

RESERVOIR LAND STEWARDSHIP DESIGN STANDARDS

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THE CITY OF
COLUMBUS
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DEPARTMENT OF
PUBLIC UTILITIES

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COLUMBUS
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RECREATION AND PARKS
DEPARTMENT

The draft standards are available online at www.columbus.gov/watershed.
For further information or questions, please call 614-245-0451.

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Abbreviations

| | |
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| ACQ | Alkaline Copper Quaternary |
| CRPD | Columbus Recreation and Parks Department |
| FRP | Fiber-Reinforced Plastic |
| NGVD | National Geodetic Vertical Datum |
| NRCS | Natural Resources Conservation Service |
| ODNR | Ohio Department of Natural Resources |
| OEPA | Ohio Environmental Protection Agency |
| ORAM | Ohio Rapid Assessment Method |
| OSHA | Occupational Safety and Health Administrations |
| PCP | Pentachlorophenol |
| PE | Professional Engineer |
| PVI | Paths, Views, and Invasive |
| SAV | Submerged Aquatic Vegetation |
| TRM | Turf Reinforcement Mat |
| USACE | U.S. Army Corps of Engineers |
| USFWS | U.S. Fish and Wildlife Service |
| WQC | Water Quality Certification |

Glossary

Bank – the rising ground immediately bordering a body of water.

Building – any structure having a roof supported by columns or walls, or any series of structures separated only by "fire separations" but contained under a common roof or within common walls and requiring a building permit in accordance with Title 41 of the Building Code that is used for shelter, occupancy, enclosure, or support of persons, animals, or property.

Clear cutting – removal of all or most vegetation in a given area.

Coniferous tree – trees having needle-shaped or scalelike leaves, often evergreen and including forms with true cones. Examples include pines (*Pinus* spp.), spruces (*Picea* spp.), baldcypress (*Taxodium distichum*), tamarack (*Larix laricina*), eastern redcedar (*Juniperus virginiana*), and eastern hemlock (*Tsuga canadensis*).

Contiguous landowner – a landowner who owns property which shares a border with city property directly adjacent to Hoover, O'Shaughnessy, or Griggs reservoirs.

Contiguous property – privately-owned property which shares a border with city property directly adjacent to Hoover, O'Shaughnessy, or Griggs reservoirs.

Deadweight freeboard – the distance between the water surface and the dock with a live load of zero (i.e. supporting the weight of only the dock structure itself).

Drive-on dock – a floating dock which allows a vessel to be driven onto the dock directly from the water.

Embankment stabilization – the use of engineered structures, vegetation, or land management practices to maintain the stability of the shoreline from future erosion.

Emergent vegetation – plants rooted in underwater sediment whose leaves and stems extend out of the water.

Encroachment – any unauthorized maintenance or unauthorized building, structure, or personal property that extends beyond the property line of a contiguous landowner onto city owned or controlled property.

Filtered view corridor – gaps in vegetation that provide a desired view, created through selected pruning or limbing of vegetation on city owned property.

Finger dock – a secondary dock extension from the header dock.

Floating dock – a dock which, rather than having supports driven into the lake substrate, is anchored to the land on one end and suspended in the water, rising and falling with the water levels.

Freeboard – height from water surface to the top of the dock decking.

Hazardous trees – as defined by the USFS, dying trees, dead parts of live trees, or unstable live trees that are within striking distance of people or property and have the potential to cause property damage, personal injury, or fatality in the event of failure.

Header dock – the primary structure of a floating dock to which other dock sections or a ramp are attached.

Herbaceous vegetation – vascular plants without significant woody tissue above or at the ground.

Invasive species – species that are both non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm, or harm to human health, according to the National Invasive Species Council.

Land Stewardship Agreement – a legal agreement between the City and the contiguous landowner that allows certain privileges, and may include the establishment of paths, filtered view corridors, or installation of a private boat dock. The land stewardship agreement will include a land stewardship design plan that is site specific and details the extent and location of the authorized access to the reservoir.

Land Stewardship Application – an application, submitted by contiguous landowners to the city, requesting a Land Stewardship Agreement.

Land Stewardship Design Plan – a document prepared by the city and available online which will indicate the contiguous property's eligibility for access amenities such as a path, dock or filtered view corridor.

Land Stewardship Design Standards – the criteria by which the city will administer the Land Stewardship Program regarding access amenities such as a path, dock or filtered view corridor.

Land Stewardship Program – a program administered by the City of Columbus, Department of Public Utilities, Division of Water, Watershed Management Section which permits contiguous landowners to legally access the city's reservoir property for the purposes of establishing and maintaining a path, establishing a filtered view corridor, removal of invasive species, or installation and use of a private boat dock.

Live load – all the forces that are variable within a structure's normal operation cycle, such occupancy by people and furniture, but not including construction or environmental loads.

Live load freeboard – the distance between the water surface and the dock with a given live load.

Nature Preserve – land designated by the City of Columbus Parks and Recreation and managed to provide for its preservation and protection against modification, encroachment, or other use that would destroy its natural conditions or impact natural heritage.

Normal pool elevation – Listed below for each reservoir (National Geodetic Vertical Datum [NGVD] 1929):

Hoover Reservoir: 894'
O'Shaughnessy Reservoir: 848.5'
Griggs Reservoir: 756'

Ornamental trees – a native or non-native tree species or cultivar purposefully planted for its aesthetic appeal.

Overland path – a designated route on city property that provides a contiguous landowner access to the reservoir.

Platform Dock – a dock that is attached to shore by a ramp and generally is described as a square or rectangular shape (although it may take different shapes) and can moor multiple vessels from respective sides.

Potential wetland area – an area identified during preliminary surveys as a having the potential to be designated as a wetland, but not yet having had an official wetland delineation.

Ramp – the section of the dock that connects the floating portion of the dock to the shore.

Riprap – the placement of rocks or other similar materials to prevent or reduce shoreline erosion.

Seasonal dock structures – a dock removed from the reservoir and stored on land during the colder months when docks are not in use.

Shoreline buffer – a vegetated zone along a reservoir's shoreline which serves to protect water quality, stabilize shoreline soils, mitigate flood flows, provide habitat for fish and wildlife, and improve aesthetic appeal.

Shoreline erosion – the gradual or rapid removal of sediments from the shoreline, caused by a number of factors including storms, wave action, rain, ice, winds, runoff, and loss of trees and other vegetation.

Shrubs – Woody species that, at maturity, typically do not reach a height of at least 20 feet and include: haws (*Viburnum* spp.), honeysuckles (*Lonicera* spp.), buckthorns (*Rhamnus* spp.), burning bush (*Euonymus* spp.), chokeberry (*Aronia* spp.), roses (*Rosa* spp.), serviceberry (*Amelanchier* spp.), spicebush (*Lindera* spp.), sumacs (*Rhus* spp.), and other low-growing, similar species.

Spuds – metal posts, no wider than 4" in diameter, inside a sleeve attached to the dock that stabilize the dock by use of friction against the riverbed and not by being driven, drilled, augured or pushed into the riverbed. The "foot" end of the spud (the portion against the river bottom) must be capped or otherwise closed and not be an open pipe. Spuds should not have chisel shaped or pointed ends.

Stairs/stairway – risers and treads that connect one level with another, including any landings and platforms in between those levels.

Stepping stones – large stones embedded in soil or river gravel to form steps along a path.

Steps – a type of stairway, typically installed outdoors on a gradual slope, with broad treads connecting relatively short risers.

Submerged aquatic vegetation – rooted, vascular plants that grow completely underwater except for periods of brief exposure at low water levels.

Trees – Woody species that, at maturity, typically reach a height of at least 20 feet and include : ashes (*Fraxinus* spp.), elms (*Ulmus* spp.), maples (*Acer* spp.), oaks (*Quercus* spp.), pines (*Pinus* spp.), poplars (*Populus* spp.), birches (*Betula* spp.), beeches (*Fagus* spp.), dogwoods (*Cornus* spp.), buckeyes (*Aesculus* spp.), hickories (*Carya* spp.), walnuts (*Juglans* spp.), mulberries (*Morus* spp.), pawpaw (*Asimina triloba*), persimmon (*Diospyros virginiana*), tuliptree (*Liriodendron tulipifera*), locusts (*Robinia* spp.; *Gleditsia* spp.), sycamore (*Platanus occidentalis*), hackberry (*Celtis occidentalis*), black gum (*Nyssa sylvatica*), sweetgum (*Liquidambar styraciflua*), sassafras (*Sassafras albidum*), eastern redcedar (*Juniperus virginiana*), redbud (*Cercis canadensis*), eastern hemlock (*Tsuga canadensis*), spruces (*Picea* spp.), catalpas (*Catalpa* spp.), hawthorns (*Crataegus* spp.), cherries/plums (*Prunus* spp.), and other similar species.

Vegetation stratum – a vertical layer of vegetation with a common height range. Commonly defined vegetation strata include forest floor, herbaceous, shrub, understory, and canopy.

Woody vegetation – category of plant species producing hard, supportive woody tissue, such as bark, from cellulose and lignin.

Wetland – as defined by USACE, areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wetland delineation – determination of wetland boundaries according to the 1987 USACE Wetland Delineation Manual and applicable regional supplements.

DRAFT

1.0 INTRODUCTION

Hoover, O'Shaughnessy, and Griggs Reservoirs are owned and operated by the City of Columbus to provide drinking water to 1.2 million people and over 4,000 acres of recreational opportunities for residents and visitors throughout Central Ohio. The city property surrounding these reservoirs is adjacent to approximately 1,200 private residential properties. The city's Land Stewardship Program protects city property along the reservoirs while permitting contiguous landowners to legally access the city's property for the purposes of maintaining a path, establishing a view corridor, removing invasive and noxious species, and/or installing a boat dock in accordance with the Land Stewardship Standards.

PROGRAM HISTORY

In the 1980s, with a growing population and an increasing demand for superior drinking water, the city recognized the need to maintain and protect its reservoirs. Around 1989, the Waterways Task Force was formed and given the responsibility of drafting management plans for each of the city's three reservoirs. The reservoir management plans were completed in 1990 (Hoover), 1991 (O'Shaughnessy), and 1995 (Griggs). In 1994 the Department of Public Utilities, Division of Water created the Watershed Management Section to oversee implementation of the Waterways Task Force plans in conjunction with the Columbus Recreation and Parks Department (CRPD).



The Land Stewardship Program has evolved several times, including the addition of the 50/20/30 rule in 2008, PVI (Paths, Views, and Invasive) standards in 2015, and the 2019 Land Stewardship Program Update. Throughout this time, the Columbus Department of Public Utilities has remained committed to maintaining the reservoirs for the primary function of providing a quality drinking water supply for our customers while also providing the community with compatible recreational opportunities.

COMPREHENSIVE PROGRAM UPDATE

The City of Columbus has updated the reservoir Land Stewardship Design Standards to clarify and update the program requirements, combining them in one document. The intent of the update is to ensure that the standards, which may allow contiguous landowners to access the water and perform stewardship activities, are clear, consistent, and science based. Preventing erosion and sedimentation, enhancing shorelines and riparian areas, and maintaining habitat for native species will contribute to the long-term health of the reservoirs. Updates to the Land Stewardship Program have been designed to provide the following:

- A balanced approach to meet water quality needs, maintain public access, and authorize stewardship activities.
- Updated access and design standards for consistency and to protect water quality and shoreline health, addressing:
 - Overland paths
 - Filtered view corridors
 - Private docks
 - Steps and stairs
 - Embankment stabilization
 - Wetlands
 - Nature preserves
 - Vegetation management

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- Inclusive design criteria to encompass the diversity of geological and ecological characteristics.
- A transparent and streamlined program.
- Consistent and clear guidelines that are applied throughout the three reservoirs.

THE IMPORTANCE OF HEALTHY SHORELINES

Maintaining a healthy native shoreline buffer adjacent to the water is important to protect reservoir health. Vegetated shoreline buffers are a widely employed water resource management tool and naturally provide a variety of environmental benefits, such as protecting water quality, stabilizing shoreline soils, mitigating flood flows, providing habitat for fish and wildlife, and improving aesthetic appeal.

The Land Stewardship Program recognizes the desires for recreational access to the reservoirs. The goal of the Land Stewardship Program is to provide protection of water quality, drinking water supply, and ecological resource protection while supporting recreational access through defined and consistent standards. The Land Stewardship Design Standards provide a reasonable balance between the responsibility to protect a large portion of the region's drinking water supply and providing contiguous landowners with access to the reservoir's amenities with minimal impact to water quality and the environment.

LAND STEWARDSHIP PROGRAM PARTICIPATION AND PROCESS

Property owners planning to maintain or install amenities such as a path or dock or perform any maintenance to city vegetation must first obtain the city's permission as provided through a signed Land Stewardship Agreement between the city and the current contiguous property owner. Participation in the Land Stewardship Program is optional for those who do not wish to modify city reservoir property.

To provide consistency, transparency, and to streamline the process of obtaining a Land Stewardship Agreement, the city is preparing Land Stewardship Design Plans for all 1,200 contiguous reservoir properties. The Land Stewardship Design Plans will be publicly available online and will indicate the contiguous property's eligibility for access amenities such as a path, dock or view corridor. Landowners will be able to review the online plan for their property and submit an online application requesting city review of their request. The city will review the application request for compliance with the standards, review current and past encroachments associated with the application, and provide a written response to the applicant. Once a signed Land Stewardship Agreement has been obtained by the landowner, work may commence as outlined in the agreement.

Prospective applicants should thoroughly review program guidelines and applicable standards as defined in the July 2019 Reservoir Land Stewardship Design Standards and contact the Columbus Division of Water, Watershed Management Section for assistance with questions.

1.1 OVERLAND PATHS

An overland path is a designated route across city property that provides a contiguous landowner access to the reservoir. Overland paths are the contiguous landowner's responsibility to install and maintain. The overland path alignment will take into consideration slope, erodible soils, existing vegetation, and location of dock if applicable. Overland paths are generally located along a straight line marking the shortest distance from the property line to the dock area. The path alignment also considers a meandering path to avoid tree or vegetation removal or crossing streams and wetlands.

Property Eligibility

Overland path creation will be evaluated by the city for each contiguous landowner. Most contiguous landowners except will be eligible for overland paths, except for properties with excessive slopes (Section 1.4) and high-quality wetlands (Section 1.6) within the path alignment.

Obtaining Approval for an Overland Path

A contiguous landowner's request for an overland path starts with reviewing the Land Stewardship Design Plan on the city's web site to confirm eligibility. If the Land Stewardship Design Plan shows eligibility, the contiguous landowner shall complete a Land Stewardship Application and submit to the city for review. Upon receipt, the city will review the application and contact the applicant for an onsite meeting to review the final overland path alignment and confirm that the overland path meets the Land Stewardship Design Standards. Approval of the request will include a copy of the approved application and a signed Land Stewardship Agreement.

Items required for submittal

- Application
- Final overland path location
- Path material
- Land Stewardship Agreement

DESIGN CRITERIA

The approval of any overland path will be made by the Watershed Management Section through the Land Stewardship Program. The city reserves the right to deny proposed paths, steps, or stairs based on an evaluation of need, safety, materials, design, aesthetics, or other aspects. Access paths should avoid known streams, wetlands, and drainage swales whenever possible. The below factors may require greater scrutiny, denial, and/or use of other design standards for implementation:

1. Slope (Section 1.4)
2. Wetlands (Section 1.6)
3. Nature Preserves (Section 1.7)
4. Existing trees/vegetation (Section 1.8)

WIDTH

1. All path widths shall be a maximum of **five (5)** feet horizontally
2. All path heights (i.e., the clearing above the path) shall be a maximum of **ten (10)** feet vertically
3. Overland paths and steps are not permitted to extend beyond the shoreline at normal pool elevation
4. Overland path alignment from most to least preferred:
 - a. Straight line path
 - b. Meandering path to avoid streams, drainage swales, wetlands, steep slopes, removal of trees and/or desirable vegetation.
 - c. Steps or stars due to alignment and slope (Appendix, Figures A-9 and A-10)

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5. Vegetation removal is permitted, with city approval, only in the following cases to establish the path:
 - a. Herbaceous vegetation
 - b. Invasive plant species (Section 1.8)
 - c. Dead, diseased or hazardous trees (Section 1.8)
 - d. Woody vegetation (1 inch or less basal diameter at ground surface)
6. Tree limbs larger than four inches in diameter shall not be removed to create or maintain overland paths.

Any potentially dead or hazardous tree will be assessed by the city, who will make the final determination on tree condition and hazard potential. Limited removal of trees greater than 1-inch basal diameter may be considered for path creation if no other reasonable alternative exists. In such cases, the city tree replacement policy would apply.

MATERIALS

1. Overland path materials from most to least preferred:
 - a. Mown vegetation
 - b. Soil
 - c. Mulch – only natural and undyed, up to **two (2)** inches thick
 - d. Washed river gravel – up to **three (3)** inches thick
 - e. Stepping stones
2. For mulch and washed river gravel, a plastic or wood landscape edging is required.
3. Slopes under 20% (5:1): For stepping stones and washed river gravel, an underlayment of filter fabric is required. These are considered navigable slopes and no steps or stairs are permitted (Section 1.4).
4. Slopes between 20% (5:1) and 33% (3:1) will utilize the above noted materials unless the contiguous landowner requests different materials for health or safety reasons.
5. No asphalt, compacted gravel, or concrete will be permitted for overland paths.
6. For slopes exceeding 33% (3:1), refer to Section 1.4.

Whenever hard surface materials are used, groundwater infiltration shall be considered and maximized. For example, this could be accomplished by placing stepping stones no closer than 8 inches apart, using filter fabric under stone to minimize the necessary thickness of the stone layer, and not using crushed limestone due to its tendency to compact and become relatively impervious. Proposed materials will be reviewed and approved as part of the proposed Land Stewardship Design Plan for the property.

MAINTENANCE

1. The contiguous landowner is responsible for ensuring that the overland path is safely passable, maintained in a good condition, and to the approved specification.
2. If erosion is observed along or as a result of an approved overland path, then the landowner shall remediate the erosion. The proposed remediation shall be submitted to the city for approval prior to working on city property.
3. The contiguous landowner is allowed to routinely mow the approved five-foot overland path. Periodic side trimming of herbaceous vegetation and tree branches less than four inches in diameter is allowed to maintain the five-foot wide by ten-foot high path corridor.
4. The city must be consulted before removing any tree that blocks, falls across, or has a potential to fall across the path. No trees shall be cut up or removed from city property without city approval.
5. Paths on city property may not be maintained with fertilizer, pesticides, or herbicides.

Routine maintenance shall be conducted by hand, although motorized lawnmowers and trimmers are allowed assuming their use does not impact areas outside the allowed path corridor. Refueling of motorized equipment is not allowed on city property. Paths not maintained to the city's standards or determined to be a hazard to health and safety will be subject to the city's encroachment enforcement procedures.

1.2 FILTERED VIEW CORRIDORS

Although the city strives to establish reservoir buffers consisting of mature trees and understory, consideration has been given to allow filtered view corridors which do not compromise reservoir water quality nor greatly impact riparian habitat. Filtered view corridors are gaps in vegetation around the reservoir that provide a desired view, created through selected pruning or limbing of vegetation but not through the complete removal of vegetation. Filtered view corridors may be considered to allow the contiguous landowner an enhanced view of the adjacent water body.

Property Eligibility

Filtered view corridors will be evaluated by the city for each contiguous landowner. Filtered view corridors for eligible properties will provide a filtered view across city property, with limbing and pruning limited to areas between 3 and 20 feet above ground surface. Contiguous properties within the established Nature Preserves or greater than 250 feet from the water's edge are not eligible for a filtered view corridor.

Obtaining Approval for a Filtered View Corridor

A contiguous landowner's request for a filtered view corridor starts with reviewing the Land Stewardship Design Plan on the city's web site to confirm eligibility. If the Land Stewardship Design Plan shows eligibility, the contiguous landowner shall complete a Land Stewardship Application and submit to the city for review. Upon receipt, the city will review the Land Stewardship Application and contact the applicant for an onsite meeting to review the filtered view corridor location and confirm that the location and present vegetation meet the Land Stewardship Design Standards. Approval of the request will include a copy of the approved Land Stewardship Application and a signed Land Stewardship Agreement.

Items required for submittal

- Application
- Final location of filtered view corridor location and width (including description of proposed vegetation management, if any)
- Land Stewardship Agreement

DESIGN CRITERIA

1. The maximum width for a filtered view corridor shall be 50 feet at any point on city property, not to exceed 1/3 of the total contiguous property width (see Figure 1).
2. To prevent excessive alteration of the buffer, filtered view corridors are not allowed when the contiguous property line is greater than 250 feet from the reservoir water's edge.
3. Invasive and noxious species removal shall be completed prior to any limbing, pruning, or trimming of native vegetation. After the invasive and noxious species removal, the city will review the filtered view corridor with the contiguous landowners to determine if additional limbing or pruning will be approved.
4. No more than 25% of the total crown (leaf area) of a deciduous tree may be removed when limbing or pruning. City personnel will make the final determination of the leaf area (limbs) that are eligible for removal. At no time shall the removal of the crown (leaf area) be allowed that does not follow guidelines to maintain a healthy tree.
5. No pruning is permitted for coniferous trees except for dead limbs.
6. Shrubs may not be pruned below 25% of the total pre-pruning height. (For example, a 6' shrub can be pruned down to 4.5'.)
7. Removal of any vegetation within the buffer requires city approval.
8. Limbing and pruning may be restricted between April 1 and October 31 to protect the health of certain species.

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9. All attempts shall be made to retain a forested buffer that possesses as many of the characteristics and functions of an undisturbed native forest as possible. In establishing a filtered view corridor, an entire vegetation stratum (e.g. canopy, shrub layer, understory) shall not be removed.
10. Open or sparsely vegetated areas shall be selected for sight lines before considering undisturbed areas that would require modification and replanting.
11. Prioritize invasive and noxious species removal, pruning, and retaining existing buffer vegetation before considering the removal of any native vegetation. Removal of healthy native trees is prohibited.

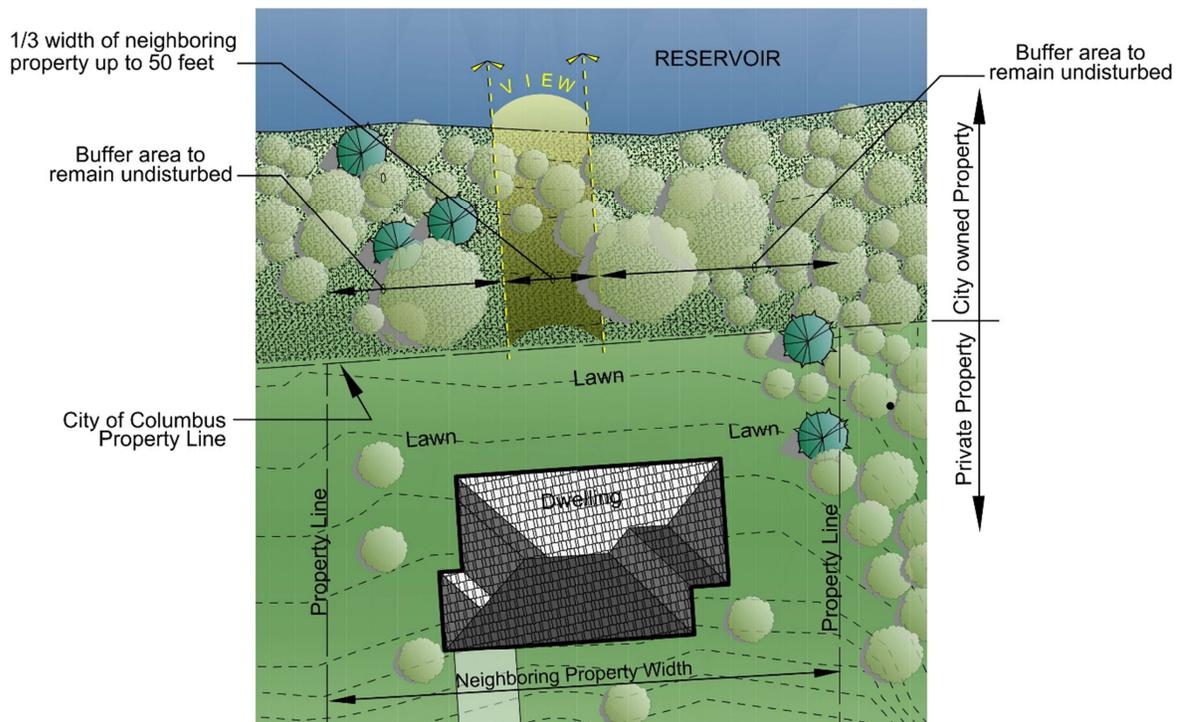


Figure 1. Typical view corridor placement

12. Clear cutting of any area or individual trees or shrubs is not permissible to achieve filtered sight lines or view corridors (see Figure 2 for examples of appropriate pruning or limbing).
13. Vegetation on and at the top of a stable bank or slope must be retained. Woody vegetation is valuable for reducing the speed and erosive ability of runoff as well as holding soil in place with deep fibrous roots. This helps to prevent erosion of the bank and bank failure.
14. Preservation of dead and living trees that provide dens and nesting places for wildlife is a priority. Removal of potential nest or roost trees of protected wildlife including Indiana and Northern Long-eared Bats and migratory birds should occur outside of the active season (i.e., removal to occur from October 1 to March 31). Further coordination with Ohio Department of Natural Resources (ODNR) and/or U.S. Fish and Wildlife Service (USFWS) may be required.
15. If only healthy, native vegetation is present, a filtered sight line or view corridor can be created by pruning tree limbs and shrubs according to criteria described above.
16. Replacement of woody vegetation will be supplemented by seeding with a native herbaceous seed mix to provide short-term cover while woody vegetation becomes established.
17. For larger trees, the recommended pruning method is crown raising.
18. Pruning of larger trees is limited to removal of lower branches no more than 4 inches in diameter and is not to exceed 20 feet above ground level, as measured from the base of the tree.
19. If a contiguous landowner is eligible, only one filtered view corridor will be permitted per contiguous property.

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20. Limbing and pruning is limited to areas between 3 and 20 feet above ground surface and shall be conducted by a certified arborist.
21. Groundcovers of woody or herbaceous vegetation, leaf litter, humus, or mulch below three feet in height shall not be disturbed or removed.

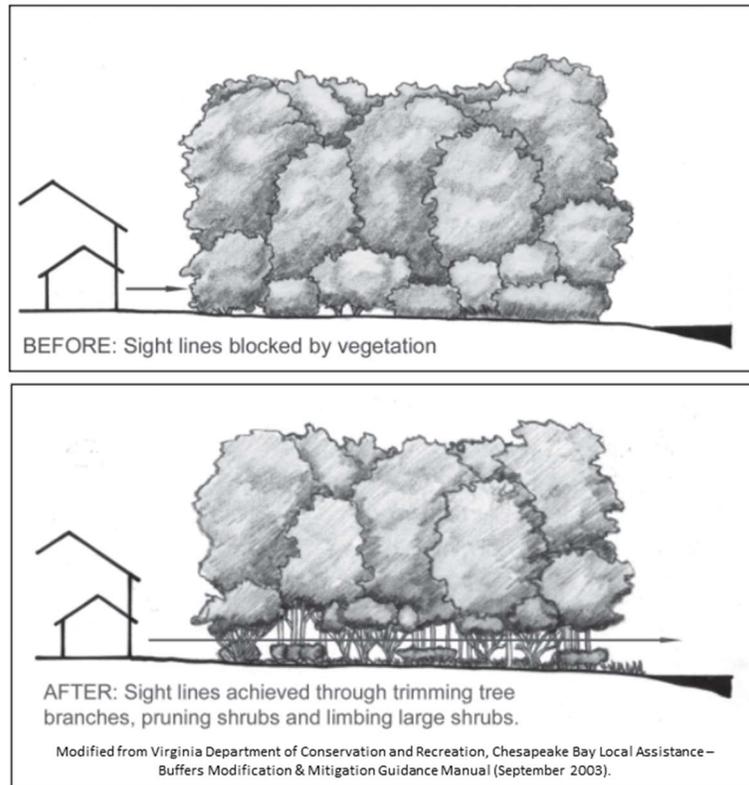


Figure 2. Example of creation of a filtered view corridor through appropriate pruning or limbing

MAINTENANCE

1. Any maintenance required to maintain the filtered view corridor requires prior city approval.
2. The contiguous landowner is responsible for legally disposing of all material resulting from tree pruning, cleanup, and restoration of disturbed areas to its natural state.
3. No vehicles and heavy equipment should be used nor mechanized activities occur on city property, and all vegetation management shall be conducted by hand, although motorized lawnmowers and trimmers are allowed assuming their use does not impact areas outside the allowed filtered view corridor. Refueling of motorized equipment is not allowed on city property.

1.3 PRIVATE DOCKS

Boat docks on city property provide a contiguous landowner boating access to the reservoir. Docks are the contiguous landowner's responsibility to install and maintain. The dock location will take into consideration existing wetlands, overland path access location, and width of water body.

Property Eligibility

Boat dock eligibility will be evaluated by the city for each contiguous landowner. Most contiguous landowners will be eligible for boat docks, except for properties with excessive slopes (Section 1.4) and high-quality wetlands (Section 1.6) within the proposed dock location. Contiguous landowners wishing to install a dock at Griggs and O'Shaughnessy reservoirs are required to obtain a U.S. Army Corps of Engineers (USACE) Section 10 permit. The applicant is required to complete the USACE Section 10 permit application and submit to the city. The city will review the application and submit to USACE on behalf of the applicant.

Obtaining Approval for a Dock

A contiguous landowner's request for a boat dock starts with reviewing the Land Stewardship Design Plan on the city's web site to confirm eligibility. If the Land Stewardship Design Plan shows eligibility, the contiguous landowner shall complete a Land Stewardship Application and submit it to the city for review. Upon receipt, the city will review the application and contact the applicant for an onsite meeting to review the final dock location and confirm the dock location meets the Land Stewardship Design Standards. Approval of the request will include a copy of the approved application and a signed Land Stewardship Agreement. Contiguous landowners are responsible for any necessary coordination and permitting with the USACE.

Items required for submittal

- Application
- Final location of dock
- Shop drawings showing dimensions, materials, and design criteria for the dock
- Detail of dock landing and dock tiebacks including shore attachment
- Land Stewardship Agreement

DESIGN CRITERIA

1. **Dock and Ramp Design**
 - a. Dock and ramp must be pre-engineered and qualified dock manufactures.
 - b. If the dock submittal is not from a pre-engineered and qualified dock manufacture the applicant shall provide detailed plans and specifications for the dock design. The design shall include a plan view showing the dock configuration, ramp location, floatation materials, and freeboard calculations that are signed and stamped by a registered Professional Engineer (PE).
 - c. Ramp must be designed for a minimum live load of 50 pounds per square foot (psf).
 - d. Maximum slope of ramp must be less than 3H:1V at normal pool elevation or 2.5H:1V at average low water reservoir water elevation or where dock bottoms out.
 - e. Ramp hand railing must be provided for ramps steeper than 5H:1V.
 - f. Boat stakes are not permitted on city property.
2. **Dock Freeboard (height from water surface to top of dock decking)**
 - a. Deadweight freeboard of unoccupied floating dock must be between 12" and 24", except for drive-on docks.
 - b. Live load freeboard, assuming a live load of 30 psf, must be more than 6".

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3. Floats

- a. Floats must be commercially manufactured flotation units that completely encase the flotation material and do not consist of metal drums or plastic barrels.

4. Size

- a. The overall width (shortest dimension from edge to edge of dock) of any section of any floating dock may not be less than four (4) feet.
- b. The overall width (shortest dimension from edge to edge of dock) of any finger dock may not exceed six (6) feet.
- c. The overall width (shortest dimension from edge to edge of dock) of any header dock may not exceed eight (8) feet.
- d. The overall width (shortest dimension from edge to edge of dock) of any platform dock may not exceed twelve (12) feet.
- e. The overall width (shortest dimension from edge to edge of dock) of any ramp section may not exceed eight (8) feet.
- f. The overall width of any dock, including any vessel(s) docked at that location, may not exceed twenty-six (26) feet (parallel to shore).
- g. The dock (including any ramp, attachment(s) and docked vessel(s)) may not extend greater than fifty (50) feet from the onshore platform or twenty five percent (25%) of the width of the channel at that point, whichever is less. The fifty (50) feet will be the measurement of the length of the dock and ramp at the point it is attached to the on-shore landing platform or otherwise affixed to shore and not the distance it extends into the reservoir due to the angle of attachment.

5. Miscellaneous Design Criteria

- a. As part of the floating dock permit, there may be a landing platform area on shore, not to exceed eighty (80) square feet in size. The only purpose of this platform is to provide a secure structure to serve as an attachment point for the floating dock. No concrete, cement or mortar is permitted as part of this platform. This structure may not include any walls, roofs, or other improvements except an approved handrail if desired. The landing platform shall be constructed at ground level unless the terrain is not even, then only elevated enough so that the platform may be level as close to the ground as possible. The landing platform may not extend over the water beyond the normal pool elevation. The specific site of the landing platform will be determined by the city based upon best management practices.
- b. The floating dock structure shall not have any walls or enclosed areas. An open sided canopy may be permitted provided that the overall height of the canopy structure does not exceed twelve (12) feet from the surface of the dock. Canopy covers must be metal, canvas, nylon or other fabric, and no advertising may be displayed on the canopy.
- c. No part of the floating dock or permitted landing platform may be constructed from any materials or constructed in any manner to be considered a permanent structure (i.e. there will be no use of concrete, and all sections must be removable by use of common hand tools). Tying to trees (either the dock or any watercraft) or attachment to any natural feature (rocks, stumps, etc.) is strictly prohibited.
- d. If a contiguous landowner is eligible, only one private floating dock permit will be permitted per contiguous property. Each private floating dock may be permitted to moor no more than three vessels registered to that contiguous landowner.
- e. The proposed location of the private floating dock shall be determined by the city and contained within the area of City of Columbus-owned shoreline defined by an extension of the contiguous landowner's boundary lines. In cases where the angles are not perpendicular, or nearly perpendicular, this area will be determined by drawing a line perpendicular to the shoreline back to the contiguous landowner's sideline. Docks and moorings shall be located such that the dock or vessels attached to the dock, and vessels moored, are more than ten (10) feet from the sidelines of the city-owned shoreline area as defined above and a minimum dock separation of 20 feet between adjacent boat docks. If there is not a suitable site within this area, the request may be denied.

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- f. New private moorings will not be permitted. Existing private moorings, including any vessel(s) moored at that location, must be located no farther than fifty (50) feet from the normal pool elevation shoreline but may not be any further than 25% of the width of the channel at that point. Each private mooring must be marked with at least a twelve (12) inch round diameter, orange marine buoy. The owner's address must be clearly marked upon the buoy.
- g. The installation of facilities conducive to human habitation; including but not limited to household furnishings, water or electrical lines or hook ups, living quarters, sewers, toilets, or fueling facilities are not permitted on any private dock.
- h. A hand powered or mechanical boatlift may be permitted so long as all other rules pertaining to docks are followed. Lifts that require electricity must comply with established electric service rules. Application for a boatlift must be in writing as part of the proposed dock plan and include specifications of the lift device.
- i. No pilings may be driven through the water into the riverbed. Guide or support poles attached to the dock (or lift device) must have flat feet that rest on the riverbed or use non-driven spuds. Spuds must be removable using common hand tools, and the permit holder must be able to demonstrate this upon request of the dock. Failure or inability to remove the spuds will be considered grounds for revoking dock privileges.
- j. All floating docks and associated structures must be designed and constructed to have low visual or physical impact upon the City of Columbus-owned property, and the dock must be maintained in a safe condition. Permittees must make every reasonable effort to construct and operate the authorized dock in a manner that minimizes any adverse impacts on fish, wildlife, natural resources and ecosystem services, including water quality.
- k. Permitted docks must properly display the annual permit and property address on the dock structure. At minimum, the property address must include the house numbers in three [3] inch high numbers. The permit and address shall be placed on the dock and face the open navigable water, visible to patrol watercraft.
- l. The primary purpose of the private floating dock structure shall be as a safe mooring for permitted watercraft. This regulation does not exclude the permit holder, his/her family, and guests from legally fishing from the dock. Personal property used in connection with recreational water activities, such as chairs, dock boxes, mooring lines, and so forth, shall be permitted on dock structures so long as such property is not otherwise prohibited. Private docks may not have any items attached to them or be used for any purpose other than safe mooring of permitted watercraft. Guest watercraft meeting code requirements may moor to the permit holder's dock. However, if the duration exceeds sixteen (16) hours on any date, the permit holder must obtain a temporary permit from the city and all related regulations apply.
- m. Requests for modifications or renovations to an existing dock must be submitted in writing and approved by the city. No work shall commence until the city's written approval is received by the landowner. The property owner is hereby authorized to make minor repairs to the dock and associated structures when necessary to ensure the safety of the users. These repairs must use identical replacement materials and may not alter the appearance or dimensions of the permitted structure. No chemical treatments (e.g. paint, waterproofing, etc.) or power washing may be applied to the dock structure on city property.
- n. Navigational channels artificially established by dredging the bottom of the waterway are prohibited.

MATERIALS

- 1. Docks decking material must be made of wood, plastic, metal, or composite materials.
- 2. Qualified pre-manufactured docks are preferable.
- 3. Floats must be commercially manufactured flotation units that meet or exceed ODNR standards (Ohio Administrative Code 1501:41-12-12), completely encase the flotation material, and do not consist of metal drums or plastic barrels.
- 4. Treated wood materials used for decking and/or walkways shall comply with Federal and State Environmental Protection Agency recommendations and regulations. All wooden materials

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should be free of any chemicals that are toxic to aquatic life. All paint and coatings for docks are prohibited, including staining and powder coating on city property.

5. Galvanized or plated hardware should be used in dock construction. Lumber pressure-treated with Alkaline Copper Quaternary (ACQ) process is very corrosive; therefore, special care should be used when selecting fasteners and hardware.
6. Canopy covers must be metal, canvas, nylon or other fabric, and no advertising may be displayed on the canopy. Canopy covers shall be of a neutral color. The final color of the canopy will be subject to city approval.
7. No part of the floating dock or permitted landing platform may be constructed from any materials or constructed in any manner to be considered a permanent structure (i.e. there will be no use of concrete, and all sections must be removable by use of common hand tools).
8. Permanent electrical connections on city property are prohibited.
9. Solar-powered lights are acceptable. Lighting plans should be included with dock applications and must be approved by the city prior to installation.

MAINTENANCE

1. The contiguous landowner is responsible to maintain the dock in good working condition. An annual inspection of the dock structure is required by the contiguous landowner with each dock permit renewal.
2. Maintenance of existing dock structures on city property requires prior city approval. The landowner is hereby authorized to make minor repairs to the dock and associated structures when necessary to ensure the safety of the users.
3. Seasonal dock structures (i.e., those removed and stored during the winter months) shall be stored in upland areas on private property beyond the top of bank. Re-installation shall occur in the previously used footprint in order to avoid or minimize damage to the surrounding area.
4. Power washing and application of coatings to docks is prohibited on city property, including application of paint, staining, powder coating, and sealants. Docks must be removed from city property before power washing or applying coatings.
5. If the city determines that any dock, structure, stairs, or other previously approved improvement located on or attached to city property has become a detriment to the city, the person who installed such improvement shall remove it at their expense upon receiving written notice of the city's determination. If the person who installed the improvement is no longer the contiguous landowner, the city may remove and dispose of said encroachment.

If the current contiguous landowner wishes to continue to use the improvement in conjunction with a pre-existing dock or stake, that current landowner may submit a request to the city to allow the improvement to remain. If the city allows the improvement to remain, the current landowner must do all of the following:

- Submit a new or renewal dock permit application.
- Submit a signed responsibility form.
- Keep the dock permit current and valid.
- Resolve any encroachments or make repairs (if applicable).

If at any time, the current landowner fails to renew their dock permit by the annual March 15 deadline, the improvement shall no longer be approved and must be removed at the expense of the responsible party.

1.4 STEPS AND STAIRS

Steps or stairs may be required based on the final access path alignment. Construction of steps and stairs on city property shall be avoided when possible. If steps or stairs are required, the design standard for steps and stairs shall follow Occupational Safety and Health Administration (OSHA) regulations that govern the design and construction of such structures when used to access public lands.

Property Eligibility

Steps and stairs will be evaluated by the city for each contiguous landowner as part of the overland path request. Steps and stairs will be eligible for properties with excessive slopes (i.e. 20-119% slope). Steps and stairs will not be eligible for properties with slopes >119% or with high-quality wetlands (Section 1.6) within the steps or stairs location.

Obtaining Approval for Steps and Stairs

A contiguous landowner's request for steps or stairs starts with reviewing the Land Stewardship Design Plan on the city's website to confirm eligibility. If the Land Stewardship Design Plan shows eligibility, the contiguous landowner shall complete a Land Stewardship Application and submit to the city for review. Upon receipt, the city will review the application and contact the applicant for an onsite meeting to review the overland path and the location of steps or stairs. Approval of the request will include a copy of the approved application and a signed Land Stewardship Agreement.

Items required for submittal

- Application
- Final location of steps or stairs
- Drawings showing dimensions, materials, and design criteria for the steps, stairs and hand railing locations
- Land Stewardship Agreement

DESIGN CRITERIA

The design standard for steps and stairs shall follow OSHA regulations that govern the design and construction of such structures when used to access public lands (Table 1). The use of ladders, alternating tread-type stairs, ship stairs, and spiral staircases is prohibited.

Table 1. Steps and Stairs Eligibility

| Slope | Type |
|-----------------|---|
| < 20% (5:1) | No steps or stairs permitted (Section 1.1) |
| 20% - 33% (3:1) | No steps or stairs permitted unless requested for health or safety reasons and approved by the city (Section 1.1) |
| 33% - 57% | Stepping stone or timber steps per standard detail are permitted (Appendix Figures A-9 and A-10) |
| 57 % - 119 % | Standard stairs |
| > 119 % | No steps or stairs permitted. |

The water access system (overland path, steps and/or stairs) shall be installed in a manner that will minimize disturbance of the shoreline and adhere to the following:

1. All construction should be completed on land.
2. No material is to be removed from the shoreline.

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3. Overland path to follow path guidelines (Section 1.1)
4. Water access system shall be designed and evaluated for high and low water levels.
5. The landowner is responsible for the disposal of all excess construction material.
6. Limits of construction width (width of construction workspace on city property) and stairs shall be 5-feet.
7. No concrete is permitted as a part of the steps and stairs design and construction.
8. Large and nontypical stairs design may require review by a licensed PE. If stairs require landings, elevated high off of existing ground, or the length of stairs are excessive the city may require the stairs to be designed by a PE before approving the application request.
9. No ladders, ship stairs, or spiral staircases are permitted.

Standard Stairs

A stairway denotes risers and treads that connect one level with another and includes any landings and platforms in between those levels. Standard stairs have a maximum riser height of 9.5 inches, a minimum tread depth of 9.5 inches, and a minimum width of 22 inches between vertical barriers as shown in Figure 3 (OSHA 1910.25(c)).

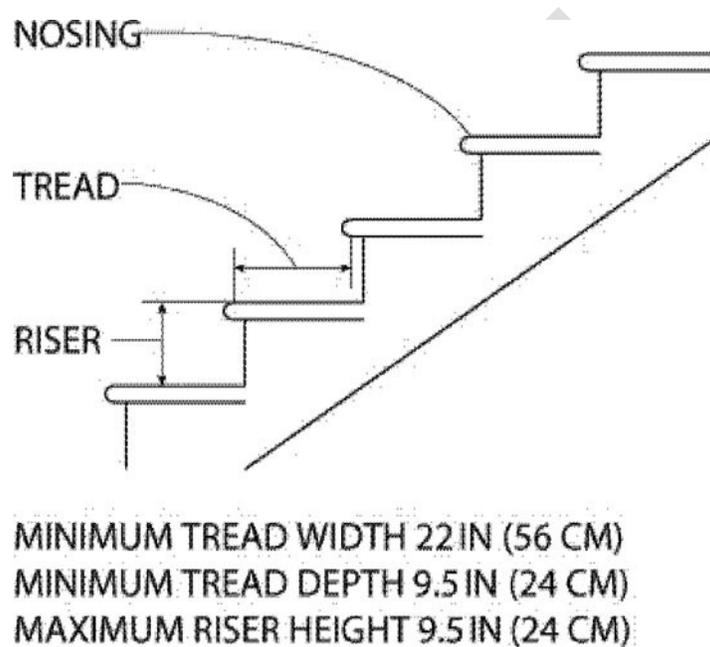


Figure 3. OSHA Standard Stairs

Below (Table 2) is a summary of the Stairs Design Criteria that shall be used by contiguous landowners when planning and designing their stairs system.

Table 2. Stairs Design Criteria

| Stairs Design Criteria | | | | | |
|------------------------|-----------------|--------------------------|--------------------------|---------------------------|--------------------|
| Slope | Type | Minimum tread width (in) | Minimum tread depth (in) | Maximum riser height (in) | Vertical Clearance |
| 57 % - 119 % | Standard Stairs | 22 | 9.5 | 9.5 | 6'-8" |

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Notes:

1. “Vertical Clearance” refers to vertical clearance above any stair tread to any overhead obstruction, as measured from the leading edge of the tread. (Landowners are to ensure vertical clearance by maintaining surrounding obstructions, trees/brush etc. per Section 1.1)
2. Stairs should have uniform riser heights and tread depths between landings.
3. Each stair can support at least five times the normal anticipated live load, but never less than a concentrated load of 1,000 pounds applied at any point.
4. All stair treads and surface for ramps must have a non-slip surface.
5. Stairs have uniform riser heights and tread depths between landings (OSHA 1910.25(b)(3)).

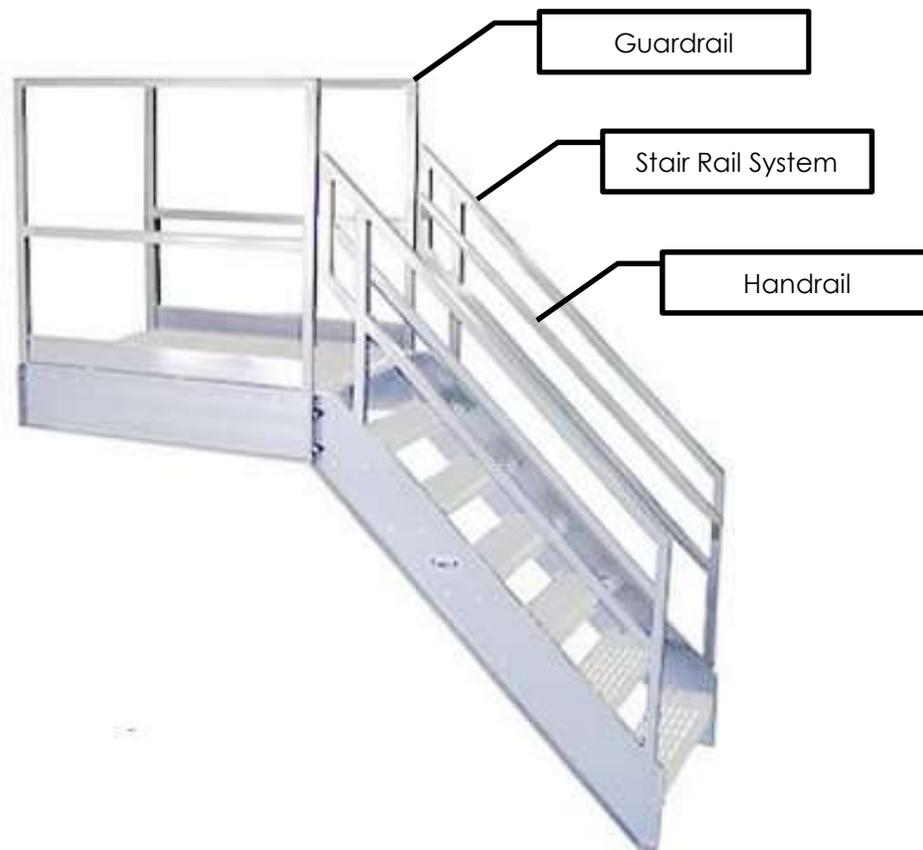


Figure 4. Stairway System – Guardrail, Stair Rail, Handrail

Guardrails, stair rail systems, and handrails (Figure 4) all prevent slips, trips and falls, but they serve different purposes and have different OSHA regulations. Guardrails are barriers erected along an unprotected or exposed side or edge of a walking surface such as a landing or elevated walking platform to prevent falls. A stair rail system is a barrier erected along the exposed or open side of stairways to prevent a fall. Handrails are rails that provide a handhold for support. Refer to Table 3 for OSHA criteria for guardrails and stair rails, and to Table 4 for OSHA handrail criteria.

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Table 3. Guardrail or Stair Rail System Criteria

| Guardrail or stair rail system | | | |
|--------------------------------|--|-----------|-----------------------------|
| Required for Landing when | Required for Stairway/Ramp when | Height | Intermediate Rails Required |
| ≥ 4 ft rise | stairway has at least 3 treads and at least 4 risers | 42" (±3") | Mid rail @ 21" |
| Per OSHA guidelines | | | |

Table 4. Handrail Criteria

| Handrail system | | | |
|---------------------|--------------|---------|---------------------------------|
| 1 Open Side | 2 Open Sides | Height | Distance between handrails (in) |
| Open Side | Both Sides | 34"-38" | Per OSHA guidelines |
| Both Sides | Both Sides | 30"-34" | Per OSHA guidelines |
| Per OSHA guidelines | | | |

MATERIALS

- Standard stairs shall consist of metal, fiber-reinforced plastic (FRP), and/or pressure treated timber materials only. All stair treads and surface for ramps may have a non-slip surface.
- Treated wood materials used for steps and stairs shall comply with Federal and State Environmental Protection Agency recommendations and regulations. All wooden materials should be free of any chemicals that are toxic to aquatic life. Lumber pressure-treated with Alkaline Copper Quaternary (AQC) process is very corrosive; therefore, special care should be used when selecting fasteners and hardware. Galvanized or plated hardware should be used in steps and stairs construction.
- Timber steps frames should be constructed out of natural cedar, pressure treated timber, or composite materials and filled with topsoil or washed river gravel. Construction using railroad ties is prohibited.
- No concrete is permitted as a part of the steps and stairs construction.

MAINTENANCE

- Maintenance of existing stair structures on city property requires prior city approval.
- The contiguous landowner is responsible to maintain the steps and stairs in good working condition. An annual inspection of the steps and stairs structure is required by the contiguous landowner.
- Power washing and application of coatings to steps and stairs is prohibited on city property, including application of paint, staining, powder coating, and sealants.

1.5 EMBANKMENT STABILIZATION

On lake, river, and reservoir shorelines, the impact of water flow, wave action, and ice against the shoreline over time can cause substantial areas of shoreline erosion. In these circumstances, re-establishing a stabilized shoreline using embankment stabilization techniques will often reduce the bank erosion rate or prevent bank failure at the water's edge. Embankment stabilization techniques are typically separated into hard and soft-armor options. The most common hard-armor technique is riprap revetment, which consists of large rocks placed in the water and up the slope along eroding shorelines. Riprap revetment is generally used for embankment stabilization along shorelines where the root-mass from vegetation is not sufficient to prevent erosion. The soft-armor methods utilize organic and inorganic materials, combined with the root-mass of plants, to create a living barrier of protection. Revegetation, bioengineered bank, and reinforced bank are soft-armor methods that can provide a measure of stabilization and a reduction in the bank erosion rate.

Property Eligibility

Embankment stabilization requests will be evaluated by the city on a case-by-case basis for each contiguous landowner. Embankment stabilization will be eligible for properties that have significant shoreline erosion and the potential for further erosion of property. Embankment stabilization designs made by a licensed PE are required for each request that addresses the specific site erosion. There are numerous variables in embankment stabilization design which will be considered by the city to determine if the request meets the land stewardship goals.

Obtaining Approval for an Embankment Stabilization

Obtaining approval for an embankment stabilization is an iterative process which may require several submittals, city reviews, and site visits. A contiguous landowner's request for embankment stabilization starts with contacting the city and meeting on site for a preliminary evaluation of the request. If the preliminary evaluation determines the request is eligible, the contiguous landowner shall complete a Land Stewardship Application and submit to the city for review. Upon receipt, the city will review the application to determine if the embankment stabilization meets the Land Stewardship Design Standards and provide review and approval of the design. Approval of the request will include a copy of the approved application and a signed Land Stewardship Agreement. Due to the site variability and time to review individual design, the process of obtaining approval for an embankment stabilization may take several months. Embankment stabilization projects may require state and federal permitting (e.g. Section 404 permitting). The necessity for permitting is dependent on-site specifics and is determined on a case-by-case basis. Where permitting is required, contiguous landowners will be responsible for completing the permit applications.

Items required for submittal

- Application
- Location of proposed embankment stabilization
- Plan of embankment stabilization and supporting design calculations (if required)
- Maintenance plan
- Land Stewardship Agreement

DESIGN CRITERIA

Below (Table 5) is a comparison of different embankment stabilization methods and their application, benefits, limitations, and costs.

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Table 5. Embankment Stabilization Comparison Matrix

| Preferability | Method | Application | Benefits | Limitations | Cost |
|----------------------|--------------------|--|---|---|-------------------|
| Most preferred | Revegetation | <ul style="list-style-type: none"> Existing slope of 3H:V1 or flatter Low to moderate existing erosion Low wave/wake action | <ul style="list-style-type: none"> Re-establishes native vegetation and ecosystem function Easy to implement | <ul style="list-style-type: none"> Requires good soil for establishment Effective only after root establishment Not suitable for high energy areas (i.e. high wave/wake action) | Low |
| | Bioengineered Bank | <ul style="list-style-type: none"> Proposed slope range of 1H:1V to 3H:1V Low wave/wake action | <ul style="list-style-type: none"> Re-establishes native vegetation and ecosystem function Can rebuild areas previously lost to erosion | <ul style="list-style-type: none"> Requires specialized installation techniques Requires import and use of specialized materials Fully effective only after root establishment | Moderate |
| | Reinforced Bank | <ul style="list-style-type: none"> Proposed slope range of 1H:1V to 3H:1V Moderate wave/wake action | <ul style="list-style-type: none"> Re-establishes native vegetation and ecosystem function Can rebuild areas previously lost to erosion | <ul style="list-style-type: none"> Requires specialized installation techniques Requires import and use of specialized materials Fully effective only after root establishment | Moderate to High |
| Least preferred | Riprap Revetment | <ul style="list-style-type: none"> Proposed slope range of 1H:1V to 5H:1V High wave/wake action | <ul style="list-style-type: none"> High resistance to wave action Effective in areas where vegetative methods infeasible Can rebuild areas previously lost to erosion Low maintenance | <ul style="list-style-type: none"> Must be founded on non-erosive material Requires heavy equipment to install Requires import of materials Poor aesthetics and limited ecological function | High to Very High |

All embankment stabilization activity must be approved by the city prior to implementation. Further, the contiguous landowner requesting the implementation of any embankment stabilization activity must enter into an agreement with the city regarding responsibility of long-term maintenance prior to embankment stabilization plan approval. All embankment stabilization designs shall include protection below normal pool elevation.

Technical Design Standards

Revegetation

Vegetation is a critical component of a stable shoreline, providing energy dissipation, soil stabilization, and numerous ecosystem functions. Re-establishing this feature can be an effective and inexpensive way to correct shoreline problems (see example in Figure 5). Once established, the deep roots of the plants protect the shoreline from erosion by holding the soil below, while the above-ground portions deflect wind and wave energy. Revegetation is applicable in areas with low to moderate slopes (typically 3H:1V or flatter) and low to moderate existing erosion. The method typically begins by removing existing invasive and noxious vegetation by hand or mechanical means. The seed bed is then prepared by raking to minimize soil compaction. Native seed is sown with temporary soil stabilization measures, which could include a cover crop, mulch, erosion control blanket, or a combination depending on specific site conditions. This method can be modified to include woody vegetation through the installation of live stakes, wherein dormant cuttings from colonizing species (e.g. willow, dogwood, buttonbush) are directly inserted into the ground with a mallet or by hand in a pilot hole. These stakes add to the tensile strength and shear resistance of the soil by adding physical support from the woody portion of the stake and vegetative material with a deeper rooting depth.



Figure 5. Example of Revegetation

The main advantage of this method is that installation does not require technical design or skilled labor, and the cost is relatively low. Its successful implementation is limited by the presence of good soil for seed germination and root development. Revegetated areas become more stable with time as plants mature, but there is a time lag between installation and full effectiveness while root systems are developing. Maintenance of plantings (typically watering, replacement of dead material, and invasive and noxious species management) may be required until vegetation becomes fully established. Beyond this establishment period (typically two to three growing seasons), maintenance is generally limited to occasional pruning and invasive and noxious species treatments, as needed. Pruning activities should be performed in accordance with applicable vegetation management standards (Section 1.8) and standards for filtered view corridors (Section 1.2).

Refer to *Natural Resources Conservation Service (NRCS) Technical Release 69* for additional design details.

Bioengineered Bank

The bioengineered bank uses natural materials to construct a fill slope that can be used to rebuild an area previously lost to erosion, repair a previous fill, restore a shallow slump, or stabilize a loose slope (see example in Figure 6). The slope is built by stacking 12 to 18-inch tall lifts of soil wrapped in coir fabric with layers of live branches (typically species used for live stakes) installed between the lifts. The outside face of the lifts is seeded and mulched prior to wrapping with coir. Lifts are offset to create an average slope of 2H:1V (range of 1H:1V to 3H:1V) with approximately 75% of the live branches' total length buried between the lifts. The coir fabric provides initial structural stability and erosion resistance for the bank. Once the vegetation becomes established, the root systems reinforce the fill, and exposed vegetative portions dissipate energy while the mass of fill provides global stability.

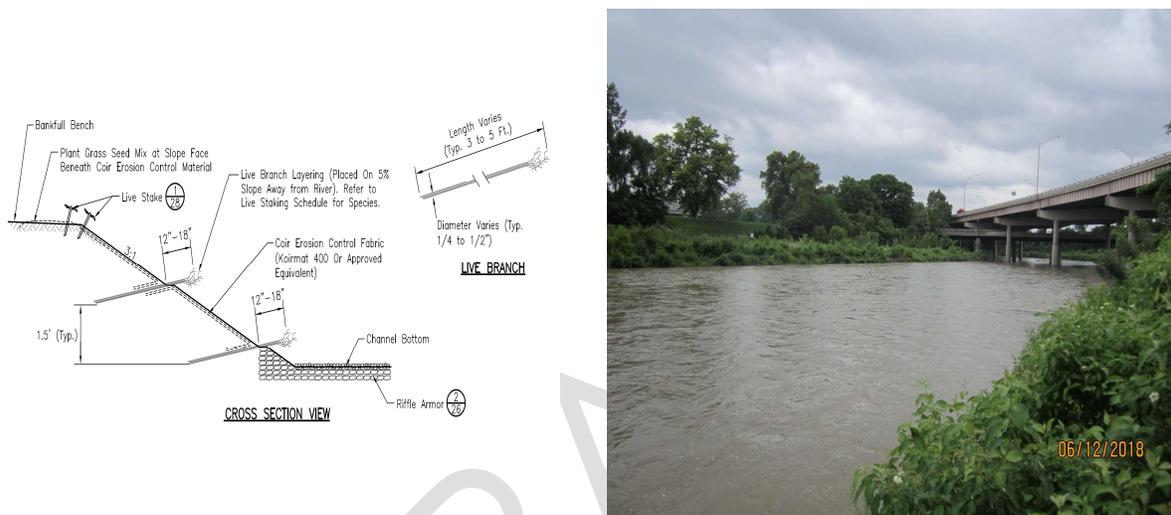


Figure 6. Example of Bioengineered Bank

This approach can be used in areas that are steeper and subjected to more wave action than those that can be simply revegetated. Bioengineered banks are particularly well suited for situations where the existing bank cannot be reshaped to a lesser slope. Bioengineering provides many of the advantages of more traditional hard-armor techniques while also enhancing ecosystem function and aesthetics of the shoreline it repairs. It utilizes low-cost materials and is less expensive to construct than more structural approaches; however, it does require skilled labor and potentially the use of heavy equipment. Construction is also limited to the dormant season of the live branches (typically November-March). Full benefits are not realized until the vegetation becomes established, but effectiveness increases with time and the coir fabric reinforcement helps mitigate the time lag. Initial establishment may require irrigation, replacement of dead material, and invasive and noxious species management, but long-term maintenance of the structure is negligible.

Refer to *NRCS Technical Release 69* for additional design details.

Reinforced Bank

Reinforced banks are constructed using bioengineering techniques with the addition of structural materials to further increase stability. They can be used in the same situations as bioengineering techniques but are better suited for higher energy scenarios that exceed the capabilities of coir fiber matting, but also do not require hard-armor techniques. The reinforced bank technique can therefore provide many of the benefits of both bioengineering and traditional hard armoring. Typically, a fill slope is built by stacking lifts of soil wrapped in turf reinforcement mat (TRM), a web of interlocking synthetic fibers stitched between netting. Further structural support for the bank is provided by placing geogrid, a webbed

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sheet of synthetic material with high tensile strength, horizontally between the TRM soil wraps. The face of the lifts is seeded with native grasses and forbs, and woody vegetation is introduced to the structure by adding live branches between the lifts. This allows for development of a diverse native plant community on the rebuilt slope while providing enhanced stability of the bank.

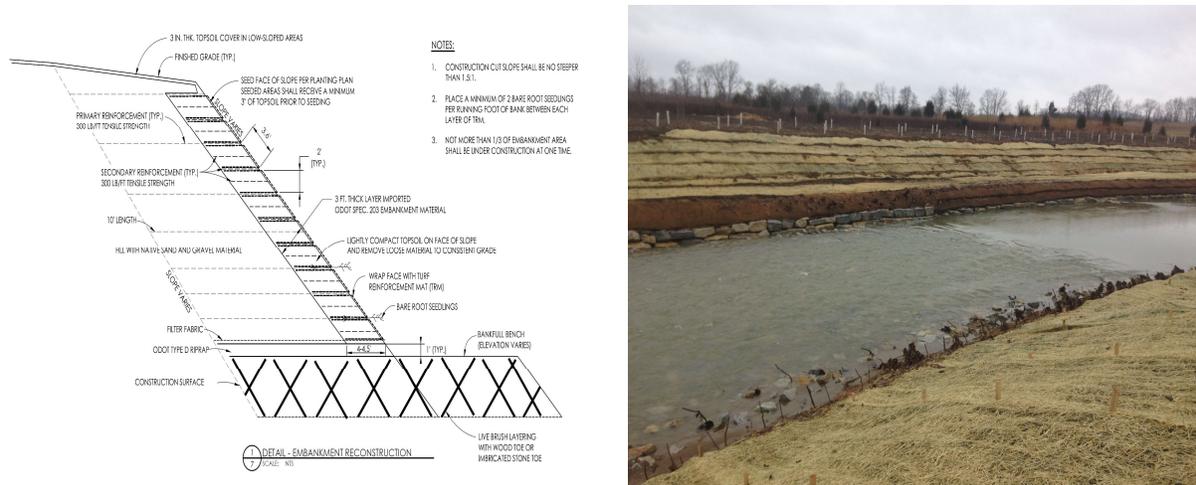


Figure 7. Example of Reinforced Bank

The reinforced bank approach saves cost while achieving natural aesthetics and ecological benefits not achievable by hard-armor approaches. The TRM and geogrid reinforcement have a long service life (up to 50 years) and provide stability from initial installation until after the vegetation matures. The use of the structural materials does, however, increase the construction cost above that of the general bioengineered bank. Consultation with a design professional is also required to properly size and distribute the structural reinforcement in the bank, and construction of the structure requires skilled labor and the likely use of heavy equipment. As with other approaches with a substantial vegetative component, minor maintenance during the first few growing seasons (e.g. irrigation, replacement of dead material, and invasive and noxious species control) may be required. After full vegetation establishment, maintenance is negligible.

Refer to *NRCS Technical Release 69* for general design details. This approach shall be modified by a design professional to incorporate the structural material (refer to Figure 7 for an example).

Riprap Revetment

Riprap is used where vegetative methods are less effective, typically in steeply sloped areas, areas with substantial erosion, and/or those subject to high wave/wake energy (see example in Figure 8). The primary limitation are the soils located below the structure; they must be stable enough to support the weight of the stone to be placed. The area to be protected is first graded in preparation for structure placement; the final slope should be 1.H:1V or flatter. A layer of gravel bedding and/or geotextile fabric is placed on the prepared slope to act as a filter layer, which prevents soil piping through the voids in the rock installed above. If piping occurs, the structure will subside as bank materials move through the rock, eventually causing the structure to fail. Riprap is placed over the filter layer to the required thickness, which is typically two times the diameter of the median sized stone in the gradation selected. Riprap should be durable limestone, dolomite, or granite to minimize weathering and should be angular in shape to maximize aggregate interlock and resulting structure stability.



Figure 8. Example of Riprap Revetment

Hard armoring provides immediate, substantial erosion protection to an unstable shoreline; however, the required materials give it an unnatural look, and its ecological value is limited. Construction cost is often high, as the materials are expensive, and it must be placed by a skilled contractor with heavy equipment. Additionally, a design professional is required to be consulted to determine proper rock size, gradation, and riprap layer depth. There is no establishment period, as with soft-armor stabilization techniques, but the structure should be monitored periodically. Long-term maintenance may be required to control unintentional vegetation establishment, and if rock weathering and structure settling occurs. Designed vegetative riprap solutions are not permitted for use.

Riprap revetments shall be designed according to the procedure presented in *NRCS Technical Release 210-69, Rock Riprap for Slope Protection Against Wave Action*, and certified by a PE licensed to practice in the State of Ohio.

MATERIALS

1. Natural materials and revegetation stabilization design methods are preferred.
2. No concrete is permitted as a part of the embankment stabilization construction.

MAINTENANCE

1. Maintenance of embankment stabilization on city property shall be maintained by the contiguous landowner.
2. Any maintenance of the embankment stabilization requires notification and approval by the city.

1.6 WETLANDS

When the location of overland access paths and docks cannot avoid existing wetlands, the following standards apply to determine wetlands eligibility. The city will consider crossing wetlands provided the crossings follow all Federal and State wetland permitting requirements. The contiguous landowner may be required to complete a wetland delineation to verify the Federal and State permitting requirements are satisfied. Boardwalks may be considered as an option to cross wetlands with minimal impact.

Property Eligibility

Crossing wetland will be evaluated by the city for each contiguous landowner as part of the overland path request. Wetland crossings will be eligible for properties providing the wetland crossing impact does not trigger the requirement for certain Ohio Environmental Protection Agency (OEPA) or USACE wetland permits (see Table 6).

Obtaining Approval for Crossing Wetlands

A contiguous landowner's request for an overland path or dock with a potential of crossing wetlands starts with reviewing the Land Stewardship Design Plan on the city's web site to confirm eligibility. If the Land Stewardship Design Plan and final overland path or dock location is within a potential wetland area (identified by the city in preliminary surveys), the contiguous landowner may be required to complete a wetland delineation to determine eligibility. If the wetland crossing has been determined to be eligible, the contiguous landowner shall complete a Land Stewardship Application and submit to the city for review. Upon receipt, the city will review the application and contact the applicant for an onsite meeting to review the proposed wetland crossing. Approval of the request will include a copy of the approved application and a signed Land Stewardship Agreement. Contiguous landowners will be responsible for coordinating with the city, OEPA, and USACE to obtain approvals for crossing wetlands.

Items required for submittal

- Application
- Wetland delineation by a certified professional, if required (confirm with the city before starting)
- Final location of wetland crossing
- Drawings showing dimensions, materials, and design criteria for crossing the wetland locations
- Land Stewardship Agreement

DESIGN CRITERIA

1. Wetlands shall be avoided if practical alternatives exist elsewhere onsite.
2. Contiguous landowners requesting overland paths or docks in potential wetland areas are required to obtain a wetland delineation performed by a qualified professional and confirm the jurisdictional status, Ohio Rapid Assessment Method (ORAM) category, and extent of wetlands on city property requested to be accessed.
 - Wetland delineation is not required if potential wetland exist only along the shoreline below normal pool elevation AND the proposed dock design does not have floats or supports within the limits of the potential wetland areas.
3. Access across wetlands above normal pool elevation will require a boardwalk with an elevated deck not directly on the ground surface.
4. Boardwalks are not permitted below normal pool elevation.
5. Dock and overland path requests, including boardwalks, crossing wetlands must follow applicable state and federal regulations. Contiguous landowners must coordinate with the city, OEPA, and USACE to necessary approvals.

RESERVOIR LAND STEWARDSHIP DESIGN STANDARDS

6. Docks and overland paths, including boardwalks, shall only be allowed when a federal USACE Section 404 permit is not required; an Individual 401 Water Quality Certification (WQC) is not required from OEPA; or an OEPA isolated wetland permit is not required (Table 6).
 - o For residential, commercial, and institutional developments, the following conditions would need to apply:
 - Adjacent affected wetland area is < 0.5 acres.
 - Wetland is a non-forested Category 1 or Category 2 wetland – low to moderate quality that supports minimal to moderate wildlife habitat and hydrological functions.
7. No docks or overland paths, including boardwalks, shall be constructed in Category 3 wetlands.
8. Dock and boardwalk clearance shall maintain a one-foot minimum clearance over submerged aquatic vegetation (SAV) or emergent vegetation from the bottom of the structure to the top of existing vegetation.
9. No dredging or deepening is allowed.
10. Seasonal dock structures (i.e., those removed and stored during the winter months) must not be stored in wetland areas or directly on the bank. Seasonal dock structures shall be stored in upland areas on private property beyond the top of shoreline bank. Re-installation shall occur in the previously used footprint in order to avoid or minimize damage to wetlands.
11. Boardwalks must adhere to OSHA regulations, according to which boardwalks raised 4 feet or more above ground level require toe kick board and handrail systems outlined in Section 1.4.

WIDTH

1. Dock and overland paths, including boardwalks: limit the width to a maximum of five feet.
2. Extend the gangway past the shoreline wetlands and place the dock such that it is not within the wetland limits. Docks must adhere to all other Land Stewardship Design Standards (Section 1.3).
3. If a dock is placed in a cove or tributary, the structure shall not extend more than 25% across the waterway to minimize impacts to water flow and navigation (Section 1.3).

MATERIALS

1. The use of treated wood not specifically approved by the city for use in wetlands and aquatic environments is strictly prohibited. Creosote or pentachlorophenol (PCP) or products containing these compounds shall not be used.
2. Dock and overland path materials crossing wetlands shall use grated material or planks spaced at least 0.5" apart to allow light penetration.
3. Boardwalks used to span wetland areas must be made of wood, composite or metal materials.
 - o Boardwalks must be anchored to the ground to prevent floating away during periods of high water or flooding.
 - o Piles or supports must be anchored and can be made of wood, composite material, or metal. Concrete cannot be used to set piles.

Table 6. Permitting Requirements for Floating Docks or Dock/Boardwalk

| ORAM Wetland Category | USACE | OEPA | Proposed Standard |
|-----------------------|---------------------------------|---|----------------------------------|
| 1 | No permit required ¹ | No permit required ² | Access may be approved |
| 2 | No permit required ¹ | No permit required ² | Access may be approved |
| 3 | No permit required ¹ | Individual 401 WQC required or Director's Authorization is required | Access not approved ³ |
| Isolated Wetland | No permit required ¹ | An isolated wetland permit or Director's Authorization is required | Access not approved ³ |

¹ The USACE does not consider floating docks or dock/boardwalk pilings in wetlands to be fill. Therefore, no permit is required
² The OEPA generally accepts the USACE determination of fill. Therefore, no permit is required
³ Individual 401 WQC and Isolated Wetlands Permits require mitigation which the city will not allow.

MAINTENANCE

1. Pruning and trimming of vegetation within the portion of the overland path in wetland areas is limited to a five-foot-wide by ten-foot-high area (Section 1.1).
2. Boardwalks must be made of wood, plastic, metal or composite materials.
3. Treated wood materials used for decking and/or walkways shall comply with Federal and State Environmental Protection Agency recommendations and regulations. All wooden materials should be free of any chemicals that are toxic to aquatic life. Lumber pressure-treated with the ACQ process is very corrosive; therefore, special care should be used when selecting fasteners and hardware. Galvanized or plated hardware should be used in boardwalk construction. Boardwalks shall not be painted, stained, sealed, or powder coated on city property.
4. No part of the boardwalk may be constructed from any materials or constructed in any manner to be considered a permanent structure (i.e. there will be no use of concrete and all sections must be removable by use of common hand tools).

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1.7 NATURE PRESERVES

Landowners contiguous to city designated Nature Preserve areas are subject to the same Land Stewardship Agreement standards as contiguous landowners not within the Nature Preserve. Additional restrictions in designated Nature Preserves are required to balance the Land Stewardship Program goals and Nature Preserve designation.

Property Eligibility

Overland paths and docks will be considered for eligibility in designated Nature Preserves. Overland paths and docks will be evaluated by the city for each contiguous landowner as part of the overland path or dock request. Stairs, filtered view corridors, pruning, and limbing will not be eligible within the designated Nature Preserve areas.

Obtaining Approval for Overland Path and Dock in a Nature Preserve

A contiguous landowner's request for an overland path and/or a dock starts with reviewing the Land Stewardship Design Plan on the city's website to confirm eligibility. If the Land Stewardship Design Plan shows eligibility, the contiguous landowner shall complete a Land Stewardship Application and submit to the city for review. Upon receipt, the city will review the application and contact the applicant for an onsite meeting to review the overland path and/or dock location. Approval of the request will include a copy of the approved application and a signed Land Stewardship Agreement.

Items required for submittal

- Application
- Final location of overland path
- Path material
- Final location of dock
- Shop drawings showing dimensions, materials, and design criteria for the dock
- Detail of dock landing and dock tiebacks including shore attachment
- Land Stewardship Agreement

The Land Stewardship Design Standards set the following restrictions on city designated Nature Preserves:

1. No person shall release any wild or domestic animal or plant or grow any type of seed or vegetation within the Nature Preserves without written permission from the city. Release of native plants and seeding of native vegetation within the Nature Preserve is only authorized through an approved Land Stewardship Agreement and may only be allowed following invasive and noxious species removal activities or when associated with the maintenance of an approved path. Any contiguous landowner that desires to revegetate or supplement native vegetation in Nature Preserves requires written permission from the city. The city will hold discussions with the contiguous landowner over funding and implementing any proposed actions.
2. No person shall collect, remove, or otherwise disturb soil, sand, gravel, rocks, ice, minerals, fossils, plants, plant materials, animals, or any other natural substance from the Nature Preserve. A Land Stewardship Agreement may be utilized to authorize limited soil and vegetation disturbances for the purposes of an approved path.
3. Land Stewardship Agreements may be permitted within the Nature Preserve, but the agreement must require that the land be left completely undisturbed, with the exception of an approved overland path to allow access to the shoreline or a permitted dock.
4. All persons must remain on official, designated, or improved trails or boardwalks, unless involved in a City of Columbus sponsored program that involves off-trail activities, or in accordance with a special or general permit issued by the city.
5. Filtered view corridors are not permitted in designated Nature Preserves areas.

DESIGN CRITERIA

The Land Stewardship Design Standards discussed throughout this document apply to areas within designated Nature Preserves with the following conditions:

1. Paths must be maintained in a natural condition (mown vegetation or dirt).
2. Stairs are not permitted in nature preserves (Section 1.4).
3. Wood framed timber steps, where applicable and as described in Section 1.4, are permitted. Stone steps are not permitted.
4. Vegetation management (i.e. pruning or limbing) is not permitted in nature preserves, with the exception of the approved overland path (Section 1.1).
5. Invasive and noxious species removal is permitted in nature preserves with prior city approval.
6. No fertilizer, herbicide, or pesticides are permitted on city property.
7. Filtered view corridors are not permitted in nature preserves.

WIDTH

1. A natural five-foot-wide path to allow access to the shoreline or a private dock is permitted.

MATERIALS

1. The path may be mown but must be maintained in a natural condition and may not contain cement, mortar, bricks, or stairs. Boardwalks must be installed for paths crossing wetland areas (Section 1.6).
2. Wood framed timber steps may be installed, where applicable and as described in Section 1.4. Stone steps are not permitted.

MAINTENANCE

1. The contiguous landowner is responsible to ensure that the overland path is safely passable, maintained in a good condition, and to the approved specifications.
2. If erosion is observed along or as a result of an approved overland path, then the contiguous landowner shall remediate the erosion. The proposed remediation shall be submitted to the city for approval prior to working on city property.
3. The contiguous landowner is permitted to routinely mow an approved five-foot overland path. Periodic side trimming of herbaceous vegetation and tree branches less than four inches in diameter is permitted in order to maintain the five-foot-wide by ten-foot-high path corridor.
4. The city must be consulted before removing any tree that blocks, falls across, or has a potential to fall across the path. No trees shall be cut up or removed from city property without city approval.

Routine maintenance shall be conducted by hand, although motorized lawnmowers and trimmers are allowed assuming their use does not impact areas outside the allowed path corridor. Paths not maintained to the city's satisfaction or determined to be a hazard to health and safety will be subject to the city's encroachment enforcement procedures.

1.8 VEGETATION MANAGEMENT

Vegetation management refers to any physical alteration of existing native or non-native vegetation not expressly detailed in previous sections. This includes mowing, pruning, trimming, limbing of live or dead native or non-native vines, grasses, shrubs or trees.

Property Eligibility

Vegetation management will be evaluated by the city for each contiguous landowner on a case-by-case basis. Vegetation management will be eligible for properties with invasive and noxious species, filtered view corridors, and/or hazardous trees.

Obtaining Approval for Vegetation Management

A contiguous landowner's request for vegetation management starts with contacting the city Watershed office to schedule a preliminary onsite meeting to review the request. The contiguous landowner shall complete a Land Stewardship Application and submit to the city for review. Approval of the request will include a copy of the approved application and a signed Land Stewardship Agreement.

Items required for submittal

- Application
- Written description of the proposed work
- Name, address, and contact information of the preapproved company that will do the work.
- Land Stewardship Agreement

DESIGN CRITERIA

1. Current 50:30:20 agreements will be phased out and new agreements put in place that are more consistent with the updated standards that emphasize buffer establishment and management.
2. Contiguous landowners are encouraged to establish "no-mow" zones on their properties to increase the width of the undisturbed buffer to the maximum extent possible.
3. Motorized equipment is prohibited on city property, with the exception of lawnmowers and hand operated motorized equipment (weed trimmers, hedge trimmers, etc.) used in approved paths and authorized mow areas only. Refueling of motorized equipment is not allowed on city property
4. Hazardous trees on city property, as determined by city staff or their approved designee, may not be removed without city approval.
5. With exception to the conditions discussed in Section 1.1 of this document, no native trees or woody vegetation may be removed from city property.
6. Hazardous tree removal must be performed by city staff, a designee of the city (contractor), or with prior approval from the city, a certified arborist contracted by the contiguous landowner.
7. When a contiguous landowner's existing primary or secondary (e.g., sheds, decks, patios, gazebos, etc.) residential structure is within 15 feet of the city-owned property, that landowner is permitted to regularly mow an area that extends a maximum of 10 feet into the city property. No mowing is allowed in the area extending 50 feet from the top of the shoreline bank. Any new structures constructed, after the Land Stewardship Design Standards are approved, will not be eligible for the 10-foot mowing on city property.

MAINTENANCE

1. No mowing is permitted on city property, except for establishment and maintenance of approved access paths and in defined areas surrounding existing structures located immediately adjacent to the city property line. Now new mow areas will be permitted for new structures.

RESERVOIR LAND STEWARDSHIP DESIGN STANDARDS

2. Approved access paths may be mowed regularly to maintain a maximum five-foot width in order to achieve desired uses. Mowing of areas beyond the five-foot maximum path width is not permitted.
3. Removal or mowing of herbaceous groundcovers is not permitted to create a view corridor or site lines.
4. Dumping lawn waste such as grass clippings, leaves, limbs, or brush on city property is prohibited.

INVASIVE AND NOXIOUS SPECIES REMOVAL

The city maintains a list of invasive species and native noxious species that are actively managed for removal or control. This list will be reviewed and updated at a minimum of every two years. Contact the city for an up-to-date list.

1. Planting of non-native species on city property is prohibited. Existing non-native, ornamental trees may be retained on city property if not on the city's invasive and noxious species list.
2. No removal, pruning, or trimming of vegetation is permitted on city property without the prior approval of the city.
3. Only city staff or approved, licensed contractors are permitted to apply fertilizers, herbicides, or pesticides on city property.
4. The city encourages contiguous property owners to implement a 25-foot buffer from city property when applying fertilizer, herbicides, or pesticides on private property.
5. Invasive and noxious species removals must be conducted by approved landscaping contractors under city staff oversight.
6. Volunteer groups may be utilized to conduct invasive and noxious species removals with prior approval under supervision of city staff.
7. When invasive and noxious species cover is greater than or equal to 50 percent of total plant cover, a native revegetation plan should be developed and implemented after removal of invasive and noxious species.
8. To avoid increased shoreline erosion, invasive and noxious species removal should not occur within 10 feet of the top of shoreline bank or below the top of bank unless the area will be reseeded and/or replanted with native vegetation.

A native revegetation plan is a simple written outline of how the area that was recently cleared of invasive and noxious species will be revegetated with native species. The plan may be developed with input from the contiguous landowner, or the city alone may develop the plan. Typical components of the native revegetation plan include the following:

- Revegetation Schedule
- Total revegetated Area
- Revegetation Methods (e.g., broadcast seeding, live staking, etc.)
- Type of Seed/Plantings (i.e., species composition)
- Total Number of Plantings or Quantity of Seed
- Characteristics of Seed/Plantings (e.g., pounds pure live seed, planting size, etc.)
- Soil Preparation
- Plant Spacing/Seed Application Rates
- Supplier Name and Certifications

Revegetation activities should occur immediately following invasive and noxious species removal.

APPENDIX A
STEPS DETAILS

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RESERVOIR LAND STEWARDSHIP DESIGN STANDARDS

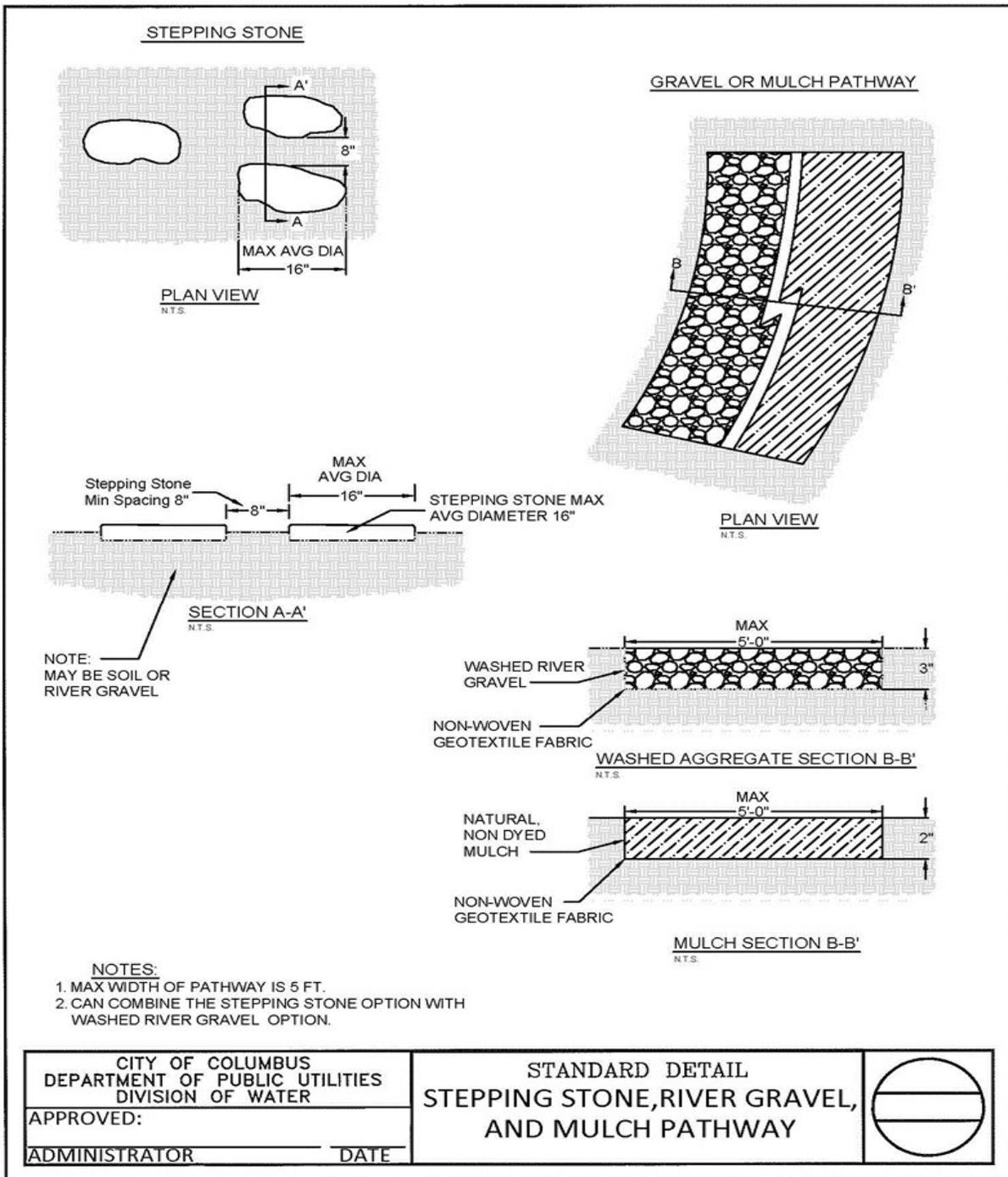


Figure A-9. Standard Detail: Steppingstone, River Gravel, and Mulch Pathway

RESERVOIR LAND STEWARDSHIP DESIGN STANDARDS

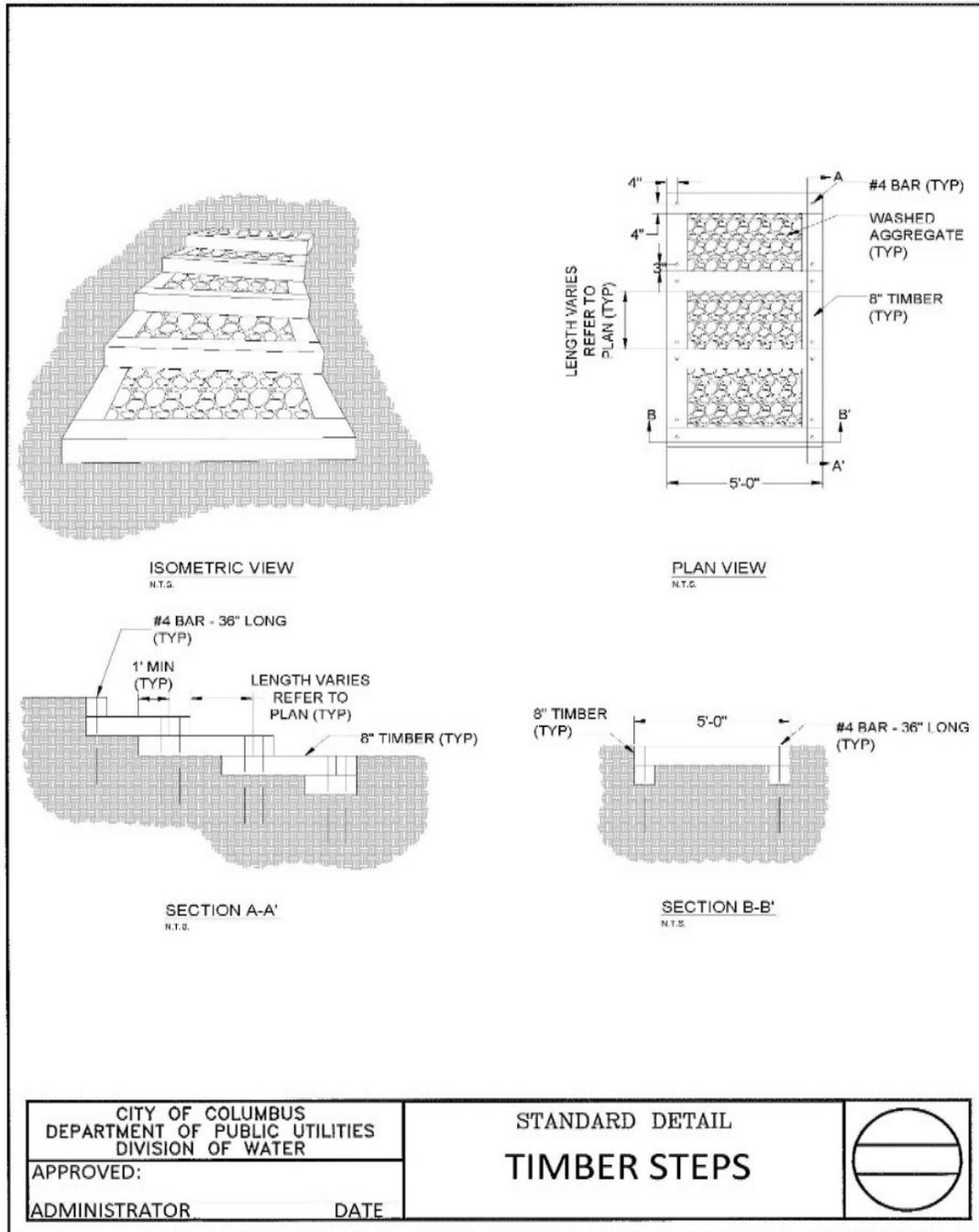


Figure A-10. Standard Detail: Timber Steps