FRONT COVER
This **marsh**, with its lush aquatic vegetation, lies along the Iowa River floodplain at Otter Creek Marsh State Wildlife Refuge in Tama County. The backwaters persist in broadly curved sloughs scoured by the river's earlier meanders.

Photo by Roger A. Hill

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Water forms

of Iowa

With the puddling of raindrops, water gathers for its innumerable journeys throughout Iowa. As it flows along, water may become part of a kettlehole, a marsh, a farm pond, a river, a flood, an aquifer, a fen, a cave, a spring, or a waterfall. In all of its aspects, water adds fluid beauty to the landscape. Both above and below ground, water is an ever-present geologic force as well as a vital natural resource, and the focus of environmental protection and natural resource issues.

Roger A. Hill

Thousands of years ago, water in its crystalline form of ice carried the raw building materials of much of Iowa's present landscape into the state within the grasp of massive glaciers. In turn, the melting of these ice sheets laid the courses of most rivers seen on today's maps. Even the state's bedrock foundation, whose picturesque ledges and bluffs outcrop along some of these river valleys, originated millions of years ago as layers of sediment on ancient sea floors, along coastlines, and in stream channels.

Iowa's past geological environments supplied the earth materials that contain our present surface and groundwater resources. These materials shape the forms that water takes on the land surface, and they also determine how fast and how far water moves underground and where it can be tapped for wells. Earth materials affect groundwater's natural quality, as well as its vulnerability to contamination introduced from the land surface.

Though the ground generally is regarded as being "solid," there are spaces within earth materials. Their abundance, size and interconnectedness determine what happens to water below ground. It is a myth that this water is stored in large underground rivers and lakes. In sand, gravel or sandstone, groundwater is stored in spaces between the grains. In limestone and dolomite, the openings are actually fractures, from hairline width to cavern sized. Groundwater can move freely through all these materials. Clay and shale, however, have the opposite effect. The tiny pores amid these closely packed materials may hold water, but it cannot easily flow through them. Movement of water underground is further affected by the slope of the water-bearing strata (called aquifers), and whether they are confined by dense overlying materials or perhaps are under the influence of a nearby pumping well.

Underground water is pumped by wells into the kitchen faucets of 75 percent of Iowa homes. To find these vital but concealed groundwater resources, and safeguard their drinking quality, we need to know how the aquifers are distributed beneath the state – their depth, thickness, extent and the details of their composition as well as the earth materials occurring above and below them. Ongoing research to improve the accuracy of this geologic information will give Iowans the information they need to locate wells and protect water supplies from contamination now and in years to come.


Photographic Services, The University of Iowa

Water circulates through our environment in a process known as the ***hydrologic cycle****. Precipitation from clouds falls to the ground where it may be taken up by plant roots, flow as surface runoff to streams, or slowly percolate deeper into the earth to become groundwater. Water returns as vapor to the atmosphere primarily by evaporation from lakes and streams, and by plant transpiration.*


Roger A. Hill

During low-flow conditions in a river channel, it is possible to see the ***sediment load*** *carried by water. These rounded cobbles are part of the load moved during flood flows along the Skunk River in Story County. Smaller grains of sand, silt and clay can travel farther and gradually settle as the flow volume decreases. The capacity of flowing water to erode and deposit earth materials makes it the most effective geological process shaping the Iowa landscape today.*

A ***flood*** *occurs when a river overflows its banks and spreads out to cover land not usually under water. When these Cedar River floodwaters recede at Seminole Valley Park in Cedar Rapids, cleanup crews will find deposits of sand and silt as well as scoured out areas.*


Peter M. Schulmeyer, USGS


Dick Baker

The water in these ***kettleholes*** *accumulates from rainfall and snowmelt as well as groundwater seepage. The wetland features are a legacy of melting glacial ice 13,000 to 11,000 years ago. (Right) Freda Haffner Kettlehole State Preserve, Dickinson County. (Below) Bjorkboda Marsh, Hamilton County.*


Roger A. Hill

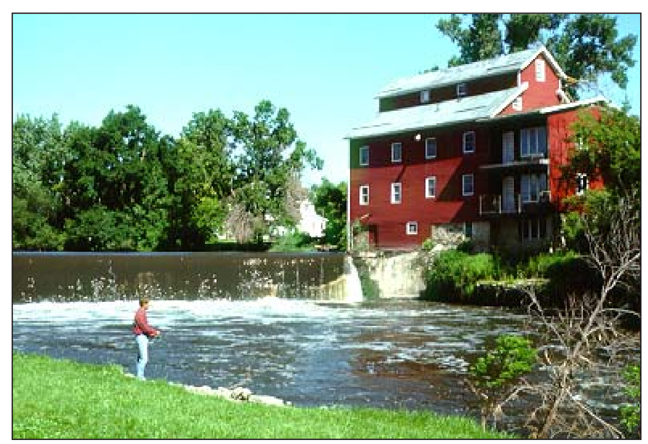

Carol Thompson

A ***fen*** *is a spongy mound of peat fed by mineralized groundwater and supporting a unique wetland flora. In Iowa, these "mound springs" are typically found on hillsides. Note the rust color as groundwater flow comes in contact with the air, causing dissolved iron to oxidize. Silver Lake Fen State Preserve, Dickinson County.*


Lynette Seigley

The flow of groundwater from this column of concrete and steel at Osage Spring Municipal Park (Mitchell County) resembles a ***flowing artesian well****. The site has yielded a year-round water supply for at least 100 years. Upwelling of groundwater occurs where a water source, confined under the pressure by overlying impermeable rock, finds a natural opening to the land surface or is tapped by a well. This groundwater contains noticeable amounts of dissolved iron (note rust-colored buildup on the column).*

This historic ***milldam*** *was built on the Winnebago River at Fertile, in Worth County, to put the river's flow to work. The dam raised the river level so the force of falling water could be used to turn wheels and stones within the mill to grind grain into flour.*


Lowell Washburn


Carol Thompson

Springs *occur where groundwater flows from rock or soil material to the land surface. This spring tumbles from crevice openings in dolomite near the entrance to Spook Cave in Clayton County. In northeastern Iowa, springs often flow near the base of steep-sided valleys that intercept a contact between contrasting rock types.*


Michael Bounk

Caverns *form as groundwater moves through subterranean crevices in limestone over long periods of time. In this scenic chamber, water seeps in along the ceiling and slowly adds more calcium carbonate (lime) to the glistening formations that decorate the cavern walls. Cold Water Cave, Winneshiek County.*

A ***river*** *is a volume of water flowing along a well-defined channel toward some larger (and lower) body of water. In a river channel, the local groundwater table is visible as surface water. Springs and seeps are significant contributors to northeast Iowa rivers, especially along the Upper Iowa River in Winneshiek County.*


Greg Ludvigson

A berm built across a hillslope captures the runoff from rainfall, storing it for livestock use. ***Farm ponds*** *are particularly abundant in the southern half of Iowa where the lack of sufficient groundwater creates a need for impounding water supplies, and the rolling topography favors their construction.*


Roger A. Hill

Lake Macbride (right) is a ***reservoir*** *separated from the Iowa River (left) by a dam near the center of this view. The muddy (flooding) Iowa River contains a greater load of suspended silt and clay than the clearer waters of Lake Macbride. This reflects the greater land area draining to the Iowa River and the effects of runoff from cultivated land.*


Photographic Services, The University of Iowa