

# Marina Design and Maintenance

Marina design considerations are important for new marinas but should also be applied to existing marinas wishing to expand or reconfigure their facilities.

## Environmental Concerns

Land management decisions, operating procedures, and structural improvements may all contribute to—or detract from—the quality of the land and water surrounding your marina. Roads and parking areas may convey polluted stormwater directly into adjacent waterways. Dredging may re-suspend toxic compounds such as heavy metals, hydrocarbons, and synthetic chemicals. Hazardous chemicals may be leached into the water from piers and other similar structures. Broken or degraded floats may release buoyant debris, which birds and fish mistake for food. Finally, the location and installation of shoreside and in-water structures may lead to accelerated coastal erosion and sedimentation. Sedimentation is the rain of soil particles through the water column. It may bury bottom dwelling organisms, block sunlight, reduce the feeding efficiency of visual feeders, and clog fish gills.

## Regulatory Issues

Good planning and design practices will assure that appropriate and adequate environmental safeguards will be incorporated into a prospective project which are considered by DNREC during the Marina Construction Permit review process. During the permit review process DNREC will balance the needs of development and growth with its own primary mission, which is to protect the natural environment of the State for all of our citizens and for future generations.

DNREC adopted Marina Regulations in 1990, the full text of which is included as Appendix X of this Delaware Clean Marina Guidebook. DNREC also maintains a *Marina Guidebook* that contains useful information about the planning, design, and operation of marinas. This guidebook can be used as a public service, as an educational tool, and for technology transfer, and is available on request directly from DNREC. Please refer to DNREC's *Marina Regulations* and *Marina Guidebook* for more details.

The Department's review of all Marina Permit applications will include consideration of the following design features:

**Marina Flushing.** Marinas are to be designed to maximize flushing so as to prevent the possible water quality degradation that would negatively affect the surrounding areas.

- Marina basins shall be designed so that they do not include square corners or stagnant water areas that tend to collect debris or cause shoaling or flushing problems.
- Marina basin and access channel depths shall not be deeper than the existing controlling depth of the receiving water body and shall be designed to introduce a negative slope (shallow to deep) when moving from the head of the basin toward the receiving water body.

For copies of DNREC's Marina Guidebook, call DNREC's Wetlands and Subaqueous Lands Section at (302) 739-9943.

**Dredging and Dredged Material Disposal.** Dredging and dredged material disposal activities shall be in accordance with the Regulations Governing the Use of Subaqueous Lands, as authorized by Title 7. Del. C., Chapter 72. Dredged material disposal activities may also be regulated, depending upon the nature of the spoil material, by the Delaware Regulations Governing Solid Waste or the Delaware Regulations Governing Hazardous Waste.

- a. Dredging shall be limited to the minimum dimensions necessary for the project and should avoid sensitive areas such as wetlands, shellfish resources, and SAV. Delaware Surface Water Quality Standards must not be violated because of dredging operations.
- b. DNREC may authorize dredging or other marina activities on a seasonally restricted basis in known nursery and spawning areas of important species. Marinas shall not be permitted in areas that would require frequent maintenance dredging, resulting in harm to aquatic life and preventing the recolonization of benthic organisms (plants and animals on the seabed). Such areas include those which would require maintenance dredging more often than once every four years.
- c. Dredging activities shall not be approved until the applicant can demonstrate that both initial and future maintenance dredging demands can be accommodated by the proposed disposal plan. Future maintenance dredging shall be estimated using a project life not less than 30 years unless the applicant can provide good reasons why the project life will be less than 30 years.

**Shoreline Protection Structures.** Construction of shoreline protection structures shall be in accordance with the Delaware Regulations Governing the Use of Subaqueous Lands, as authorized under Title 7. Del. C., Chapter 72. Shoreline protection structures should be designed to minimize adverse impacts to aquatic resources. Vertical bulkheads should be avoided if at all possible. When bulkheading is proposed as part of a marina project, the permit application must include an evaluation of alternatives to bulkheading. Such evaluations must demonstrate that no practicable and appropriate alternatives to bulkheading, such as vegetative stabilization, rock sills or revetments, exist to accomplish the primary purpose of the project.

**Navigation and Access Channels.**

- a. Marinas shall only be located in areas which, in DNREC's determination, offer safe and convenient access to waters of navigable depth. Such locations tend to present maximum opportunities for flushing, with less danger of sedimentation than very shallow sites. Safe and convenient access will be determined on a case-by-case basis. Factors such as existing water depths, distance to existing channels and their depths, and tidal and wave action will be considered.
- b. Where feasible, docks and piers shall be extended to navigable depths rather than employing dredging to provide such depths closer to shore. In some cases, limitations on maximum vessel drafts may be necessary. Minimum navigable depths shall be based on the kind of vessels expected to use the marina, but shall not exceed the depths of the receiving water body.
- c. Alignment of channels shall make maximum practical use of natural or existing channels.





- d. Docks, moorings, pilings, and other structures or berthing areas associated with marinas shall be located a minimum of ten (10) feet from a navigation channel.
- e. Marina docking facilities shall not extend beyond existing structures in the immediate vicinity unless absolutely necessary to obtain adequate water depths for a water dependent activity.
  - a. Where adequate water depths exist for water dependent marina structures, berthing areas shall not extend channelward more than 10% of the width of the water body at that location, not to exceed 250 feet. In no case shall a structure extend channelward more than 20 percent of the width of the water body (as measured from mean low water to mean low water).

**Vessel Traffic and Navigation.**

- a. Marinas shall be designed to minimize adverse effects on the existing public and private use of waters of the State. This includes applications for mooring sites (permanent or temporary), speed or traffic reductions, or any other device, either physical or regulatory, that may cause the use of State waters to be restricted.
- b. New marinas must be sited and/or designed, to the maximum extent practicable, to afford adequate protection against wakes caused by vessel traffic.

**Water Supply.**

- a. Marina construction, maintenance, dredged material disposal, or operation shall not be allowed to contribute substances to groundwater in violation of Title 7. Del. C., Chapter 60, §6003, regardless of whether the affected groundwater is used as a public or private water supply.
- b. Marina construction, maintenance, dredged material disposal, or operation shall not be allowed to contaminate a public water supply as defined by the Delaware Surface Water Quality Standards, whether existing or reserved for future use.
- c. When an applicant proposes to construct an upland basin marina, whether through excavation or other means (i.e. connection of an existing landlocked water body to tidal waters), documentation must be provided to demonstrate that the basin will not cause intrusion of saltwater into a public or private water supply.
- d. Applicants must demonstrate that there is an adequate water supply to serve all of the project's needs, and that all required permits and/or approvals can be obtained for the proposed method of water supply, whether by well installation, hook-up to an existing water supply system, or other means.

**Wastewater Facilities.**

- a. In accordance with Title 7. Del. C., Chapter 60, §6035, discharge of raw, untreated, or inadequately treated sewage from marine sanitation devices into waters of the State, including marina basins, is prohibited.
- b. All marinas shall comply with the provisions set forth in Title 7. Del. C., Chapter 60, §6035.
- c. Adequate restroom facilities for the use of marina patrons shall be provided to discourage any overboard discharge of untreated or inadequately treated sewage from vessels, and to protect water quality. Toilet facilities shall be constructed in a location that would facilitate their use by the users of the marina. The number of toilets required for any given marina shall be determined by the nature

(recreational, public, or commercial) and size of the marina and by its specific configuration. There shall be adequate restroom facilities to serve patrons such that use of shoreside facilities is encouraged. Public restroom facilities will not be required at recreational marinas if every resident who utilizes a slip within the marina can quickly and conveniently travel from the slip to their residence.

- d. The applicant shall demonstrate adequate capacity to properly dispose of all sanitary wastes generated by the project.
- e. An ample number of signs shall be provided to identify the location of public restrooms and of pumpout facilities or dump stations. Such signs shall also fully explain the procedures and rules governing the use of these facilities.
- f. The applicant must demonstrate that proper treatment, storage, or disposal permits have been or can be obtained.

**Parking.** In the absence of local planning requirements, dedicated parking spaces should be provided at a rate of 0.50 spaces/slip, plus such additional spaces required by local codes for retail activities, handicapped citizens, residences, and employee parking. The applicant may submit information to DNREC in support of an alternative parking space rate. DNREC will review such information to determine if the proposed standard is appropriate for use. In the event of a conflict between this requirement and an applicable local building code or requirement, the local code shall have precedence.

**Stormwater Management.** Stormwater runoff becomes polluted with oils, greases, organic and inorganic wastes, and other potentially harmful substances. The movement of these substances into streams and estuaries can have significant adverse water quality impacts. To minimize these impacts, all marina permit applications shall include plans for stormwater management and sediment and erosion control. These plans must be reviewed and approved by the appropriate plan approval agency in order to ensure compliance with Title 7, Del. C., Chapter 40, the Delaware Sediment and Stormwater Regulations, and the National Pollutant Discharge Elimination System (NPDES) Stormwater Regulations, (40 CFR 122.26).

In the event that the proposed marina project is exempted or waived from the requirements of Chapter 40 or the NPDES Stormwater Program, surface water and groundwater quality protection must still be demonstrated by the applicant. In reviewing the plans for stormwater management and sediment and erosion control, DNREC will rely upon the water quality provisions of Chapter 40 and the Delaware Sediment and Stormwater Regulations.

**Solid Waste Management.** Storage, handling, and disposal of solid wastes shall be in strict accordance with DNREC's Regulations Governing Solid Waste.

- a. Discharge of solid waste, including but not limited to, garbage, maintenance waste, plastics, refuse, and rubbish into waters of the State, including marina basins, is prohibited.
- b. Solid wastes shall be managed so as to prevent their entrance into any surface or ground waters of the State.

### **Vessel Maintenance Areas and Activities.**

- a. Vessel maintenance areas shall be sited as far from the water as is practicable, and shall be designed so that all maintenance activities that are potential sources of water or air pollution can be accomplished over dry land and under roof, where practicable, as determined by DNREC. Control of by-products, debris, residues, spills, and stormwater runoff shall comply with applicable DNREC regulations. All drains from maintenance areas must lead to a sump, holding tank, or pump out facility from which the wastes can later be extracted for treatment and/or disposal by approved methods. Drainage of maintenance areas directly into surface or groundwater shall not be allowed.
- b. Maintenance activities including, but not limited to, painting, welding, woodworking, and LPG servicing shall comply with applicable State regulations, as well as with National Fire Protection Association (NFPA) Code 303: Fire Protection Standards for Marinas and Boatyards.
- c. Only biodegradable detergents shall be allowed for vessel washing and cleaning within waters of the State.
- d. Waste oils and other wastes generated as a result of maintenance and repair operations shall not be disposed of into ground or surface water.
- e. Materials used in maintenance and repair operations shall be stored and handled in accordance with local fire codes or, if none exist, with applicable codes and standards of NFPA and with applicable DNREC regulations. Such material shall be stored in such a way as to prevent adverse environmental impacts.

### **Fuel Storage and Delivery Facilities.**

- a. Fuels shall be stored and handled in accordance with local fire codes or, if none exist, with NFPA Code 303: Fire Protection Standards for Marinas and Boatyards, and with applicable DNREC regulations. All vessel fueling operations shall be undertaken at the fueling station or other specifically designated remote location in accordance with NFPA Code 302: Fire Protection Standards for Pleasure and Commercial Motor Crafts.
- b. Aboveground and underground fuel storage tank installations shall comply with all State and/or local storage tank regulations.

**Fire Protection Systems.** Fire protection systems shall comply with local fire codes or, if none exist, with NFPA Code 303: Fire Protection Standard for Marinas and Boatyards.

**Life Safety Equipment.** Flotation devices shall be provided at regular intervals throughout the marina to ensure the safety of marina users.

**Fish Wastes.** Fish waste disposal shall be in accordance with Title 7, Del. C., Chapter 60, and with any applicable DNREC approved policies.

**Marina Structures.** Marina structures in, on, or over subaqueous lands shall be designed to comply with applicable requirements of the Delaware Regulations Governing the Use of Subaqueous Lands, existing guidance policies, and with the following:

- a. They shall be designed to minimize adverse impacts on navigation, public use of waters, and natural resources, while allowing the applicant adequate access to waters of navigable depth.
- b. They shall not significantly restrict water flows.
- c. The width and length of all structures shall be limited to what is reasonable for the intended use. To the extent feasible, heights and widths should be chosen to minimize shading of vegetation. Shading of submerged aquatic vegetation (SAV) should be avoided.
- d. Barrier-free access for the handicapped shall be provided for all marina structures in accordance with federal, state, or local statutes, regulations, or ordinances.
- e. They shall have sufficient strength to resist expected dead, live, wind, and impact loads. Adequate consideration shall be made for forces imposed by earth pressures, flowing water, floating objects or debris (including ice), and vessel docking and mooring operations.
- f. Marina structures shall not be constructed using creosote treated timber.

## Best Management Practices for Marina Facilities and Structures

**Use Fixed or Floating Piers to Enhance Water Circulation.** While being mindful of the need for pier/dock systems to provide access during routine operations and under emergency circumstances (e.g., evacuation preceding or during a storm), piers, and other structures should be placed to enhance, rather than to obstruct, water circulation.

- ❖ Select an open design for new or expanding marinas. Open marina designs have no fabricated or natural barriers to restrict the exchange of ambient water and water within the marina area.
- ❖ Install wave attenuators to reduce the force of incoming water, if protection is necessary. Wave attenuators do not restrict water exchange nor do they interfere with bottom ecology or aesthetic view. Furthermore, they are easily removed and do not significantly interfere with fish migration and shoreline processes.
- ❖ Design new or expanding marinas with as few segments as possible to promote circulation within the basin. The fewer the segments, the better the circulation.
- ❖ Use a de-ice bubbler system to aerate areas with poor circulation.

### **Use Environmentally Neutral Materials.**

- ❖ For new pilings and other structures that are in or above the water, use materials that will not leach toxic chemicals into the water and which will not degrade in less than ten years time, e.g., reinforced concrete, coated steel, recycled plastic, vinyl sheet piling.
- ❖ Be sure to contain shavings when field cutting plastic pilings and timbers.
- ❖ Purchase floatable foams that have been coated or encapsulated in plastic or wood. As these floats age, degraded foam is contained by the covering.
- ❖ Avoid exotic timbers that are not farm raised. Some tropical trees, such as greenheart and bongossi, are also naturally durable although their harvest maybe harmful to tropical forests.

To understand what is meant by “segment” see DNREC’s *Marina Guidebook*.

- ✧ Use naturally durable timbers conservatively. Black locust, cedar, chestnut, and white oak are naturally durable but expensive and may be hard to find.
- ✧ The use of wood treated with creosote for pilings and other structures in the aquatic environment is prohibited in Delaware. Wood pressure treated with chromated copper arsenate (CCA), ammoniacal copper zinc arsenate (ACZA), or ammoniacal copper arsenate (ACA) is often used. There is concern that these pressure treated timbers may also contribute to water pollution, however.

#### **Limit Shaded Areas Over the Water.**

- ✧ Near-shore bottom-dwelling organisms require sunlight. In order to provide them with as much sunlight as possible, limit the number of covered slips.

**Minimize the Need for Dredging.** New marinas must be located in areas where deep water access can be obtained with a minimum of excavation, filling, and dredging. Existing marinas that require maintenance dredging more frequently than once every four years should investigate practicable options to increase circulation or reduce sediment accumulation.

- ❖ Extend piers and docks into naturally deep waters.
- ❖ Locate slips for deep draft boats in naturally deep water.
- ❖ Dredge channels to follow the course of the natural channel.
- ❖ Use dredging methods, like hydraulic dredging, that minimize environmental impacts.
- ❖ Use turbidity curtains to contain suspended sediments.
- ✧ Provide dry storage for smaller boats.

#### **Follow Natural Channels.**

- ❖ Align entrance channels with natural channels to increase flushing.
- ❖ Boat lanes should progressively widen toward the seaward end and narrow toward the inland end to allow water to flow freely and maintain its velocity within the marina.
- ❖ Avoid locating the entrance channel perpendicular to the natural channel as shoaling (and, therefore, dredging) is a potential problem.
- ❖ Avoid long winding channels connecting marinas to open water.
- ❖ Where possible, establish two openings at opposite ends of the marina to promote flow-through currents.

#### **Employ Nonstructural Shore Erosion Control Measures.**

- ❖ Nonstructural measures, such as beach nourishment, marsh creation, and other methods that encourage the preservation of the natural environment are the preferred methods of shore erosion control.
- ✧ If non-structural measures alone are not sufficient to control erosion, use revetments, breakwaters, or groins to stabilize and ensure the long-term viability of the non-structural controls.
- ✧ As a last resort, use structural controls in this order of preference: low profile rock sills with wetland vegetation behind them, shoreline revetments, breakwaters, groins, and bulkheads.
- ❖ Minimize the adverse effects of erosion control projects on adjacent properties, navigation, threatened or endangered species, significant historic or archaeological resources, and oyster bars.

### **Conserve Water.**

- ❖ Equip all freshwater hoses with automatic shutoff nozzles.
- ❖ Fix leaks and drips.
- ❖ Install “low-flow” faucets, toilets, and showerheads.

### **Maintain Structures Using Clean Marina Practices.**

- ❖ Scrape, sand, and paint in-water and landside structures according to the same management principles as for vessels (refer to the Vessel Maintenance and Repair chapter).
- ❖ If feasible, move floating structures to shore for scraping, painting, and major repairs.



## Best Management Practices for Protecting Sensitive Areas

### **Minimize Impervious Areas.**

- ❖ Keep paved areas to an absolute minimum, e.g., just designated work areas and roadways for heavy equipment.

### **Use Upland and Inland Areas.**

- ❖ Locate buildings, workshops, and waste storage facilities in upland areas, away from fragile shoreside ecosystems, to the greatest extent possible. Upland areas also provide a measure of protection against floods.
- ❖ Locate parking and vessel storage areas away from the water where feasible.
- ❖ Consider inland areas for boat repair activities and winter storage. Use hydraulic trailers to quickly and easily move boats to inland storage locations.

### **Expand Upward.**

- ❖ Rather than adding wet slips, expand storage capacity by adding dry-stack storage, which provides the following environmental benefits:
  - Dry-stacked boats do not accumulate marine growth. Consequently, toxic antifouling paints are not necessary and the associated need to wash, scrape, and paint is eliminated.
  - Dry-stacked boats are less likely to accumulate water in their bilges. They are, therefore, less likely to discharge oily bilge water.
- ❖ Control stormwater runoff from dry-stack areas as well as from any expanded parking areas.
- ❖ Keep forklifts and other equipment well tuned to prevent grease or oil from dripping onto staging areas or into the water.

### **Conserve Sensitive Land.**

- ❖ Provide a serene setting for your marina by placing adjacent, sensitive land in a conservation easement. Income, estate, and property tax benefits are available.
- ❖ Sell or donate the land (or the development rights to the land) to a local land trust or a non-profit organization such as The Nature Conservancy or The Trust for Public Land.



*Landscape with native plants that require little care in terms of water, fertilizer, and pesticides.*

**Practice Water-wise Landscaping.** Save on water bills, reduce your maintenance activities, and protect water quality by minimizing your water use.

- ❖ Select plants, preferably native, that are suited to the existing conditions (i.e., soil, moisture, and sunlight) so that they will require little care in terms of water, fertilizer, and pesticides. Refer to Appendix II for information sources for beneficial native plants.
- ❖ Water only when plants indicate that they are thirsty: shrubs will wilt and grass will lie flat and show footprints. Water in the early morning or early evening as temperatures generally are cooler. Plants will not be shocked and water loss to evaporation will be minimized.
- ❖ Water deeply and infrequently rather than lightly and often. Deep watering promotes stronger root systems, which enable plants to draw on subsurface water during hot spells and droughts.
- ❖ Select equipment that delivers water prudently. Sprinklers work well for lawns. Soaker hoses or drip irrigation systems deliver water directly to the roots of shrubs, flowers, and vegetables with minimal loss to evaporation.
- ❖ Place mulch (wood chips, bark, grass clippings, nut shells, etc.) to a depth of 3-4" around plants to keep water in the soil, prevent weeds, and reduce the amount of sediment picked up by stormwater. Planting groundcover at the base of trees serves the same function.
- ❖ Group plants with similar water needs together. This practice will ease your maintenance burden, conserve water, and benefit the plants.
- ◇ Replace lawn areas with wildflowers, groundcover, shrubs, and trees.
- ◇ Recycle "gray water." Gray water is water that has been used once—maybe for dishwashing or in a washing machine—but is not overly contaminated. It can be filtered and used to water landscaped areas. Because regulations vary, be sure to check local ordinances for permit requirements and written approval before pursuing this option.
- ◇ Collect rainwater by directing downspouts into covered containers. Use the collected water on your landscaped areas.

## Best Management Practices for Creating Habitat Areas

**Maintain and/or Develop Vegetated Areas.** Vegetation filters and slows the flow of surface water runoff, stabilizes shorelines, and provides wildlife habitat, flood protection, and visual diversity.

- ❖ Maintain vegetated buffers (grassy or wooded) between all impervious areas (e.g., parking lots, boat storage areas) and the water.
- ❖ Plant vegetated areas with "beneficial" plants: those plants that require minimal care in terms of trimming, watering, and applications of fertilizer and pesticides. Native, or indigenous, plants demand little care since they are adapted to the local climate and soil types. Also, many horticultural varieties and imported plants may be considered beneficial if they have few maintenance requirements and if they do not displace naturally occurring vegetation (that is, if they are not invasive). Refer to Appendix II for Delaware native plant information sources.

- ❖ Select perennial plants instead of annuals. Perennial plants need only be planted once, tend to shade out most weeds, and few require additional water or maintenance.
- ❖ Choose plants that bear flowers, fruit, nuts, and seeds to attract birds, small mammals, and other wildlife.
- ❖ Maintain proper soil pH and fertility levels. Fertility describes the presence of nutrients and minerals in the soil. Acidity and alkalinity levels are indicated by pH. These two measures together tell you which plants your soil can support. Soil pH may be adjusted by adding lime (base) or gypsum (acid). Add organic matter such as compost, leaf mold, manure, grass clippings, bark, or peat moss to improve fertility.
- ❖ Annually, submit a soil sample to the University of Delaware's Cooperative Extension Service to determine fertility, pH, and application rates for soil amendments. Cost of the test is \$7.50. Contact the University of Delaware Soil Testing Program, 152 Townsend Hall, Newark DE 19717-1303, (302) 831-1392 (Phone), (302) 831-0605 (Fax), [kgartley@udel.edu](mailto:kgartley@udel.edu) (E-mail)
- ❖ Foster beneficial critters. For example, earthworms move through the soil feeding on microorganisms. In the process, they aerate the soil, improving the flow of water and air to plant roots.
- ❖ Compost leaves, branches, grass trimmings, and other organic matter. Use the mature compost to nourish your soil. Alternatively, chip branches and leaves and use as mulch to discourage weeds and to conserve moisture.

## Information Sources

Appendix I

Appendix II

Delaware Department of Natural Resources and Environmental Control (DNREC)

- For copies of DNREC's *Marina Guidebook* or *Marina Regulations*, call DNREC's Wetlands and Subaqueous Lands Section (302) 739-9943

The Nature Conservancy  
(302) 654-4707

The Trust for Public Land  
(202) 543-7552

U.S. Fish and Wildlife Service  
(413) 253-8200