Many launch types are available to meet the needs of various environments. This section can help you choose the appropriate design and construction method for your site.
### List of Figures, Tables and Case Studies

| Figure 3-1 | Concrete Mats – Variations and Specifications |
| Figure 3-2 | Concrete Mats – Variations and Specifications, cont. |
| Figure 3-3 | Wooden Stairs – Materials - Diagram from Iowa DNR Water Trails Toolkit |
| Figure 3-4 | Wooden Stairs – Variations and Specifications - Diagram from Iowa DNR Water Trails Toolkit |
| Figure 3-5 | Wooden Stairs – White Rock Park Detailed Profile |
| Figure 3-6 | Wooden Stairs – White Rock Park Landscape Profile |
| Figure 3-7 | Wooden Stairs – Fisherman’s Bridge |
| Figure 3-8 | Concrete Stairs – White Rock Park Side Profile |
| Figure 3-9 | Concrete Stairs – White Rock Park Bird’s Eye View |
| Figure 3-10 | Concrete Stairs – White Rock Park Detail of Grab Rail |
| Figure 3-11 | Concrete Stairs – White Rock Park Canoe Launch Channel |
| Figure 3-12 | Huntley Gill, Guardia Architects |
| Figure 3-13 | Cantilevers – Materials |
| Figure 3-14 | Cantilevers – MN Division of State Parks: Bird’s Eye View |
| Figure 3-15 | Cantilevers – MN Division of State Parks: Side Profile |
| Figure 3-16 | Cantilevers – MN Division of State Parks: Front Profile |
| Figure 3-17 | Floating – Annsville Creek Launch: Bird’s Eye View |
| Figure 3-18 | Floating – Annsville Creek Launch: Profile View |
List of Figures, Tables, and Case Studies

<table>
<thead>
<tr>
<th>Figure/Table</th>
<th>Case Study/Design</th>
<th>Location/Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>132</td>
<td>Case Study 3-1</td>
<td>Geotextile Mats – Deal Island WMA, St. Peters, MD</td>
</tr>
<tr>
<td>142</td>
<td>Case Study 3-2</td>
<td>Concrete Mats – York Bridge, Missouri River, MT</td>
</tr>
<tr>
<td>163</td>
<td>Case Study 3-3</td>
<td>Wooden Stairs – Jump Rock Park Launch Site</td>
</tr>
<tr>
<td>164</td>
<td>Case Study 3-4</td>
<td>Wooden Stairs – Concept Drawings for White Rock Park, La Grange, TX</td>
</tr>
<tr>
<td>167</td>
<td>Case Study 3-5</td>
<td>Wooden Stairs – Fisherman’s Bridge</td>
</tr>
<tr>
<td>177</td>
<td>Case Study 3-6</td>
<td>Concrete Stairs – Confluence Park, South Platte River, Denver, CO</td>
</tr>
<tr>
<td>181</td>
<td>Case Study 3-7</td>
<td>Concrete Stairs – White Rock Park, Colorado River, La Grange, TX</td>
</tr>
<tr>
<td>213</td>
<td>Case Study 3-8</td>
<td>Floating Launch Design – Janes Island Kayak Dock</td>
</tr>
<tr>
<td>217</td>
<td>Case Study 3-9</td>
<td>Annsville Creek Paddlesport Center, Hudson River Watertrail Case Study</td>
</tr>
<tr>
<td>225</td>
<td>Case Study 3-10</td>
<td>Bladensburg Waterfront Accessible Launch Example</td>
</tr>
<tr>
<td>241</td>
<td>Case Study 3-11</td>
<td>Portages – Pejepscot River Access, Androscoggin River, Libson Falls-Brunswick, ME</td>
</tr>
<tr>
<td>129</td>
<td>Table 3-1</td>
<td>Geotextile Mats Materials – Vendors</td>
</tr>
<tr>
<td>137</td>
<td>Table 3-2</td>
<td>Concrete Mats Materials – Vendors</td>
</tr>
<tr>
<td>204</td>
<td>Table 3-3</td>
<td>Floating Launch Design Materials – Vendors</td>
</tr>
</tbody>
</table>
### Launch Design Categories

<table>
<thead>
<tr>
<th>Ramps</th>
<th>![Ramp Illustration]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect for gradually sloped banks. Various materials are used depending on the desired or necessary characteristics of your site.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stairs</th>
<th>![Stairs Illustration]</th>
</tr>
</thead>
<tbody>
<tr>
<td>On sites where the banks are too steep to access by a ramp, stairs are an appropriate launch option.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elevated</th>
<th>![Elevated Illustration]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated launches can be used to bypass environmentally sensitive areas or areas of unstable ground. They are an appropriate choice for bulk-head banks as well.</td>
<td></td>
</tr>
</tbody>
</table>
Minimal Construction Design

Natural Surfaces

Incorporates the natural characteristics of a site to create a stable, safe surface for launching.
Natural Surfaces

The simplest and most cost-effective launches require little or no construction. Paddlers may use natural features (e.g., riverbanks, rock outcrops, banks adjacent to bridges) or existing shorelines with decks, bulkheads or boardwalks. Any of these can suffice as long as currents in the area are relatively modest, water depth allows for stable launching without damage to boats, and the bank or shore is close (vertically, above) to the surface of the water. Paddlers must also have enough space to place their boats in the water and easily step in or out of them.
Natural Surfaces: Materials 1

- Native soil, sand, gravel, or vegetation may be added to improve drainage and control erosion; fist-sized rip-rap can be added to trap sediment and fill in over time. See photo to right.

- Natural materials unique to a particular area may blend with the natural landscape and be most easily accessible (e.g., in the Chesapeake Bay region native crushed oyster shells are used to reinforce surface landings)

- Flat rocks can provide excellent firm surfaces. Avoid pointed or jagged rocks: they create unstable surfaces that can damage watercraft or injure paddlers.
Natural Surfaces: Materials 2

- Matting can be used to temporarily stabilize a sandy beach with a firm substrate.
- Gravel can be used to form simple ramps, preferably in areas with minimal wave action or water level fluctuation, as seen in the picture below.
- Braided rope, tied to a tree or other shoreline anchor, can serve as a makeshift handrail.
- Existing shoreline configurations (e.g., bulkheads, boardwalks, uneven rocks) can be converted into beach areas by adding firm sand substrates and/or gravel; these are called “implanted” beaches.

![Image of people launching a canoe.]
Natural Surfaces:  
Design Variations and Specifications

- Graded banks should be 12’ wide at water line tapered to 9’ wide at top and 15’ long (length will depend on water levels and shoreline stability).

- Launch area should be at least 20’ at sites that are used for both rafting and paddling.

Smith River, MT kayak and raft launch
Natural Surfaces: Design Variations and Specifications

- Preferred slope is 8%.
- The water level should be deep enough to enable launching without damaging a boat - at least 2 feet; kayakers may want at least 4 feet in depth to allow them to practice rolling.

Natural surface design on the James River, VA
Natural Surfaces: Advantages

- Cost-effective/low maintenance
- Native materials can be easily added or shifted to suit needs and changing conditions
- Low environmental impact due to the lack or low level of construction
- Can be combined with simple construction to restore habitat or control erosion
- Aesthetically pleasing, given the minimal visual alteration to natural shoreline
- Shoreline and beaches can provide easy anchorage
Natural Surfaces: Disadvantages

- May not be consistently accessible due to varying flows, water levels, exposure, or other climatic factors
- Can be slippery or difficult to manage when wet
- Can be steep
- Could cause damage to wetland habitats, depending on frequency of use
- Not easily spotted from rivers – paddlers may pass them by if there is no signage or clear indication of the access site
- Gravel ramps can erode easily and can scratch boats if paddlers do not land properly
- Chemicals from railroad ties or treated wood may pollute water where leaching occurs
Natural Surfaces: Photo 1
Clear Creek, Golden, Colorado
Natural Surfaces: Photo 2
Arkansas River, Salida, Colorado
Mat Launch Designs

Geotextile Mats
Geotextile mats/blocks are lightweight mats composed of open cells that allow water to pass through. If implemented correctly, they are effective at stabilizing banks.

Concrete Mats
A concrete mats create a permeable surface that is flexible to the characteristics of your landscape. They are often used in bank stabilization projects.
Geotextile Mats

Geotextile mats or blocks are lightweight, plastic mats composed of open cells that allow water to pass through to vegetation below. Since they enable access in environmentally sensitive areas without significantly disrupting riparian habitats or vegetation, they are often used near lakes or reservoirs or to access water from marshy areas.

To further understand Geotextile mats check out this link:

Geotextile Mats: Materials

Commercial products offer a flexible material that can support heavy weight while protecting vegetation. Interlocking mats are stabilized by topsoil or vegetative material spread into the cells. Grass can be also used at sites that see low to moderate use. Fist-sized gravel can provide a smooth surface for walking and also serve as reliable anchors.

The following vendors carry geotextile products and supplies. This is not an exhaustive list and is meant only as a sampling. It is not an endorsement of these companies or their products.

- Terram
- Propex ™ Geotextile Systems
- US Construction Fabrics
- Presto Geosystems®
- Boddingtons
- US Fabrics
- Carthage Mills
- Nilex
Geotextile Mats: Variations and Specifications

- Proper anchoring of mats and blocks is essential, as erosion can cause them to separate and scatter in the water, potentially becoming dangerous strainers in the water downstream.
- In areas that become submerged, gravel can be added into cells in order to add weight and anchor them in place.

Articulating concrete block installation with geotextile fabric
Same site with fully vegetated concrete block/geotextile installation completed
Geotextile Mats: Advantages and Disadvantages

Advantages

• Lightweight
• Made of recycled polyethylene
• Allow light to penetrate (40% open area per panel)
• Will not leach chemicals into water or surrounding riparian area
• Will not rot
• Have tread width of 20”

Disadvantages

• Can be more expensive than other materials
• Require the use of special tools
• May take longer to install than other materials
• Can create potentially dangerous strainers, down river or elsewhere on a water body, if erosion causes blocks to separate and scatter in the water.
Geotextile Mats Case Study:
Deal Island Wildlife Management Area,
St. Peters Creek, Maryland

Constructed as part of a traditional boat launch for motorized boats, this “soft” launch was built using Geoweb cellular confinement material filled with pea gravel. The launch serves a dual purpose of providing separate access to paddlers and stabilizing the shoreline from erosion.
Geotextile Mats Case Study: Deal Island Wildlife Management Area Specifications

**Dimensions:**
Geocell is 8’ wide x 16’ long x 6” thick

**Anchor:**
Geocell is filled with #67 pea gravel, naturally rounded with no sharp edges; placed on a 4” thick compacted layer of CR-6

**Slope:**
1:8, from an elevation of +1.5’ down to an elevation of -0.5’
Geotextile Mats Case Study:
Deal Island Wildlife Management Area Photos 1
Geotextile Mats Case Study:
Deal Island Wildlife Management Area Photos 2
Concrete Mats

Concrete mats follow the changing slope of a bank and do not require cutting or filling. Installation usually requires heavy equipment, such as an excavator with a spreader bar, or a crane.

Materials

Variations and Specifications

Advantages / Disadvantages

Case Study
Concrete Mats: Materials

The following vendors carry concrete mat products and supplies. This is not an exhaustive list and is meant only as a sampling. It is also not an endorsement of these companies or their products.

- Waskey
- Shoretec®
- Nilex
- Permatile
- R. H. Moore
- International Erosion Control Systems
- Robusta
- California Flexamat
Concrete Mats: Variations and Specifications

- Articulated mats follow the changing slope of a bank. They are supplied as mats, typically delivered via flatbed trailer, that interlock as they are being placed. Their installation usually requires heavy equipment, such as an excavator with a spreader bar, or a crane.

- Placing concrete mats may require some underwater preparation, as the ends of the mats are often submerged in the water, depending on the slope. Submerged areas may need to be sub-excavated and filled with a leveling course, such as washed gravel. If the bank soil is soft, it may require extra protection; an engineering fabric can be added or sub-excavation can be increased, along with the gravel leveling.
Concrete Mats: Variations and Specifications, cont.

Bank surfaces may need smoothing, so rod readings may be used, with the water serving as a leveling device. The first mat (usually the center one) should be placed carefully, as it is needed to align the others. Once the remaining mats are set, they interlock with each other. When all mats are in place, the loops on the upper end of the mats are pulled, using an excavator, to tighten the mats together. Loops are clamped off and buried. Pea gravel may be spread over the mats to fill spaces between the blocks, stabilizing them.
Concrete Mats: Advantages

**Advantages**

• Since they are pre-cast, concrete mats will not require coffer damming to install
• Concrete mats may be applied to a shoreline without significant alteration to its slope. Cutting or filling the bank is not necessary, as it might be with a concrete ramp that needs to be poured at a steady grade.
• Since there is less risk of deposition from the cut or erosion of the fill, there is less need for regular maintenance.
• Concrete mats typically have soil or gravel between the blocks and are therefore less developed or intrusive to a natural shoreline than poured concrete.
• If erosion becomes a problem, concrete mats can adapt to changing bank structures; if supporting soil is washed away, blocks may slide downward and provide protection to eroded areas.
• Suitable where access is shared with motorized boats.
• Given the gentle approach, concrete mats can be accessible to all users.
Concrete Mats: Disadvantages

Disadvantages

• Typically are more expensive than concrete slabs
• Are heavy (an 8’ X 26’ mat weighs approximately 5 tons) and require heavy duty equipment to install
• Installation can damage shorelines vegetation, when heavy equipment is used
• May not be considered aesthetically pleasing to some (disruptive to the natural look of shoreline)
• Excessive for non-motorized use launch sites.
Concrete Mats Case Study:
York Bridge, Missouri River, Montana

**Problem:** York Bridge was initially a motor boat launch site that was also popular for canoeists, mainly due to its location above a backwater. Due mainly to heavy boater usage, there were a number of erosion problems along the shoreline.

**Solution:** Slopes on the downstream side of the detention basin were smoothed and reinforced with an articulated concrete mat, and an existing ditch was filled in order to widen the launching area. Articulated concrete was chosen as an alternative to rip-rap, to mitigate the effects of erosion while providing an alternative access to canoeists. This enables canoeists to launch without competing with motorized boaters for space. Additionally, an access to canoeists and small boaters, it also makes the detention basin easily accessible for maintenance purposes.
Concrete Mats Case Study: York Bridge, Missouri River, Montana

A gravel road provides access to both the launching area and a detention basin used for maintenance purposes.
Concrete Mats Case Study:
York Bridge, Missouri River, Montana

An articulated concrete launch helps to protect against the effects of erosion while providing paddlers with a separate access site from heavy boat traffic.
Concrete provides an extremely stable surface for launching and are very adaptable to various landscapes. Metal grating is an option where loads are light.
Concrete Ramps

- Concrete ramps may be used as launches by themselves or in combination with floating launches, piers, bridges, dock abutments, bulkheads, and rock cribs. If the ramp connects to a floating launch using a bridge, a hinged metal transfer plate will allow an easier transition.

- Concrete must be installed in dry conditions. The area must be totally clear of water when any portion of the ramp extends beneath the surface of the water. The underwater area may need to be dried out with a cofferdam, a watertight enclosure that is temporarily used to pump water out of an area during construction. If lime is used in this process, it must be managed carefully so it does not enter the water where it can pose a danger to riparian species.

- Pre-cast concrete planks and panels should only be used in bodies of water with little to no current. Pre-cast slabs are heavy and must be placed using lifting equipment. Reinforced concrete is often used for underwater sections of the pre-cast ramp.
Concrete Ramps: Materials

Surface finish, including corrugated concrete, rock salt, or exposed aggregate may be applied to concrete to increase traction or improve its appearance. One popular finish uses 1” by 1” V-grooves formed at a 60-degree angle to the centerline. V-grooves should not be used on launches that serve wheelchair use as they are difficult to travel over/on when driving a wheelchair.
Concrete Ramps: Variations and Specifications

- The width and thickness of concrete ramps vary, but cast-in-place ramps are typically 6” to 8” thick and use rebar reinforcement.
- Ramps can be cast-in-place or composed of connected pre-cast slabs, planks, or panels.
- Can cover concrete with a layer of synthetic matting or even ‘AstroTurf’ to protect sensitive boats. (See picture on right, from Great Calusa Blueway, Florida.)
Concrete Ramps: Variations and Specifications, cont.

Important elements are using a downstream-pointing departure angle of 30 to 45 degrees, and hard-surfacing for anything below the frequent flood elevation (where permanent vegetation ceases). This allows skid steers to find a bottom in high-sediment areas, and helps projects in high-scour areas withstand the force of the water. It also creates an eddy just downstream of the launch at all flows, which makes it easier for the user.
Concrete Ramps: Advantages

- Provides the most stable, sturdy surface for launching
- Durable and not subject to rot or rust
- Easy to shape and work with, adaptable to slope needs; minimal additional construction needed
- Can be relatively inexpensive to construct
- Relatively low maintenance (depending on sedimentation levels); easy and inexpensive to repair
- Used to help mitigate erosion or assist with vegetative restoration
- Their noticeable presence can assist paddlers with locating take-outs from the river
- Can be surfaced aesthetically with materials such as river rocks, fieldstones, or salt finishing
Concrete Ramps: Disadvantages

- Can cause damage to riparian ecology, preventing growth of vegetation and impacting habitats.
- Surface can be slippery, especially when muddy or wet (corrugated concrete, rock salt, or exposed aggregate on the surface can provide effective traction).
- Coffer damming may be required for installation (will increase the cost and complexity of project).
- Can be damaged or crack easily due to freezing and thawing conditions.
- Usually not aesthetically “pleasing.”
- Construction vehicles, if needed during installation, will have a heavy impact on your site.
- Potential lime deposit down river during construction.
Concrete Ramps Photo 1: Salida Boat Ramp, Arkansas River- Salida, Colorado
Concrete Ramps Photo 2: Salida Boat Ramp, Arkansas River - Salida, Colorado

Salida’s concrete boat ramp is an example of a launch site that has helped contribute to the revitalization of a town. Before this launch was installed a few years ago, this corridor of the Arkansas River was both inaccessible and unfriendly to paddlers and the general public. The area had been severely neglected and had become a depository of debris and waste from industrial sites upstream.

Part of the Arkansas River Trust’s Whitewater Park and Greenway Project, installation of this boat ramp has helped to transform this spot into a popular site for launching, fishing, and other river-based activities. Native vegetation has replaced hundreds of tons of concrete along the banks and a whitewater course was installed, which plays host to an annual white water festival, FIBArk. Photo courtesy of Trevor Clark at the 2008 FIBArk festival.
Ramps – Other Materials

Ramps designed to support people and human powered craft can call on materials used for marina dock gangways and walkways, often aluminum structures with polyvinyl chloride (pvc) or a wood/synthetic surface. The walkway to the right on the Bronx River utilizes extremely sturdy and long-lasting steel grating made from galvanized metal.

Clockwise from top left: Anacostia River (credit: NPS); Bronx River (credit: NPS); 4th Street Slip
Stair Launch Designs

**Wooden Stairs**

- Large stones or timber used to build natural stairs can create excellent access along steep banks.
- Staircases composed of timber steps may be cost effective alternatives to concrete when working with a launch site along a steep shoreline.

**Concrete Stairs**

- Concrete stairs are particularly effective in providing access along steep shorelines. They are durable and easily maintained.
Wooden Stairs

Staircases composed of timber steps may be cost effective alternatives to concrete when working with a launch site along a steep shoreline. Timber can be easily cut and shaped to meet site specifications and may be built into a steep shoreline in a variety of manners, depending on a site’s needs.

For example, timber cut into rectangular or cylindrical piece could be installed from the bottom of a slope upwards, stacked one upon another, in order to reinforce an eroding slope.
Wooden Stairs: Materials

- Timber, typically pressure-treated (review environmental issues of chemically-treated wood)
- Reinforcement bars, rebar
- Soil, gravel, or “road base” (mixture of rough soil and class 6 gravel), used as fill
- Retaining walls, rip-rap (as needed)
Wooden Stairs: Materials

- Landscape filter fabric under base course
- Anchor timbers with 1/2" rebar stakes long enough to reach stable soil (24" min.)
- 4"- to 6"-deep, compacted, Class A, crushed-stone base course
- Tread fastened to timber run with 10" timber screws
- Geoweb system only on top tread; fill Geoweb with crushed limestone
- Bankfull Water Elevation
- Low-Flow Water Elevation
- River
- Hard-Surface Stairs Exposed to Current
- Recycled Plastic Timber Stairs
- Top of Access Geoweb
Wooden Stairs: Design Variations and Specifications

- Stairs may be constructed as boxes built on top of one another, ascending a slope, to help reinforce an eroding bank.
- The launch area at the base of the stairs needs protection from excessive currents in order to prevent undercutting; large rocks or a vegetative buffer may be used.
- Launch area at base of stairs should provide consistent access to the water, during changing water levels; surface should be sturdy and able to withstand varying flows.
- Handrails are most effective when they are 24” to 32” above the height of the steps; it is important that they not be too high or low for paddlers to be able to use.
Wooden Stairs:
Design Variations and Specifications

- Fill voids using 3/8" gravel mix with fines and compact
- Recycled 6"x6" plastic timbers
- Bottom 2-3 steps to be slab stone or concrete surfacing
- Anchor stakes
- Armor both edges
- Bankfull Water Elevation
- Low-Flow Water Elevation
- River Flow Direction

36° min. width
Wooden Stairs: Advantages and Disadvantages

Advantages

• Allows paddlers easier access from a steep or eroding shoreline
• Aesthetically pleasing and less disruptive to natural shoreline than concrete
• May be easily and inexpensively repaired, if damaged

Disadvantages

• Is not accessible to all
• Installation may be costly and may require alteration to shoreline
• May be susceptible to undercutting
• May require maintenance as stairs age and weather
Wooden Stairs: Case Studies

- Jump Rock Launch Site, Arkansas River, Salida, Colorado
- White Rock Park, Colorado River, La Grange, Texas
- Fisherman’s Bridge, Arkansas River, Salida, Colorado
Wooden Stairs Case Study: Jump Rock Launch Site

Jump Rock, a site along the Arkansas River, has a stairway constructed of 8” x 8” x 8’ treated timber. On the steeper part of the hill, the timbers are placed close together with the tread and rise at 8” in some areas. As the hill becomes less steep, the tread increases but the rise remains at 8” in order to reduce erosion and need for maintenance. At the top of the hill, where it is least steep, the tread and rise decreases to the point where the top few stairs are relatively shallow.
Wooden Stairs Case Study: Concept Drawings for White Rock Park Colorado River, La Grange, Texas

The following staircase, leading to a canoe launch below a 40 ft. cutback along the Colorado River was never constructed. However, the following designs for the staircase offer an effective solution to providing access along an extremely steep bank.
Wooden Stairs Case Study: White Rock Park

Detailed Profile
Wooden Stairs Case Study:
White Rock Park

Landscape Profile
**Wooden Stairs Case Study:**
**Fisherman’s Bridge, CO**

**Problem:** The slope at this popular raft and kayak launch site is very steep and vulnerable to erosion. In order to access the river, paddlers had to slide down the bank, which increased the erosion problem.

**Solution:** A 15 foot-wide timber staircase, with a metal slide for rafts and boats, was installed into the slope. Parallel metal bars running down the center of the staircase allow paddlers and rafters to slide boats and rafts to the water below.

Construction of the staircase was designed to maximize bank stabilization. Each stair level consists of a timber box filled with “road base,” a mixture of rough soil and class six gravel. Boulders placed at the base of the staircase provide protection from undercutting.
Wooden Stairs Case Study: Fisherman’s Bridge 2
Wooden Stairs Case Study: Fisherman’s Bridge 3

Profile View of Fisherman’s Bridge
Wooden Stairs Case Study:
Fisherman’s Bridge 4
Concrete Stairs

Concrete stairs are particularly effective in providing access along steep shorelines. They are durable and easily maintained and may be used in areas where water levels change dramatically, as they are likely to withstand currents and offer access at a range of water levels.
Concrete Stairs: Materials

Concrete can provide a level and lasting access point. Once a bank is prepared to accommodate the stair dimensions (which may require some digging out with equipment, such as a backhoe), a concrete foundation is created, which can be poured into molds reinforced with rebar or metal (left). A less expensive option can be built using pre-molded concrete slabs for the steps supported laterally by rocks found on site (right).
Concrete Stairs:
Variations and Specifications

• If steps are tapered in width as they descend to the water, the bottom steps should not be too narrow. Paddlers need at least 5’ and preferably 6’ to 12’ for launching.

• Handrails may be needed to provide additional support to paddlers where shorelines are excessively steep. They may not be needed in areas with shorter distances to the water or on less dramatic slopes.

• Installing a 4’ to 8’ staging platform at the bottom of concrete steps can be useful to paddlers. This may serve as a place where kayakers can get into their boats, put on their spray skirts, and slide into the water.
Steep shoreline grade prevents site from being entirely accessible: wide and deep concrete stairs provide access to base of an accessible trail because wheelchair or trailer wheels can fit the stair tread.
Concrete Stairs: Advantages and Disadvantages

**Advantages**
- Provide effective solutions to a steep slope or eroding bank
- May be more aesthetically pleasing than concrete ramps or mats
- Can be combined with boat slides to provide easy transport of boats to water
- Require relatively little maintenance; durable

**Disadvantages**
- Are not as easily accessible as concrete ramps or other launch types
- Can be expensive
- Not accessible to all
- May require use of heavy equipment for preparation of bank before installation
- Long-term maintenance must be done by hand, which may be unrealistic for some
- Inappropriate for high-scour or high-sediment-deposition setting, or where debris and ice are likely to damage stairs
Concrete Stairs: Case Studies

Confluence Park, South Platte River, Denver, Colorado

White Rock Park, Colorado River, La Grange, Texas
Concrete Stairs Case Study: Confluence Park, South Platte River

At the confluence of two rivers in downtown Denver, sets of concrete jetties offer river access at varying water levels. The whitewater course is part of a revitalization project along the South Platte River that began in the mid-1970’s.
Concrete Stairs Case Study:
Confluence Park, South Platte River 2
Concrete Stairs Case Study: Confluence Park, South Platte River 3
Concrete Stairs Case Study:
Confluence Park, South Platte River 4
Concrete Stairs Case Study:
White Rock Park, Colorado River 1

- Developing a launch site that is accessible to all on an excessively steep slope can prove difficult, particularly if the slope cannot be leveled. However, providing at least one accessible route to the launch area can make the site more accessible to paddlers with disabilities, who may be able to maneuver the transition with some assistance. This is clearly not a preferable accommodation, but it is what was realistic for this particular site.

- At White Rock Park, an accessible route was developed to the top of a concrete stairway launch area by leveling a 40’ cutback to 10’ through several switchbacks along a concrete trail. Every 30’ or so along the trail, level resting points were installed to accommodate wheelchairs. The actual launch, a concrete staircase, was built to accommodate the short 10’ drop to the water and to withstand mud accumulation after flooding. A transfer plate, or level platform, adjoins the staircase, providing an area where one can dismount a wheelchair and either lower themselves down the staircase or be assisted to their boat.
Concrete Stairs Case Study: White Rock Park, Colorado River 2

Side Profile
Concrete Stairs Case Study: White Rock Park, Colorado River 3

Bird’s Eye View
Concrete Stairs Case Study:
White Rock Park, Colorado River 4

Detail of Grab Rail
Concrete Stairs Case Study: White Rock Park, Colorado River 5

Canoe Launch Channel
**Docks / Piers (Floating Or Fixed)**

**Docks / Piers**
A pier or dock can be used independently as a launch or in combination with other structures. They are able to span marshes or shallow areas to enable launching in water of sufficient depth.

**Cantilevers**
Cantilever launches extend out over the water from the shore, sometimes appearing to float on the water.

**Floating**
Floating launches are structures that provide access while floating on the water. Typically composed of a deck, frame, and floats, they are anchored to the shore.
Docks / Piers

- Pier structures can be used independently as launches or in combination with other structures. They can span marshes or shallow areas to enable launching in water of sufficient depth.
- In some cases, “approach pads” or walkway structures are designed to enable access to the launch itself. Structures are composed of a deck and frame, which stand above water level at all times, and are supported by piers. While piles can be used in any depth of water, pipes rest on supports (usually concrete pads) and are not suitable for deep water.

Materials

Variations and Specifications

Advantages / Disadvantages

Photo Examples
Docks / Piers: Materials

- Decking is frequently made of wood, concrete, or wood-alternative materials
- **Piles** are usually made of treated timber, steel pipes, or concrete
- Pipe with diameters 1 1/2” and 3” is often used and preferable

Kayak launch from wooden dock

Treated timber piles on wooden dock
Environmental Impact of Pipe and Pile Installation

- Pier design and construction can create negative environmental impacts, as well as health ramifications for those involved in their construction. Piling methods should be researched for those involved in their construction. *Wetland Trail Design and Construction*, produced by the US Forest Service, is a resource that discusses pile installations in depth.

- While there is limited research available on the environmental impacts of piling, some methods clearly cause less disruption to sediments and vegetation than others. The process of “diving,” for example, is significantly less disruptive than “jetting,” which uses high-pressure hoses. Disturbances to sediments in sandy areas can be greatly reduced when low-pressure pumps are used to create an initial hole and sharpened piles are installed with a drop hammer.
Environmental Impact of Wood Preservatives

- According to some studies, the greatest likelihood of water contamination from a launch construction occurs from preservatives that are applied to pilings or floats in locations that come into regular contact with water. Many states have banned the use of oil-based preservatives containing creosote (CRT) or pentachlorophenol (PCP) in aquatic areas due to their demonstrated toxic effects from leaching, since soluble components separate and leak into the water.

- The US Government has banned the sale and use of what used to be the most common material used in pressure-treated wood used for pilings and decking, chromated copper arsenate (CCA).

- ACQ, an alternative to CCA, is a water-based wood preservative that prevents decay from fungi and insects (i.e., it is a fungicide and insecticide). There are currently four AWPA standardized ACQ formulations, ACQ Types A, B, C, and D. The different formulations allow flexibility in achieving compatibility with different wood species and end use applications.

- Water-based preservatives like ACQ leave a dry, paintable surface. ACQ is registered for use on: lumber, timbers, landscape ties, fence posts, building and utility poles, land, freshwater and marine pilings, sea walls, decking, wood shingles, and other wood structures.

- More information on ACQ can be found here: [EPA: Pesticides Regulation](#) and [Best Management Practices for Treated Wood in Aquatic and Wetland Environments](#)
Docks / Piers: Variations and Specifications

- Water level should be lower than the level of the deck at all times. It is helpful to accommodate various types of boats.
- Pier legs need cross bracing and bracketing to the frames for reinforcement and stabilization, as seen in the photo.
Docks / Piers:
Advantages and Disadvantages

Advantages

• Effective in areas of strong current
• Stable surface for launching
• Good choice for providing access to paddlers with disabilities; handrails or step-downs may be easily added
• Usually requires shoreline alteration
• Relatively inexpensive
• Easily visible from rivers
• (Pipe docks) Can be easily adjusted or removed

Disadvantages

• Does not accommodate extreme variations in water level
• (Piles) Can have damaging environmental impacts, such as altering currents if they disrupt flows or sediments
• (Piles made of treated wood) Can contaminate water
Docks / Piers: Photo 1

Hudson Shores Park - Watervliet, NY; Hudson River Maritime Museum
Docks / Piers: Photo 2

Cuyahoga River, OH
Cantilevers

Cantilever launches extend out over the water from the shore, sometimes appearing to float on the water, as seen in the image below. Their main supports on shore often include anchors that are partially submerged in water.
Cantilevers: Materials

Frequently made of wood, with steel or wood supports
Cantilevers: Variations and Specifications

- Can be used as a launch on its own or connected to other launch structures.
- Anchor and frame must be built to accommodate weights of the launch, boats, and paddlers.
- Engineers should be consulted to determine if a cantilever structure is the best option given the launch’s level of use.
Cantilevers: Advantages and Disadvantages

**Advantages**
- Can provide access in environmentally sensitive areas while protecting riparian habitat and shoreline vegetation
- Suitable in a wide range of locations and shoreline configurations
- Can have removable deck sections or posts
- Relatively inexpensive

**Disadvantages**
- Load capacity is limited; cannot support excessive weight
- Treated wood can be hazardous to the environment
- May not last as long as a fixed or floating launch due to support and weight limitations
Cantilevers Case Study:
Minnesota Division of State Parks 1

This cantilever launch is composed of deck sections and posts that can be removed seasonally. 2 ½” footing pipes with cross bolts in place are installed into the shore bottom until they are firm (18” to 24” below the water surface). 2” pipes are installed through metal deck brackets and into pipes, capped on upper threaded ends. Deck is leveled by set screws in brackets. Dock can be unbolted when screws are loosened and 2” pipes are removed. Dock sections can be removed, leaving the footing pipes in place.
Cantilevers Case Study: Minnesota Division of State Parks 2

Side Profile
Cantilevers Case Study: Minnesota Division of State Parks 3
Floating

Floating launches are structures that are not built into the bottom of the water body. Typically composed of a deck, frame, and floats, they are anchored to the shore. Paddlers launch from the deck, which is supported by the frame, while the floats beneath the frame provide buoyancy. Anchoring devices help to stabilize the launch and protect it from the elements. Pile guides are often used, allowing launches to adjust to changing water levels while keeping their decks horizontal and steady. When floating launches attach to connecting structures with varying heights (e.g., gangways), pile guides can help to maintain a relatively small cross slope, making launches more likely to be accessible to paddlers with disabilities.

Floating launches are most effective when used on water with little debris and minimal exposure to strong currents or waves. In general, they can withstand flow rates up to 0.25 feet per second. Floating launches should be removed and secured during flooding or high flow events, and unless they are specifically designed to endure ice formation, they should be removed before freezing occurs.
Floating: Materials

Concerns with Plastic and Wood Products

- A variety of materials can be used for the decks, frames, and floats that make up a floating launch. Consider the durability needs of your launch site when choosing your materials. Plastics are regularly used for this launch design and have various levels of durability.

- Treated wood is also commonly used for floating launches. Treated wood must be used with caution in regard to the environment and to the health of those involved in construction. While treated wood can last up to five times as long as untreated wood, there are risks involved with their preservatives and chemical treatments.
Floating: Materials

The following vendors carry floating launch products and supplies. This is not an exhaustive list and is meant as a sampling. It is also not an endorsement of these companies or their products.

- Mod-U-Dock
- Connect-A-Dock
- Traveldock™
- CMI Waterfront™ Solutions
- Flotation Systems, Inc.®
- GatorDock™
- Tiger Docks
- ShoreMaster
- JetDock
- Dock Floats Ltd.
- Alumidock®
Floating: Deck Materials

- Wood is simple and inexpensive to use; pine, redwood, cedar, and cypress are common choices, but they will not last very long unless treated with a preservative.
- Metal decking, such as aluminum, is used mainly for heavy-use launches that also serve motorized boats. Metal grating provides effective drainage and traction.
- Alternative materials include wood/plastic composites, vinyl, and various plastics made of recycled materials that are made to look like wood. These materials may be more expensive and require additional support devices, but are more resistant to damage and warping than wood, and require less maintenance.

Galvanized steel frame floating dock with marine-grade PVC. No toxic chemicals are in this recyclable decking.
Floating: Frame Materials

- **Wood** - Often used, but will last only 2 to 3 years if untreated
- **Metal** - Either lightweight aluminum or galvanized metal
- **Plastic** - Water resistant and will not degrade in water as rapidly as other materials
- **Steel tubing** - Used for floats and frames, and attaches to deck with brackets. Steel can be coated to increase durability.

Aluminum framed floating dock with non-slip deck surface
Floating: Float Materials 1

- Polyethylene, the most frequently chosen plastic, can function as both a frame and float; they may have grooves and brackets that easily attach to shoreline structures or floats may have built-in cleats, which facilitate anchoring.

- When expanded polystyrene foam (EPS) is used, the best choice is extruded closed cell because it has the strongest inner structure; it must be used with a protective covering to prevent damage from chemicals, water, and debris.

- Plastic float drums made of rotationally molded polyethylene are more durable than EPS and provide protection from impact damage, animals, and the effects of ultraviolet (sun) light; these are most effective when filled with EPS, which act as shock-absorbers and protect drums, if damaged, from losing buoyancy.
Floating: Float Materials 2

- Fiberglass float drums are not as strong as plastic float drums or as readily available, but they are lightweight and water-resistant. Fiberglass will degrade in sunlight over time more than most plastics.

- Foam-filled tires provide effective stabilization in areas with heavy debris or current; these can be made of recycled tires filled with EPS and capped with plywood. Commercial versions are available that are pre-made sealed and attached.

- Recycled 50-gallon cooking oil drums can also be used, but must be cleaned professionally to safeguard against contamination. Motor oil drums or any drums that have held noxious or hazardous materials should never be used.

- Concrete floats are sturdy and stable, but are also costly and heavy.

- High-density polyethylene (HDPE) can be used for both flotation and for framing, as seen in the image to the right.
Floating:
Variations and Specifications

- May be used in combination with bridges, **gangways**, fixed piers, or **bulkheads** to enable paddlers to put-in at water of sufficient depth. These structures may be attached with hinges and used across shallow areas to provide access to a floating dock; they should have slopes of less than 20 degrees (or no more than 8.33%) and should remain horizontal at high water levels. Equip with handrails to offer maximum stability for users.
- May be used in combination with elevated walkways or geotextile mats in environmentally sensitive areas, in order to prevent damage to riparian areas.
- May be used in combination with motorized boat ramps to enable hand-launching.
- Needs a deck that rises at least 2 feet above water to enable safe access.
- Should float on at least 3 feet of water.
- Should not rest too high above the surface of the water, as this can make transitions from canoes and kayaks difficult.
Floating: Advantages

**Advantages**

- Adjusts to fluctuating water levels – (it’s always the “right” height)
- Provides a sturdy surface, and a solution to unsafe conditions or inconvenient access
- Has few long-term environmental effects
- Is easily removable in inclement weather or heavy flows, and may therefore requires less maintenance
- Provides an alternative to gravel ramps that will erode in areas of stronger waves or currents
- Is easy to purchase and assemble; allows for flexibility in design
- When wet, is not as slippery as launches with sloped surfaces
- Is unlikely to scratch boats
- Keeps feet dry during cold weather paddling
Floating: Disadvantages

**Disadvantages**

- Not appropriate for all access locations. Use should be limited to areas where the minimum water depth is 3+ feet at all times, changes in water level are slow, and exposure to the elements is minimal.
- May not consistently be accessible to all, since slopes of connecting structures may alter with changing water levels. Locks and **piles** may be used to create a specific elevation and keep the cross slope to a minimum.
- The launch may be exposed to stronger currents than it can withstand and additional structure may be needed.
- The anchoring process must be carefully considered, as it must take into account particular climate and site conditions. When placing anchor piles, the combination of wind, wave, current, and impact forces should be accounted for.
- Not effective for use in areas where tidal fluctuations are rapid and extreme. Floats may be beached at low tide or floats can disrupt sediments as they rise with high tide.
Floating Launch Design: Case Studies

Janes Island Kayak Dock, Dougherty Creek Canal, Janes Island State Park, Maryland

Annsville Creek Paddlesport Center, Hudson River Greenway Water Trail
Hudson Highland State Park, New York

Bladensburg Waterfront Accessible Launch,
The Maryland-National Capital Park and Planning Commission
Floating Launch Design Case Study: Janes Island Kayak Dock

Problem:
• Paddlers needed an alternative launch site at a busy marina. The existing concrete boat ramp was crowded with powerboat use and its slippery surface and steep incline made it hazardous for paddlers. Since the entire shoreline is bulk headed, there were no “soft landing” alternatives to provide paddlers with access to the water.

Solution:
• Maryland Department of Natural Resources purchased a floating 8’ x 20’ dock designed specifically for canoes and kayaks that attaches to bulkhead pilings with metal rings. The new launch was placed outside the entrance to the marina basin so that paddlers do not have to cross incoming and outgoing boat traffic into the basin. Paddlers access the launch from a ladder, so it is not easily accessible to those with disabilities.
Floating Launch Design Case Study: Janes Island Kayak Dock Specifications

Deck:
2’ x 6’ with 3” x 6” side stringers

Frame:
Wood, 2’ x 6’ cross stringers, ¼” steel brackets reinforce outside corners

Floats:
Polyethylene shell filled with foam, 8” x 20” x 72” long
Floating Launch Design Janes Island Kayak Dock Photo 1
Floating Launch Design Janes Island Kayak Dock Photo 2
Floating Launch Design Case Study: Annsville Creek

• Commercially manufactured floating launches may be used in combination with other structures, such as gangways or pier launches. Wholesalers sell floating launches built of pre-fabricated modular sections that can be connected together to adapt to site specifications.

• The following photos and designs portray access at Annsville Creek to the Hudson River Greenway Water Trail, a tidal river with water levels that may fluctuate 4 feet between tides.

• Several different structures are used at this site to accommodate paddlers at different water levels: a modular polyethylene floating launch connects to a wooden floating dock that is accessible from a concrete landing on the shore via two parallel aluminum gangways. The floating launch has four kayak slots or boat slides, where paddlers can easily transition into and out of the water. The entire launch configuration is accessible and is used to teach paddlers with disabilities, as well as to train instructors who teach paddlers with disabilities.
Floating Launch Design Case Study: Annsville Creek Specifications

**Floating Launch:**
22’ wide x 30’ long; structure made of 234 polyethylene polymodules.

**Wooden Floating Dock:**
8’ wide x 30’ long, connects to floating launch and two transition plates.

**Transition Plates:**
Two parallel aluminum gangways, each 4’ wide x 25’ long at shoreline; extends into water 42” below shoreline level

**Reinforcements:**
Rip-rap extends from edge of concrete landing across half of gangway length

• Total width of kayak slots = 16.67’
• Small, upright, inverted modules on outer edge of launch are vented to allow for adjustment.
Floating Launch Design Case Study: Annsville Creek 1

Bird’s Eye View
Floating Launch Design Case Study: Annsville Creek 2

Profile View

REVISED FLOATING DOCK ANCHORAGE SYSTEM
Floating Launch Design: Annsville Creek Photo 1
Floating Launch Design: Annsville Creek Photo 2
Floating Launch Design: Annsville Creek Photo 3
Floating Launch Design: Annsville Creek Photo 4

Several views of pieced-dock systems.
Floating Launch Case Study: Bladensburg Waterfront Launch Photo 1
Floating Launch Case Study: Bladensburg Waterfront Launch Photo 2
Elevated Walkways and Portages

The main focus of this guide is launch development, but an important additional element of site design is creating appropriate pathways to launch sites.
Elevated Walkways

Elevated walkways are raised structures that allow paddlers to access launching areas without having direct contact with the ground. They are effective in minimizing potential impacts from recreational use on riparian habitats, fragile shorelines, or other environmentally sensitive areas. While providing a stable surface, elevated walkways can also prevent erosion, protect existing vegetation, and promote vegetation of damaged areas. Elevated walkways usually let light penetrate to the ground below so that vegetation beneath them receives the sunlight necessary for growth.
Elevated Walkways: Materials

Typically constructed from expanded metal, aluminum, fiberglass, or wood. They are most effective when used with tripods or other above-ground supports. These can include posts that are driven into the bank; however, posts should not be installed too close to the edge of the bank, or they may contribute to erosion. If a ladder is used, it should have minimal contact with the bank or shoreline vegetation at all water levels. Shorter walkways are preferable so that wildlife may access water easily.
Elevated Walkways: Variations and Specifications

Elevated walkways are versatile:
• They may be combined with other walkways or connecting structures to provide access to floating or other types of launches.
• They may be attached to stairs or ladders that lead to launch structures or rest on the bottom of a river or lake.
• They can be cantilevered over a river while supported by a tripod.
Elevated Walkways: Advantages and Disadvantages

Advantages

• Keeps people off vegetation
• Allows native vegetation to grow
• Provides access and directs people to recreational sites
• Protects investment - stream bank and restoration work
• Prevents trampling and erosion of vegetation
• Protects fish and wildlife habitat

Disadvantages

• Moderately expensive
• Requires maintenance
• May need to be seasonally removed, at least partly
• Drilling pipe for walkways requires heavy machinery and may be difficult and destabilize banks
• Aesthetics - not natural structure
Elevated Walkways:
Bladensburg Waterfront Launch Photo 1
Portages

Portages are land routes used to transport boats to and from a launch area or between access sites. Where dams or other obstructions interrupt a paddling route, portages can provide a direct, often less hazardous path from one water access point to another.

Portages can also serve as detours around difficult sections of water that paddlers choose not to run, and they may serve as navigable connections between lakes or other bodies of water, helping to create a continuous paddling route. While this chapter discusses designs for portages around dams, the information provided may be applicable to portages in each of these settings.
Portages: Materials

- Portages can be simple routes, such as trails made of soil, gravel, or asphalt. They can also be built structures, such as staircases with chutes or slides. The materials used and amount of construction necessary will depend on circumstances at an individual site such as the shore configuration, frequency of usage, dam ownership and available funds.

- Signage is crucial to making a portage visible to paddlers and for informing them about potential hazards on the water. Regardless of their visibility from the water, portages should be clearly marked in order to provide paddlers with sufficient time to reach the shore and take out. Clear and appropriate signage should discourage paddlers from attempting to clear a low head dam or spillway.
Portages: Regulations

- Some dam owners have installed signage to educate paddlers about potential dangers. Dams for hydropower use may be required to have signage. The Federal Energy Regulatory Commission (FERC) provides regulatory oversight at hydropower dams to help develop and maintain a low hazard environment for the public, and considers designated and well-marked portages to be crucial communications tools to inform paddlers portaging around, putting in, or taking out at a hydropower dam.

- Licensing requirements issued by FERC require hydropower applicants to review recreational needs in the areas around their facilities. Licensees must assess and update the capacity of their public recreational facilities during the term of the license.

- For further information on the relationship between hydropower licensing and recreational use and liability, see:

  “Hydropower Relicensing and Recreational Liability”
Portages: Variations and Specifications

• According to *FERC Guidelines for Public Safety at Hydropower Projects*, a portage should not be located within 300 feet of a dam, spillway, or powerhouse.

• The following general recommendations for portage areas are gathered from several sources, including an April 2003 assessment of the Trinity River in Texas.

• An effective Portage should include:
  – Clear, well-marked signage allowing paddlers sufficient time to reach shore before the take-out
  – A path at least 2’ wide around the dam, with a slope no steeper than a 1:3
  – An accessible portage featuring a slope that does not exceed 8.33% or 1:12
  – At least 8’ overhead clearance on the path and 4’ to 8’ clearance on either side
  – A vertical distance of 12” or less between the height of a boat and shore
  – A route that minimizes the distance that paddlers must carry their boats
  – Access points located on inside bends or areas of calm water
  – A backup or second path downstream from the portage access point upstream from a dam, when possible, giving paddlers an additional second opportunity area to take out.
Portages: Variations and Specifications
Portages: Advantages

Advantages

• Provides defined and safe routes around dams and other structures that can be obstacles for paddlers, as long as they are well located and clearly marked
• Enables paddlers to navigate a somewhat continuous route along a water trail
• Gives paddlers designated routes to transport their boats between parking areas and launch sites
• May prevent damage to riparian or other sensitive areas by directing paddlers to a designated route

Portages that require little maintenance
Portages: Disadvantages

Disadvantages

- May not be easy for paddlers to manage while transporting their boats, if portages have a steep slope, uneven surface, or limited space
- May not provide paddlers with sufficient time or space to take out, especially if currents or winds are strong, if portage is located immediately upstream of a dam or other obstruction
- May be difficult to locate or access if not clearly marked

An extremely low maintenance and rather tough portage to navigate!
Portages Case Study: Pejepscot River Access

Pejepscot River Access, Androscoggin River, Lisbon Falls-Brunswick, Maine

Pejepscot Dam, Androscoggin River, Maine
Portages Case Study: Pejepscot River Access

**Problem:** One of the largest rivers in Maine, the Androscoggin hosts 28 dams along its 170 river miles. Not all of the dams have navigable routes around them; some require excessively long portages or do not provide portage trails at all. Other dams have portage trails that provide access both upstream and downstream. Most portage trails are marked with signs, however dam warnings are not easily visible on all sections of the river.

**Solution:** The Pejepscot River Access, downstream of Lisbon Falls, offers a solution to launching from a steep, rocky, and unstable shoreline where boulders, rock fragments, and fallen tree limbs make river access a challenge. Takeout occurs just above the dam, and a short portage through the woods connects paddlers with access just below the dam. A metal staircase, with a handrail on one side and a carpet-covered wooden slide on the other, enables paddlers to easily maneuver their boats down to the water. The carpet provides traction and helps to protect boat bottoms from damage. The staircase leads to a rocky, but sturdy and level launch area at the water’s edge.
Steel canoe portage stairway with padded canoe slide in place to allow canoes/kayaks to be slid down to the river for launching
Resources – Chapter 3

• Guidelines for Developing Non-Motorized Boat Launches in Florida – Florida Fish & Wildlife Conservation Commission
• Iowa Water Trails Toolkit – Iowa DNR
• Construction Site Best Management Practices Manual – State of California Department of Transportation
• Wetland Trail Design and Construction – US Forest Service
• Environmental and Aesthetic Impacts of Small Docks and Piers – NOAA Coastal Ocean Program
• Minnesota Division of State Parks
• Floating Trail Bridges and Docks – US Forest Service
• Best Management Practices for Treated Wood - Western Wood Preservers Institute
• Streambank Revegetation and Protection: A Guide for Alaska – AK Department of Fish & Game
• Hydropower Relicensing, Recreational Liability, and Access – American Whitewater
• Guidelines for Public Safety at Hydropower Projects – Federal Energy Regulatory Commission
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Slide 121: http://www.greatfallsinformation.com/smithriver/
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Slide 149: Left - Hudson River Valley Greenway Cheviot Park, Germantown, NY
Slide 149: Right - Courtesy of the National Park Service
Slide 150: Courtesy of the National Park Service
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Slide 152: Courtesy of the National Park Service
Slide 153: Photo courtesy of Trevor Clark at the 2008 FIBArk festival
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Slide 193: Left image - Hudson River Valley Greenway
Slide 193: Right image - photo courtesy of Bob Campbell and Hudson River Valley Greenway
Slide 194: Right image - Share the River - Cuyahoga River, Cleveland
Slide 195: http://www.geocities.ws/dock_king/
Slide 196: http://www.nachi.org/deck-inspections.htm
Slide 197: http://helicon.meccahosting.com/~a0008353/dock.htm
Slide 203: Courtesy of the National Park Service
Slide 205: http://www.modudock.com/
Slide 206: http://www.chesapeakedock.com/services-floatingdocks.cfm
Slide 207: Courtesy of the U.S. Forest Service
Slide 208: http://hdpeinc.com/
Slide 215, 216: Maryland Department of Natural Resources
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Slide 223, 224: Hudson Valley Watertrail Association and the National Park Service
Slide 225, 226: Maryland Department of Natural Resources
Slide 227: Left image - Maryland Department of Natural Resources
Slide 227: Right image - http://walkacrossvirginia.blogspot.com/2012/05/day-11-12-dam-portages-above-lynchburg.html
Slide 228, 229: Maryland Department of Natural Resources
Slide 230: http://www.bestkayakdocks.com/
Slide 232, 234: Maryland Department of Natural Resources
Slide 234: Maryland Department of Natural Resources
Slide 235: http://walkacrossvirginia.blogspot.com/2012/05/day-11-12-dam-portages-above-lynchburg.html
Slide 236: Left image - Marshall L. Olson and Oliver L. Ammons presentation: Through Paddling on the Little TN River
Slide 236: Right image - New River Trail State Park - Mark.Hufeisen@dcr.virginia.gov
Slide 238: top image - Lelia Mellen, National Park Service
Slide 238: bottom image - Lelia Mellen, National Park Service
Slide 239: Lelia Mellen, National Park Service
Slide 240, 242: http://www.brunswickme.org/departments/parks-recreation/parks-facilities/parks-natural-areas/