OHIO STREAM MANAGEMENT GUIDE

An Introduction to Stream Management

Guide No. 01

STREAMS ARE CONNECTED TO THE LAND

The character of Ohio's rivers, streams and ground water has changed greatly over the last 200 years due to human activities. Forests and prairie lands once kept our streams narrow and deep by holding the banks intact. Stream water was cooler, cleaner and clearer, with a greater diversity of species than is found today.

Over the years agricultural production has increased through artificial land drainage. Crops are often planted up to streambanks, eliminating a crucial forested buffer zone for streams. Many of Ohio's streams were straightened to allow water to flow faster. Urbanization increases watertight surfaces (streets, roofs, and parking lots), and our streams receive greater amounts of runoff and the pollution it carries from crossing land surfaces. The increased runoff resulted in streambanks and beds being scoured and nearby cropland being lost. Downstream flood damage also increases as streams carry more water at a faster rate.

The changes we make to each watershed or drainage basin's land use, changes the character of our streams. The loss of trees and their streambank root structures allow streams to run wider and shallower, allowing sediment to fall out, silting-over important biological habitats within the stream. Sediments and pollutants must be filtered from raw water before it is used for industry and drinking. And millions of dollars are spent each year dredging sediment from channels, harbors and reservoirs.

Few people realize the overall importance of watershed-based land use practices, such as increasing the ability of surface areas to absorb water and retaining streamside forested buffer zones. Suitable streamside and in-stream habitat is the single most important factor determining the existence of diverse fish and wildlife populations. Healthy aquatic populations indicate good water quality which results in fewer external costs to society. The quality and productivity of our rivers and lakes can be improved if we retain and restore their natural characteristics.

During the 1960's and 1970's people started to see that our prosperous and productive life style was seriously impacting the quality of the environment around us, including the resource-base which supports that life style. As a society we have started to make choices to alter our land use practices in order to preserve and restore habitat that are critical for the survival of plants and animals whose continued existence we once took for granted.

Each year new information and practices help us stay productive and prosperous while protecting the natural environment. This series of Ohio Stream Management Guides is designed to make practical advice available to landowners and others responsible for land use decisions involving streams.

WHAT IS STREAM MANAGEMENT?

Stream management includes all land use activities which affect stream environments, particularly their physical structure. Streams and their watershed lands should be managed in ways that work toward finding and maintaining healthy balances between our various land uses and the needs of fish and wildlife. The Ohio Stream Management Guides will focus on the physical structure of streams and management practices which support the search for healthy balances.

More intensive land use and development tends to disrupt natural processes which protect and preserve water resources. Therefore, land uses and the design and maintenance of stream modifications and storm water structures must be managed responsibly. This means minimizing the disruption of those natural processes, and mitigating necessary disruptions as much as possible.

STREAMS ARE PART OF THE HYDROLOGIC CYCLE

Stream systems drain the land as a key part of nature's water cycle. The water cycle contains the following elements:

1. precipitation of all forms of water which falls from the atmosphere to the earth's surface;
2. infiltration and percolation of precipitation deep into the ground, replenishing the ground water supply;
3. overland flow or runoff of precipitation across land surfaces and through drainageways to streams, lakes and eventually, the ocean;
4. evaporation from surface water, soil and vegetation, returning water vapor to the atmosphere; and
5. transpiration by plants through their roots to their leaves, returning water vapor to the atmosphere.

The cycling of water from the earth's surface to the atmosphere and then returning to the earth, is called the hydrologic cycle. Hydrology is the study of the various waters of the earth, their occurrence, circulation, distribution, chemical and physical properties and reaction with the environment, including their relationships with living things.

STREAMS AND OTHER WATER RESOURCE FEATURES

Stream systems are related to other water resource features such as watersheds, lakes and reservoirs, wetlands, ground water, floodplains, riparian zones and fish and wildlife habitats.

Watersheds, or drainage basins, are areas of land which drain to a single outlet. The term watershed is also used for the outline of the drainage basin. Precipitation falling on one side of a

watershed line will drain to one outlet while precipitation falling on the other side of the line will drain to another outlet. The peak of a roof functions in the same way, dividing which direction runoff will flow off the roof. A watershed area may be as small as a farm field draining toward a gully, or as big as the Ohio River drainage basin, which is a combination of thousands of smaller watersheds across several states. Every river, stream and tributary is part of a watershed. The geography, geology and land uses in a watershed greatly influence a stream's character.

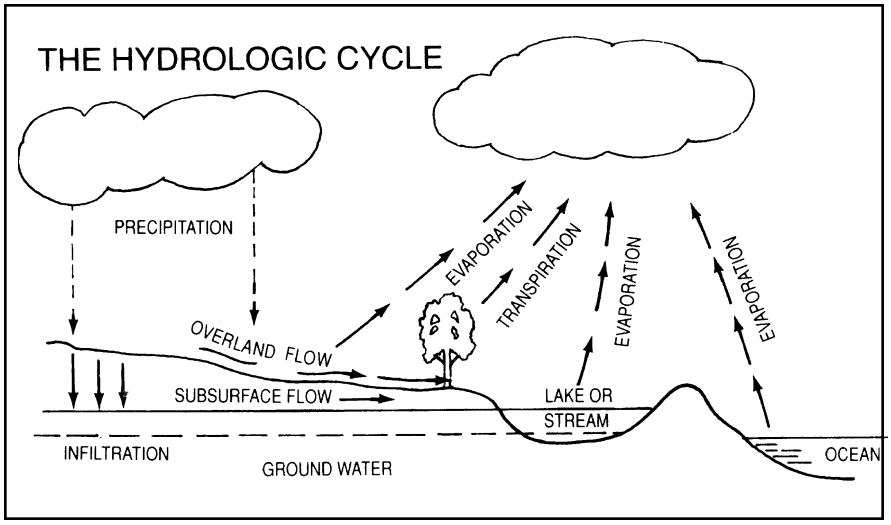
Lakes are naturally occurring impoundments of water, while reservoirs are made by humans. Lakes and reservoirs both serve as sinks where the sediment load that streams carry are deposited. These areas can provide water supply, flood control, fish and wildlife habitat, recreational opportunities and other benefits.

Wetlands are transitional areas between dry land and streams, ponds or lakes. Bogs, fens, marshes and swamps are examples of different types of wetlands. Wetlands are one of nature's ways of managing water quantity and quality. Wetlands provide a variety of no-cost, maintenance-free benefits such as, cleaning water, storing and slowing flood waters, providing ground water recharge and discharge, and providing wildlife habitat. Wetlands also have recreational, educational and aesthetic values which are enjoyed by more and more people.

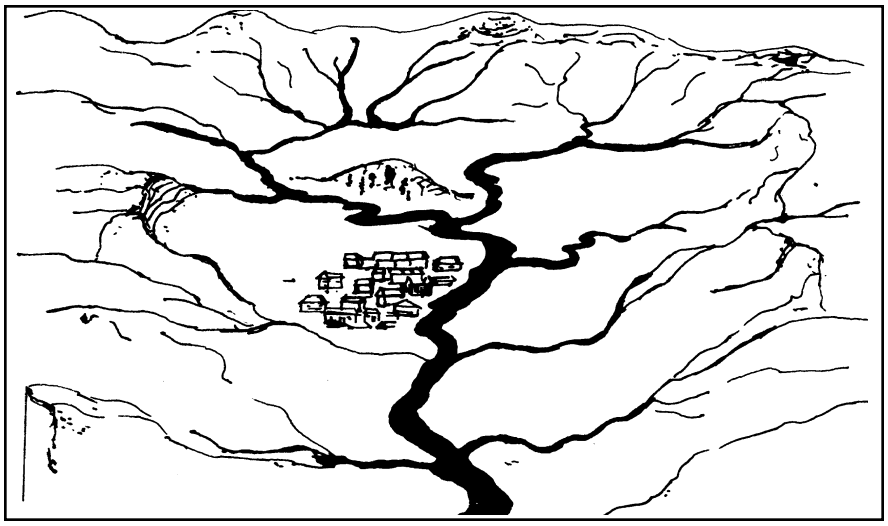
Ground water, a valuable source of drinking water, is water stored underground in porous, permeable layers of sedimentary rock or unconsolidated sand and gravel deposits, known as aquifers. Replenishment, or recharge, of the ground water supply occurs when precipitation penetrates deep into the subsurface and becomes part of the ground water system. Shallow ground water discharges into streams where water tables intersect stream channels, providing base flow to the stream. Streams may also exist as areas of discharge for deeper ground water aquifer systems.

Floodplains are the valley floors adjacent to stream channels which may be inundated during flood events. Flooding is a natural and unavoidable characteristic of all streams. Floodplains function as nature's safety valve by providing a place for floodwater to spread out, thus slowing the speed of floodwater discharge. Floodplains provide other valuable functions too, including wildlife habitat, ground water recharge, water quality maintenance and sediment control. They also have recreational, aesthetic and scientific values.

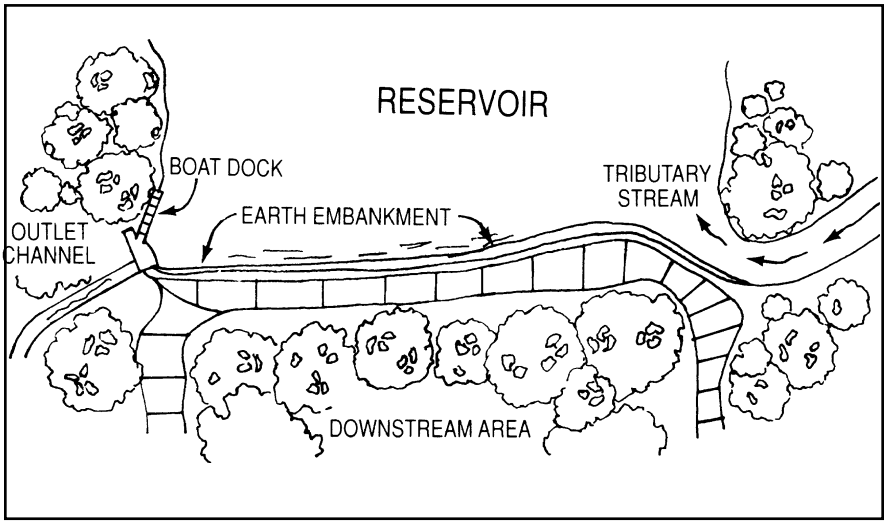
Riparian zones are lands immediately adjacent to streams, sometimes called stream corridors, usually within floodplains. The term riparian zone is often used to mean a streamside forested buffer area, particularly in water



Hydrologic Cycle



Watershed



Reservoir

quality programs and local ordinances. The width of the zone is then defined according to the program's purpose. Indeed, one of the best uses of stream side land is as a forested buffer area between the stream and other land uses. Retaining or restoring riparian land to forest provides many water quality and floodplain benefits. The riparian area provides a transition between aquatic habitat and upland habitat and may contain wetlands. The relative health of the riparian zone, or stream corridor, directly affects fish and wildlife survival.

The quality of fish and wildlife habitat is a function of the physical, chemical, and biological features of the entire watershed as well as the stream corridor. It indicates the capacity of the stream to support viable, diverse populations of both aquatic and terrestrial organisms.

HOW LAND USE AFFECTS WATER QUANTITY AND QUALITY

Land use changes affect the hydrology of an area in three ways:

1. Peak Flow Characteristics

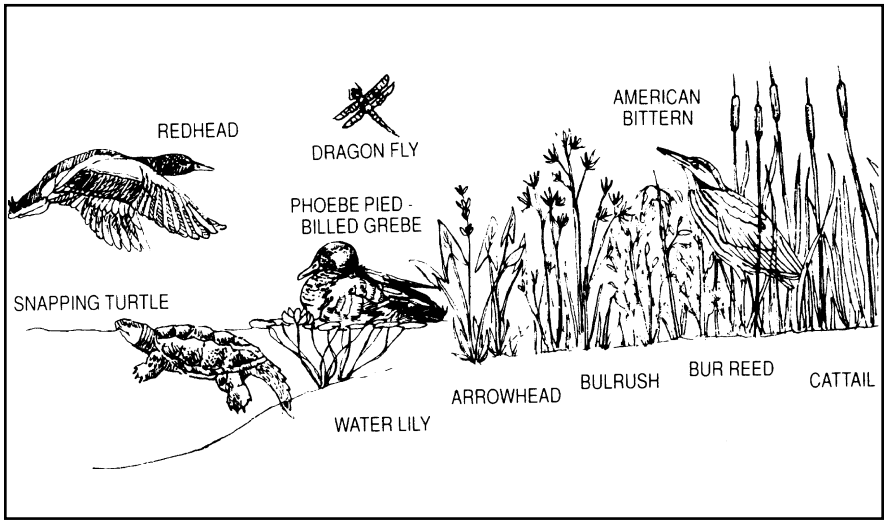
After rainfall events, runoff reaches streams and rises to reach a peak before subsiding. As land uses change from natural to agricultural or urban, the total amount of flow, peak flow height and stream flow speed increases. Streams rise higher, flow faster, and reach peak flows more quickly than under natural conditions. These effects are due to an increase in impervious area (streets, parking lots, roofs, etc.); a reduction in the opportunity for infiltration, evaporation, transpiration and depression storage; and the modification of surface drainage patterns.

2. Water Quality

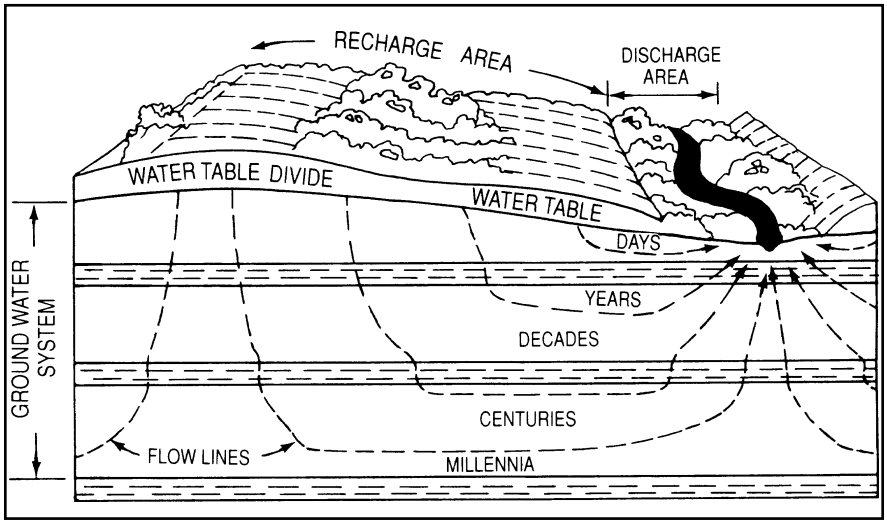
As the human use of land intensifies, the naturally occurring physical, chemical and biological activities which normally interact to recycle most of the materials found in runoff are disrupted. Human activities add pollutants such as pesticides, fertilizers, animal wastes, oil, grease and heavy metals to the land surface. Construction activities expose soil directly to precipitation. Soil and pollutant particles are washed downhill by rainfall and runoff, and increase the pollutant and sediment loads carried by receiving streams.

3. Stream Amenities

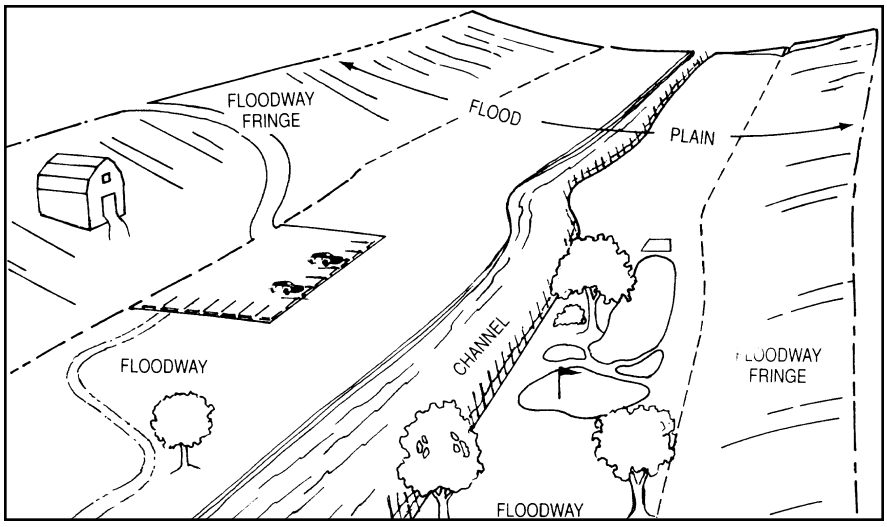
The value of natural stream corridors, as both a public and private good, reflects a higher land value near wooded stream corridors. A channel which has gradually enlarged due to increased flooding tends to possess unstable and un-vegetated banks, scoured or muddy channel beds, and accumulations of sediment and debris. In addition to being unsightly, these factors disrupt the natural balance in stream organisms. The addition of nutrients, organics and sediment caused by changes in hydrology tend to increase algae growth and turbidity (green- and brownish water),



Wetland



Ground Water



Floodplain

lower the oxygen content of the water and thereby reduce the variety of organisms supported by the stream. The beauty and value of the stream corridor is negatively affected when the stream channel is unstable, trash accumulates, and fish and wildlife communities are disrupted.

We are all land managers, so we are all stream managers. How we handle that responsibility — directly or indirectly — affects our neighbors in the watershed and along our stream. Our actions both reflect and change the society and environment around us. We should seek to improve the balance between aquatic organisms, water quality, water quantity, and land development in our Ohio watersheds and streams.

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This Guide is one of a series of Ohio Stream Management Guides covering a variety of watershed and stream management issues and methods of addressing stream related problems. The first several guides in the series are overview guides intended to give the reader an understanding of the functions and values of streams. For more information about stream management programs, issues and methodologies, see Guide 05 Index of Titles or call the ODNR Division of Soil and Water Resources at 614/265-6739. All Guides are available from the Ohio Department of Natural Resources. Single copies are available free of charge and may be reproduced. Please contact:

ODNR
Division of Soil & Water Resources
2045 Morse Road, Bldg. B
Columbus, Ohio 43229-6693
614/265-6740

The guides are also available on-line as web pages and PDF files so you may print high quality originals at your location. You will find the guides on-line at:

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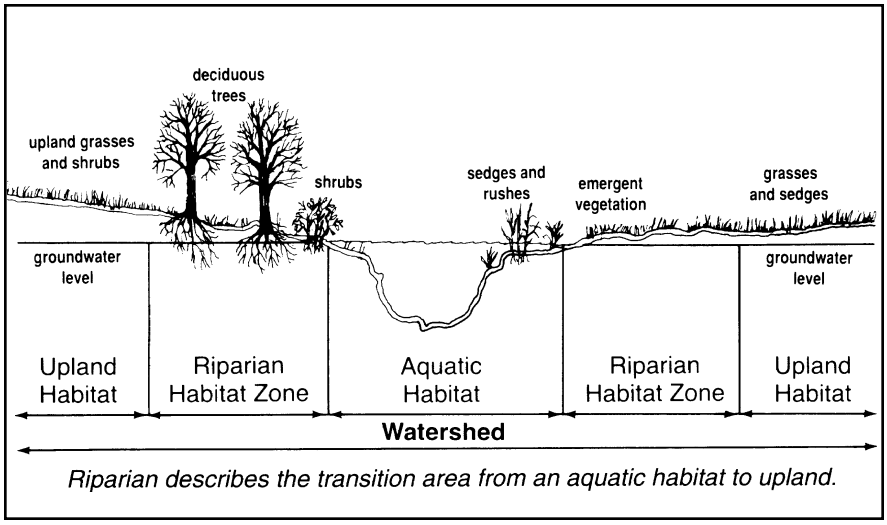

Riparian describes the transition area from an aquatic habitat to upland.

Riparian Zone

Wildlife Habitat

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Prepared by the Ohio Department of Natural Resources, Kim Baker, Division of Real Estate and Land Management, principal author. Input from staff of several ODNR divisions, state and federal agencies are used in the development of the Ohio Stream Management Guides.

Guides are available on-line at: http://www.ohiodnr.gov/soilandwater/