food for pond creatures somewhat dependent on a brackish ecosystem.

Nantucket's Shellfish Hatchery: Porthole to the harbors

In 1993, the U.S. Coast Guard transferred ownership of Station Brant Point's former boathouse just west of the Brant Point Lighthouse to the Town of Nantucket. This building is now used as a marine research laboratory and shellfish hatchery. The shellfish biologist, with the help of summer interns and volunteers, is spawning millions of scallop, quahog and other shellfish seed each summer in this hatchery, which are released into the harbor.

The lab is run by town shellfish biologist Tara Anne Riley who raises shellfish including bay scallops, oysters and quahogs to help augment the natural populations in our harbors. Kaitlyn Shaw conducts harbor research and guides the town's water quality sampling and analysis program. Each year, there is a need for volunteers and interns to help Riley run the lab, so this is an excellent opportunity for young people to learn about how the health of our harbors depend on how clean we keep our island and our water.

Fishing Sense

Nantucket is unique among the 350 cities and towns of Massachusetts in that

our town owns its ponds and is therefore responsible for them. This means that pond fishermen aren't required to buy fishing licenses, a process that would inform them of daily catch limits and minimum sizes of fish species they can take. Use the MassWildlife link in the Chapter Reference Material section of the Blue Pages to find state catch and size limits. Both Massachusetts residents and non-residents need a saltwater fishing license. Licenses are available at www.wildlifelicense.com for a fee of \$10 or free if you are a senior. They can also be obtained at local tackle stores. Why is this important? Fish are part of the food chain that processes water in our ponds. If you see people taking fish that are obviously too small and should be released, call the Environmental Police Officer or the Natural Resources Department.

Going crabbing at First or Second Bridge in Madaket or fishing in any of the ponds? Don't use lead weights on your tackle because water birds can die from ingesting the lead in these sinkers. Instead, try plated steel sinkers or washers, and plated steel hooks.

Sea for Yourself: Recreational Shellfish Permits

One of the best all around deals on Nantucket is the recreational shellfish permit issued by the town. Thirty-five dollars gets a year-round resident an annual permit, non-residents pay \$100 and non-residents on island for just a week can get a seven-day permit for \$50. This recreational permit allows the holder to pushrake for bay scallops, dig for steamers (soft-shell clams), rake for quahogs, collect blue crabs and trap American eels.

In addition to harvesting native seafood and the delicious meals that can be made from island shellfish and eels, you'll be exposed to the incredible diversity of marine life in our waters. You'll experience first-hand the eelgrass beds many of these creatures depend

on, you'll handle other species such as crabs, moon and whelk snails, razor clams and horseshoe crabs, and see terns, gulls, osprey, wading shorebirds of many varieties and large fish species such as bluefish and striped bass. In effect, you and your children can immerse yourselves in the living world of our harbors and really see the importance of clean water.

You can buy annual recreational shellfish permits at the Public Safety Building at 4 Fairgrounds Road.

A Shellfish out of Water

Shellfish are filter feeders, meaning they use their gills not only to absorb oxygen from the water, but also to glean microscopic food such as plankton and algae that would otherwise pollute our harbors. Oysters are especially adept at this. Remember to take only shellfish in their designated seasons, and only take the prescribed minimum legally harvestable size or larger. This information is described in detail on the back of the recreational permit mentioned above. If you see anyone taking any shellfish out of season, from closed areas, or in aquaculture farm plots in the harbor, call the Shellfish Warden (508-228-7230).

During the fall, juvenile bay scallops are susceptible to mass beach strandings when the island experiences sustained strong winds over several days from northerly and easterly directions. When this happens, Nantucket's Seed Stranding Team needs all the help it can muster to get the scallops back into deep water and this is a great way to learn for yourself and show your children the importance of a clean, healthy harbor. The stranding team airs announcements of strandings for which volunteers are needed on 97.7 WACK and posts the information on Facebook as well.

Taking Action

THE BIG PICTURE



Polpis Harbor

Photograph courtesy of Peter Brace

Reading the chapters and understanding their message in the Nantucket Blue Pages is easily done. Putting them into action and making them part of your daily life is where the real work begins. But it doesn't have to be work. Consider Nantucket's water like the blood in your body; you need to eat healthy foods to have healthy blood so you can remain fit and strong throughout your life. Likewise, what we put into our aquifer, our ponds, harbors and the ocean around us determines the quality of all our lives.

If, after reading the Nantucket Blue Pages cover to cover, you still don't know what you can do to help protect the quality of our waters, keep these following four points in mind:

1. Don't pollute where you live, eat and play. How would your life change if you didn't have access to clean water to drink, to swim in, to boat in, to fish in, and to harvest shellfish from? As you re-read this publication and after finding where you live and recreate on the watershed map on page 8, keep this question in mind.

2. A high standard of water quality really is up to you. There are way too many recommendations in the Nantucket Blue Pages for one person to put into action all at once. Just pick five easy ones that work for you right now and incorporate them into your daily routine. That way, you will find that it's easier to add more as you go along and then easier still to incorporate some of

the more challenging, long-term changes. As you make water quality protection just another part of your life, talk it up. Tell your friends and co-workers. Don't be shy. They all live on Nantucket too and depend on the same precious resource that you do.

3. Environmental consciousness is second nature to Nantucket. Forty-five percent of the island is preserved as open space by island conservation groups. We have two sewage treatment plants, a federal-no-discharge zone in our salt water and a fertilizer-use bylaw. There are lots of nonprofit organizations, homeowners associations, town boards and committees, and other special interest groups operating on Nantucket that have water quality

protection as one of their primary goals. Volunteering for one or several of these entities and or supporting them financially aligns you with Nantucketers who make protecting our aquifer, harbors, ponds and ocean a priority in their lives and it further empowers our island population to lobby for clean water actions.

4. Take the plunge, be a proactive water guardian.

Forget about just getting your feet wet in island water quality protection. Drench yourself in it. Dive in for the full experience and pull others in with you. Here are some great ways for you and your family and friends to quickly get immersed in Nantucket's realm of water.

- Contact the Nantucket Civic League to learn where your house and property are in relation to the nearest watershed and join your area association to get involved in keeping toxic materials from reaching groundwater and water bodies in your area.
- Join the Nantucket Clean Team every Saturday from May through the end of December in their one-hour-a-week

cleanup of the island, its beaches and downtown. In addition, you can clean your own neighborhood on a regular basis.

- Join the Nantucket Water Commission to help protect our aquifer.
- Attend Conservation Commission meetings to speak out against projects that may damage our various water bodies and sole-source aquifer. File an application with the town for appointment to the Conservation Commission to protect island wetlands.
- Support financially the Nantucket Land Council, the Nantucket Conservation Foundation, the 'Sconset Trust, the Madaket Land Trust, the Massachusetts Audubon Society and the Trustees of Reservations, or many of the other organizations for which conservation is a priority.
- Get outside and get to know the island's water bodies up close. One way you can do that is by reading *“Walking Nantucket: A Walker's Guide to Exploring Nantucket on Foot”* and

“Nantucket: A Natural History”.

- If you own a vacation home that is used or rented in the summer along Long Pond, Hither Creek, on Smith's Point, Coatue, Tuckernuck or along Hummock Pond, consider switching to a denitrifying system.
- Connect your outdoor shower drain to your septic system or sewer connection, or dig an infiltration pit to fill with gravel, and divert the gray water into it.
- Do not feed the ducks at Consue Springs because they defecate in the water, which seeps out into the Creeks and the leftover food attracts rats.
- Attend Board of Health meetings.
- Share your copy of the Nantucket Blue Pages with others!



Salt marsh with great egret

Photograph courtesy of Peter Brace

Where to Go for Help

RESOURCES FOR TAKING THE NEXT STEPS

Citizen Groups

Nantucket Civic League: (508) 228-2366

Email: nclsec@comcast.net.

Nantucket Community Association:

Email: info@nantucketcommunity.org

Nantucket Clean Team: (212) 687-6900

Email: wconnell@connellandersen.com. www.ackcleanteam.org.

Homeowners Associations

Brant Point Association

Cisco Association

Fishers Landing Association

Harbor South Civic Association

Hinckley Lane Association

Hussey Farm Association

Hummock Pond Association

Hummock Pond of Nantucket Homeowners Association

Long Pond Association

Madaket Conservation Association

Madaket Residents Association

Monomoy

Miacomet Conservation Association

Nantucket Town Association

Naushop Homeowners Trust Association

Pine Valley Association

Pocomo Area Association

Polpis Association

Quidnet Squam Association

Siasconset Civic League Association

Smith's Point Association

Surfside Association

Tom Nevers Civic Association

Tristram's Long Pond Owners Association

Wauwinet Landowners Association

West Miacomet Association

Conservation Organizations

Madaket Land Trust: (508) 228-0841

Massachusetts Audubon Society: (508) 228-9208 Email:

Esteinauer@massaudubon.org. Web: www.massaudubon.org

Nantucket Land Council: (508) 228-2818

Email: nlc@nantucketlandcouncil.org.

Web: www.nantucketlandcouncil.org/

Nantucket Islands Land Bank: (508) 228-7240

Email: resource@nantucketlandbank.org.

Web: www.nantucketlandbank.org

Nantucket Conservation Foundation: (508) 228-2884

Email: kbeattie@nantucketconservation.org.

Web: www.nantucketconservation.org/

'Sconset Land Trust: (508) 228-9917

Email: info@sconsettrust.org. Web: www.sconsettrust.org

The Trustees of Reservations: (508) 325-5646

Email: dlang@thetrustees.org. Web: www.thetrustees.org/

U.S. Fish & Wildlife Service: (978) 443-4661

Email: fw5rw_emnwr@fws.gov.

Web: www.fws.gov/northeast/nantucket/

Regional Planning

Nantucket Planning & Economic Development Commission:

(508) 7237 Email: plus@nantucket-ma.gov. Web:

www.nantucket-ma.gov/306/Planning-Economic-Development-Commission

Environmental Education

Linda Loring Nature Foundation: (508) 325-0873

Email: info@llnf.org. Web: www.llnf.org/

Maria Mitchell Association: (508) 228-9198 Email:

info@mariamitchell.org. Web: www.mariamitchell.org/

UMass Boston Nantucket Field Station: (508) 228-5268

Email: nantucketfieldstation@umb.edu. Web: www.umb.edu/nantucket/

Nantucket Marine Mammal Stranding Team:

nantucketmarinemammal@gmail.com

Clean and Sustainable Energy

Nantucket Energy Office: (508) 325-5379

Web: <http://www.nantucket-ma.gov/136/Energy-Office>

Fisheries and Shellfish Groups

Natural Resources Department: (508) 228-7230

Web: www.nantucket-ma.gov/130/Natural-Resources

Web: www.nantucket-ma.gov/131/Shellfish-Biologist

Email: triley@nantucket-ma.org

Nantucket Shellfish Association: PO Box 604, Nantucket, MA

02554. Email: info@nantucketshellfish.org
Web: www.nantucketbayscallops.org/
Nantucket Anglers Club: (508) 228-2299
Email: fish@nantucketanglersclub.com.
Web: http://nantucketanglersclub.com

Agricultural/Horticultural Resources

Sustainable Nantucket: (508) 228-3399
Email: info@sustainablenantucket.org.
Web: www.sustainablenantucket.org/
Nantucket Agricultural Commission: (508) 228-7255
Web: www.nantucket-ma.gov/196/agricultural-commission
Nantucket Garden Club: (508) 228-7596
University of Massachusetts Extension Service; Turf Program:
http://extension.umass.edu/turf/.
**University of Massachusetts Extension Service; Integrated
Pest Management:** www.umass.edu/umext/ipm/.
Soil and Plant Tissue Testing Lab: (413) 545-2311 Web:
http://soiltest.umass.edu. West Experiment Station, 682
North Pleasant Street. University of Massachusetts, Amherst ,
MA 01003

Fertilizer Best Management Practices

Web: www.nantucket-ma.gov/DocumentCenter/Home/View/87

**Water-related town departments, boards
and committees**

Water Quality Initiative: Web: www.nantucket-ma.gov/132/
Beach Management: (508) 228-7261 Email:
JCarlson@nantucket-ma.gov
Web: www.nantucket-ma.gov/673/Beaches-Parks
Coastal Management Plan: Web: www.nantucket-ma.gov/281
/Coastal-Management-Plan-Workgroup
Conservation Commission: (508) 228-7230
Email: jcarlson@nantucket-ma.gov
Web: www.nantucket-ma.gov/326/Conservation-Commission
Department of Public Works: (508) 228-7244
Email: kbuzanoski@nantucket-ma.gov
Web: www.nantucket-ma.gov/237/
Public Works Harbor Plan: Web: www.nantucket-ma.gov/436/
Harbor & Shellfish Advisory Board: (508) 228-9062
Email: coskataheaven@earthlink.net
Web: www.nantucket-ma.gov/435/Harbor-Shellfish-
Advisory-Board
Health Department: (508) 228-7200 ext 7014 & 7020
Email: rsantamaria@nantucket-ma.gov
Web: www.nantucket-ma.gov/231/Public-Health
Marine Department/Harbor Master: (508) 228-7261
Email: slucey@police.nantucket-ma.gov
Web: www.nantucket-ma.gov/141/Harbor Master
Mosquito Control Advisory Committee: (508) 228-7200 ext

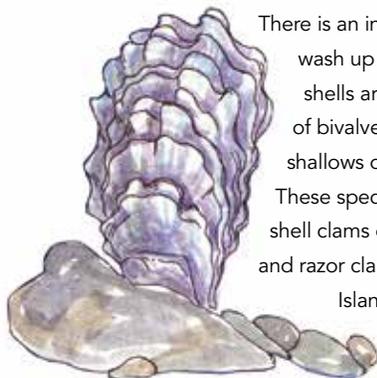
7014 & 7020 Email: rsantamaria@nantucket-ma.gov
Web: www.nantucket-ma.gov/240/Mosquito-Control-
Advisory-Committee
Planning and Land Use Services (PLUS): 508-325-7587
Email: plus@nantucket-ma.gov
Web: www.nantucket-ma.gov/230/
Planning Land Use Services PLUS/Recycling:
Web: www.nantucket-ma.gov/242/Recycling
Shellfish Management Plan: Web: www.nantucket-ma.gov/
DocumentCenter/Home/View/88
Siasconset Water Department:
(508) 257-6351
Wannacomet Water Company/Nantucket Water Commission:
(508) 228-0022 Web: www.wannacomet.org

Water-related State Entities

Massachusetts Office of Coastal Zone Management:
(508)375-6856 Email: stephen.mckenna@state.ma.us
Web: www.mass.gov/eea/agencies/czm/regional-offices/
cape-and-islands/
Massachusetts Department of Environmental Protection:
508-277-1661 Email: Service.Center@state.ma.us
Web: www.mass.gov/eea/agencies/massdep/
Massachusetts Division of Marine Fisheries: (617) 626-1520
Email: marine.fish@state.ma.us Web: www.mass.gov/eea/agencies/
dfg/dmf/
Massachusetts Estuaries Project: (508) 999-8193
Email: bhowes@umassd.edu
Web: www.oceanscience.net/estuaries/index.htm



Bivalves: Nature's Water Filters



There is an incredible diversity of shells that wash up on Nantucket's shores. Those shells are the remains of many species of bivalve mollusks that populate the shallows of our ponds, harbors and bays. These species include oysters, quahogs, soft shell clams or steamers, bay scallops, mussels, and razor clams. Shellfish harvesting on the Island can be traced back to the first Wampanoags. Today, the Island beds continue to be fished

both commercially and recreationally. These amazing creatures are great for the environment. As they feed by filtering microscopic particles from the water, they act as natural filters to improve water quality. A full-sized oyster can filter up to 50 gallons of water per day! Shellfish are also the first to suffer from pollution and poor water quality.

CHAPTER REFERENCE MATERIAL

CHAPTER 1 – A WATER PRIMER

Nantucket Island Watershed:

<http://www.mass.gov/eea/waste-mgmt-recycling/water-resources/preserving-water-resources/mass-watersheds/nantucket-island-watershed.html>

Total Maximum Daily Loads for Nantucket: <http://www.mass.gov/eea/agencies/massdep/water/watersheds/total-maximum-daily-loads-tmdls.html#13>

Electronic Field Guide to Invasive Plants of Nantucket: <http://efg.cs.umb.edu/nantucket/>

Consumer information on environmentally safe cleaning products:

www.cleaninginstitute.org/clean_living/cm_novdec2010_changes_in_automatic_dishwasher_detergents.aspx

Environment-friendly phosphate-and bleach-free dishwasher tabs, cleaners, soaps and safe cleaning products:

www.sunandearth.com

www.ecover.com/us/en/products/productscategory.aspx

www.thedailygreen.com/green-homes/latest/phosphate-free-dishwasher-detergents#slide-7

www.seventhgeneration.com/dish-detergent

www.methodhome.com/shop/smarty-dish-dishwasher-tabs/

CHAPTER 2 – QUICK START FOR THE WATER WISE

Mass Save Home Energy Assessment:

www.massave.com/residential/home-energy-assessments
(866) 527-SAVE (7283)

Hazardous Waste Collection on Nantucket:

<http://ma-nantucket.civicplus.com/242/Recycling>

Nantucket Regional Transit Authority seasonal bus service: www.nrtawave.com

Best Management Practices for Landscape Fertilizer Use on Nantucket:

www.nantucket-ma.gov/documentcenter/view/438



Push raking for scallops in Nantucket harbor.

Photograph courtesy of Peter Brace

CHAPTER 3 – WATER, WATER EVERYWHERE

Water quality protection and conservation resources:

www.epa.gov/dwstandardsregulations
http://water.epa.gov/infrastructure/drinkingwater/sourcewater/protection/upload/2007_11_29_sourcewater_pubs_citguid.pdf
<http://water.epa.gov/type/groundwater/index.cfm>
<http://water.epa.gov/drink/info/>
www.nantucket-ma.gov/249/Comprehensive-Wastewater-Management-Plan
www.nantucket-ma.gov/718/Water-Quality
www.consumerenergycenter.org/residential/appliances/washers.html
http://extension.oregonstate.edu/malheur/sites/default/files/Conserve_Water_Clothes-em8358-e.pdf
www.twdb.texas.gov/innovativewater/rainwater/doc/RainwaterHarvestingManual_3rdedition.pdf

State water resources at the Department of Environmental Protection:

www.mass.gov/eea/agencies/massdep/water/

Nantucket's municipal water supplier:

Wannacomet Water Company; (508) 228-0022
www.wannacomet.org

CHAPTER 4 – OUT OF SIGHT, OUT OF MIND

Nantucket's Comprehensive Wastewater Management Plan (CWMP):

www.nantucket-ma.gov/249/Comprehensive-Wastewater-Management-Plan

Updated CWMP – October 2014:

www.nantucket-ma.gov/documentcenter/view/7162

State septic regulations – Title 5:

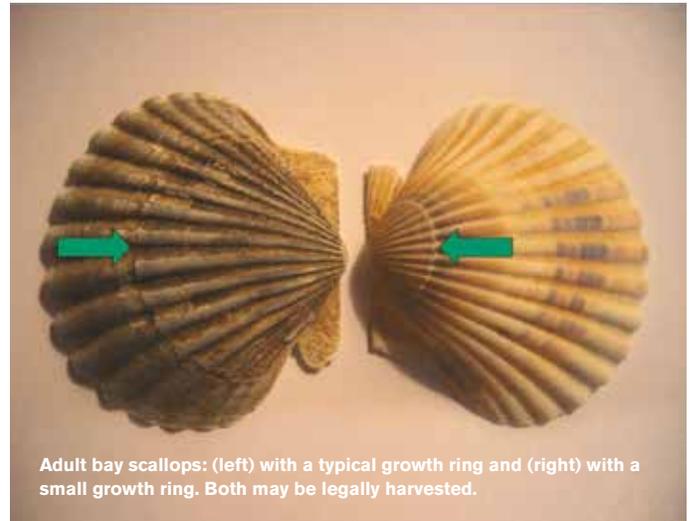
www.mass.gov/dep/water/wastewater/septicsy.htm

Enzyme accelerators for septic tanks: www.nesc.wvu.edu/pdf/ww/septic/additives_sfqw02.pdf

CHAPTER 5 – HAZARDOUS WASTE – NOT IN MY HOUSE

Natural Resources Defense Council – 10 steps to clean water:

www.nrdc.org/water/pollution/gsteps.asp



Photograph courtesy of Nantucket Shellfish Association.

Nantucket Hazardous Waste Collection information:

www.nantucket-ma.gov/243/Hazardous-Waste

Nantucket hazardous waste disposal resources:

Nantucket Health Department (508) 228-7226
Nantucket Fire Department (508) 228-2324

Green cleaning agent resources:

www.planetgreen.discovery.com/buying-guides/green-cleaning-supplies.html
www.cleaninginstitute.org/clean_living/default.aspx
www.epa.gov/epp/pubs/cleaning.htm
www.greenseal.org

Waste motor oil/filter disposal and disposal of other auto and household hazardous wastes:

www.mass.gov/eea/agencies/massdep/recycle/hazardous/motor-oil-and-oil-filters.html
www.mass.gov/eea/agencies/massdep/recycle/hazardous/hazardous-household-products-handling-and-management.html

CHAPTER 6 – RETHINK/REUSE/RECYCLE

Nantucket Landfill historical background:

www.nantucket-ma.gov/DocumentCenter/Home/View/387

Off-Island Materials Recovery Facility historical background:

www.angelfire.com/poetry/bridgewaterlam/NCL/Dump_101_Facts_Benz.1.pdf

Reduce junk mail (fee-based service):

www.41pounds.org

Landfill, MRF and Take It or Leave It days and hours:

www.nantucket-ma.gov/237/Public-Works

Hazardous waste collection days on Nantucket:

www.nantucket-ma.gov/243/Hazardous-Waste

Nantucket Clean Team – volunteer trash collection group:

www.ackcleanteam.org

Free online classified ad web site for Nantucket for selling used, unwanted items:

<http://reuseexchange.com>

Reusable produce and grocery bags:

www.reuseit.com/store/bags-totes-produce-bags-c-238_242.html

Going paperless:

<https://evernote.com>

<http://evernote.com/penultimate/>

www.visionobjects.com/en/webstore/myscript-memo/description/

CHAPTER 7 – SPARE THAT SHRUB

Nantucket Conservation Commission: (508) 228-7230

www.nantucket-ma.gov/326/Conservation-Commission

Asphalt pavement (impervious surface) alternatives:

www.oldcastlecoastal.com/clay_pavers.htm

<http://www.westerninterlock.com/products/permeable-paving-stones>

<http://www.uni-groupusa.org/>

<http://www.uni-groupusa.org/permeable.html>

nepis.epa.gov/Exe/ZyPURL.cgi?Dockkey=P100D97A.TXT

www.dauphinco.org/swm/BMPfactsheets/Porous%20Asphalt%20fact%20sheet.pdf

CHAPTER 8 – LANDSCAPING FOR HEALTHY WATERSHED

The Maria Mitchell Association’s Electronic Field Guide for Invasive Plant Species:

<http://efg.cs.umb.edu/nantucket/>

The UMass Boston Nantucket Field Station:

(508) 228-5268, www.umb.edu/nantucket/

Best Management Practices for Landscape Fertilizer Use on Nantucket Island:

www.nantucket-ma.gov/documentcenter/view/438

Nantucket’s Conservation Commission:

(508) 228-7230

www.nantucket-ma.gov/326/Conservation-Commission

The Nantucket Garden Club:

www.nantucketgardenclub.org

Nantucket Biodiversity Initiative

www.nantucketbiodiversityinitiative.org

University of Massachusetts Extension Service IPM:

www.umass.edu/umext/ipm/

Nantucket Wetlands By-Law:

www.nantucket-ma.gov/DocumentCenter/View/1008

CHAPTER 9 – RECOVERY FROM LAWN OBSESSION

Best Management Practices for Landscape Fertilizer Use on Nantucket Island:

www.nantucket-ma.gov/documentcenter/view/438

Environmental Protection Agency (EPA) pesticide resource page:

www.epa.gov/pesticides/

Books:

Handbook of Successful Ecological Lawn Care, Paul Sachs, 1996
The Encyclopedia of Organic Gardening, Rodale Books, 1993.
Redesigning the American Lawn: A Search for Environmental Harmony, F. Herbert Bormann, et al, 2001.

CHAPTER 10 – GETTING OUT ON THE WATER

Nantucket Boatyards:

Brant Point Marine (508) 228-6244

Glynn’s Marine (508) 228-0244

Grey Lady Marine (508) 228-6525

Madaket Marine (508) 228-2263

Nantucket Marine (508) 228-6505

Tugboat Tim’s (508) 228-8500

University of Massachusetts at Dartmouth School of Marine Science and Technology:

www.umassd.edu/smast/

Best management practices for cleaning boats, marinas and disposing of boat-related hazardous waste:

www.epa.gov/region02/p2/documents/best_management_

practices_marina_facilities.pdf

EPA National Pollutant Discharge Elimination System Program: (617) 918-1615 www.epa.gov/npdes

Marine ecosystem-friendly boat bottom paints:
www.epaint.com/about
www.aquagardboatpaint.com/
www.maxiglide.com, <http://www.tritonmarineproducts.com>

CHAPTER 11 – NOT JUST FOR KIDS

www.mariamitchell.org
www.nlc.org
www.ackcleanteam.org
www.explorenantucket.com (Shearwater Excursions)
www.nantucketharborplan.com
http://scholarworks.umb.edu/uhi_pubs/40/
www.nantucket-ma.gov/130/Natural-Resources
Environmental Police Officer: (508) 257-6932
Mass Wildlife Regulations:
www.mass.gov/eea/agencies/dfg/

CHAPTER 12 – TAKING ACTION

The Town of Nantucket:
www.nantucket-ma.gov

Citizen groups:
Nantucket Civic League:
<http://nantucketcivicleague.org>

Community Foundation for Nantucket:
<http://cfnan.org>

Nantucket educational, sustainable and conservation organizations:
www.nantucketlandcouncil.org/index.html
www.nantucketconservation.org

www.nantucketlandbank.org
www.sconsettrust.org
www.nantucketisle.com/tlt/index.html
www.thetrustees.org
www.umb.edu/nantucket
www.sustainablenantucket.org
www.mariamitchell.org
Nantucket Shellfish Association:
www.nantucketbayscallops.org

Books:
www.nantucketbookpartners.com/search/apachesolr_search/Walking%20Nantucket
www.nantucketbookpartners.com/product/nantucket-natural-history-peter-brace

CHAPTER 13 – WHERE TO GO FOR HELP

(See Chapter 13 on page 56)

CHAPTER 14 – TYING IT ALL TOGETHER

Nantucket Biodiversity Initiative
www.nantucketbiodiversity.org

The Encyclopedia of Life:
<http://eol.org>

The Maria Mitchell Association:
www.mariamitchell.org (508) 228-9198

Nantucket Shellfish Association:
www.nantucketbayscallops.org

Nantucket Natural Resources Department:
www.nantucket-ma.gov/130/Natural-Resources
(508) 228-7230

Natural Resources Coordinator: Jeff Carlson;
jcarlson@nantucket-ma.gov (508) 228-7230

Shellfish Biologist: Tara Anne Riley;
triley@nantucket-ma.gov (508) 228-7230

Natural Resources Enforcement Officer: JC Johnsen
jcjohnsen@nantucket-ma.gov

Shellfish Management Plan
www.nantucket-ma.gov/documentcenter/view/88

Photograph courtesy of Len Germinara



Nantucket's Harbors

JUST A REMINDER

Because Nantucket's harbors are the final collectors of water from their respective watersheds, the liquids and materials we pour into and spread onto the ground will inevitably end up in our groundwater and flow into our harbors. Chemicals in materials including lawn fertilizers, sewage from septic systems, and petroleum products in road runoff have been proven to negatively affect the creatures living in the island's three harbors and its ponds great and small.

Living Harbors – Living Ponds

You share this island environment with some pretty extraordinary animals that benefit our lives in ways most of us probably take for granted. Knowing what lives in our inshore waters and ponds means connecting you, the human inhabitants of Nantucket, with those in Nantucket, Polpis, and Madaket harbors, and the island's ponds by putting names to fins, shells, feathers and

webbed feet, and understanding how our lives impact these species.

Bay Scallops

The Atlantic bay scallop (*Argopecten irradians*), a bivalve found from Cape Cod to Maryland, is our most prized shellfish. Its adductor muscle, cherished for its unique sweet taste, supports one of a dwindling handful of financially sustainable fisheries for these scallops on the East Coast. It is Nantucket's largest commercial fishery.

Bay scallops live in two to 30 feet of water, where eelgrass grows and water quality is fair to high, relying on eelgrass as a substrate for their larvae to attach to and for seed and adults to feed and take refuge in. Both eelgrass and bay scallops are highly sensitive to changes in water quality.

The application of lawn fertilizers, the reactivation of septic systems and the general increase of human activity



Fiddler crabs in salt marsh

on the harbor and island roads occurs in spring and summer. This coincides with the bay scallops' most active period of the year when they're filter feeding on benthic diatoms and algae, and spawning. It is then that they are most at risk.

Quahogs

Quahogs live one to three inches below the mud or sand in harbors in the sub-tidal zone to 50 feet in depth. They are filter feeders that draw in water and discharge it through siphons that extend up through the sand and mud into the water.

Seed quahogs are able to attach to sand grains, sea lettuce, rocks, eelgrass and almost any kind of submerged surface after swimming around in the water as larvae for six to 12 days. When they've grown to less than half an inch, seed quahogs detach and bury themselves in the sand.

Quahogs feed on algae and diatoms by filtering food from the water with cilia on their gills. However, poisonous algae in the water can end up in their meat. Although bay scallops also feed this way, we only eat their adductor muscles, which don't absorb this poison.

Although rare, the most notorious paralytic shellfish poison is found in the



Stump Pond

shellfish exposed to dinoflagellate algae (*Karenia brevis*), commonly known as red tide. It can cause major intestinal problems and, in some cases, death after consumption of shellfish exposed to this algae. Nantucket's waters were last closed for red tide in 2005, but imagine eating a quahog dug from the west end of Polpis Harbor or from Hither Creek, both permanently closed to shellfishing because of high fecal coliform bacteria.

Soft-shell clams

Soft-shell clams are among other shellfish found around the island. Unlike the quahog, the soft-shell clam does not have a hard shell, but an elongated soft shell. There is no commercial fishery for soft-shell clams and they can only be taken with a recreational permit on Sundays Sept. 15 to June 15.

Like the quahog, soft-shell clams are also filter feeders, sucking and expelling water by siphon from their burrows down in the mud and filtering out oxygen and food with their gills. Because the entire shellfish is eaten, it too can be dangerous to humans depending how degraded the water quality is where it lives.

Oysters

Historically found in Nantucket harbors and ponds, significant beds of wild oysters in Nantucket, Polpis and Madaket harbors no longer exist, although a growing population in Sesachacha Pond is showing signs of life.

Large numbers of oysters are thriving in eight aquaculture farms just outside Polpis Harbor, in the Head of the Harbor and up in Coskata Pond likely as a result of Nantucket's fair water quality conditions. Unlike most other shellfish, oysters do well in marginal water quality and have been shown to actually improve the quality of the water they're growing in. As filter feeders, meaning they filter their food from the water with their gills while they also absorb dissolved oxygen, oysters are



also ingesting sediments, algae, ammonia and nitrate compounds, all of which pollute salt water.

Ponds

Our ponds, while far less popular as recreational and commercial resources, are still home to many species of fish whose existence also depends on clean water.

Some of the freshwater creatures that are caught for sport and for dinner include white perch, yellow perch, pumpkin seed, chain pickerel, American eels, and blue crabs. There are also painted and snapping turtles in some of our ponds, spotted turtles in certain freshwater wetlands, and many of the shorebirds mentioned below rely on our kettle and outwash ponds for sustenance, cover, and nesting sites.

Water-Dependent Birds

A diverse and fascinating flock of year-round, migratory and accidental visiting birds rely on what lives and grows in Nantucket's harbors, ponds and wetlands.

Ospreys wintering in South America and raising young on Nantucket during March through October rely

on algae-free water in order to see fish they dive for in the harbors and ponds. Piping plovers, least terns and American oystercatchers also migrate to the island to raise their chicks need fish and shellfish to survive. Other such warm season avian species include great blue and black-crowned night herons, great, snowy, little and cattle egrets, American bitterns, belted kingfishers, whimbrels, lesser and greater yellowlegs, dowitchers, sanderlings, willets. Several sandpipers, dunlins and ruddy turnstones use our islands' harbor shores as a rest stop on their way south.

Because all of these birds' food comes from salt and fresh water bodies around Nantucket, excess land-based pollutants and nutrients can cause algal blooms that cloud the water, clog the gills of shellfish and deplete dissolved oxygen when they die and decompose. All of that adds up to less food for hungry birds.

Blue Mussels

The blue mussel is also found in tidal and sub-tidal zones in a variety of settings as well as rocky areas such as the jetties.

Blue mussels, with elongated triangular shells, anchor to a secure substrate, instead of living beneath harbor bottom, such as rocks, pilings, hard bottom or other mussels using flexible strands secreted by their byssal glands within the mussel's foot. These byssal threads allow mussels to stay put in large clusters after spawning produces larvae that develop shells before attachment.

The greatest concentration of mussels is found at the west end of the island in Madaket Harbor, Tuckernuck and Eel Point Channel. When mussels are present, it's almost always a recreational fishery, but the fishing is not consistent and fluctuates due to causes not entirely known but which might include sea ducks, pea crabs and parasites.

Special thanks and appreciation to the Nantucket Land Council and the Nantucket Shellfish Association for their unwavering editing and funding support for the Nantucket Blue Pages.



Nantucket Blue Pages

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E: coskataheaven@earthlink.net

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Cover Photograph courtesy of Peter B. Brace