4

Conserving Natural Resources

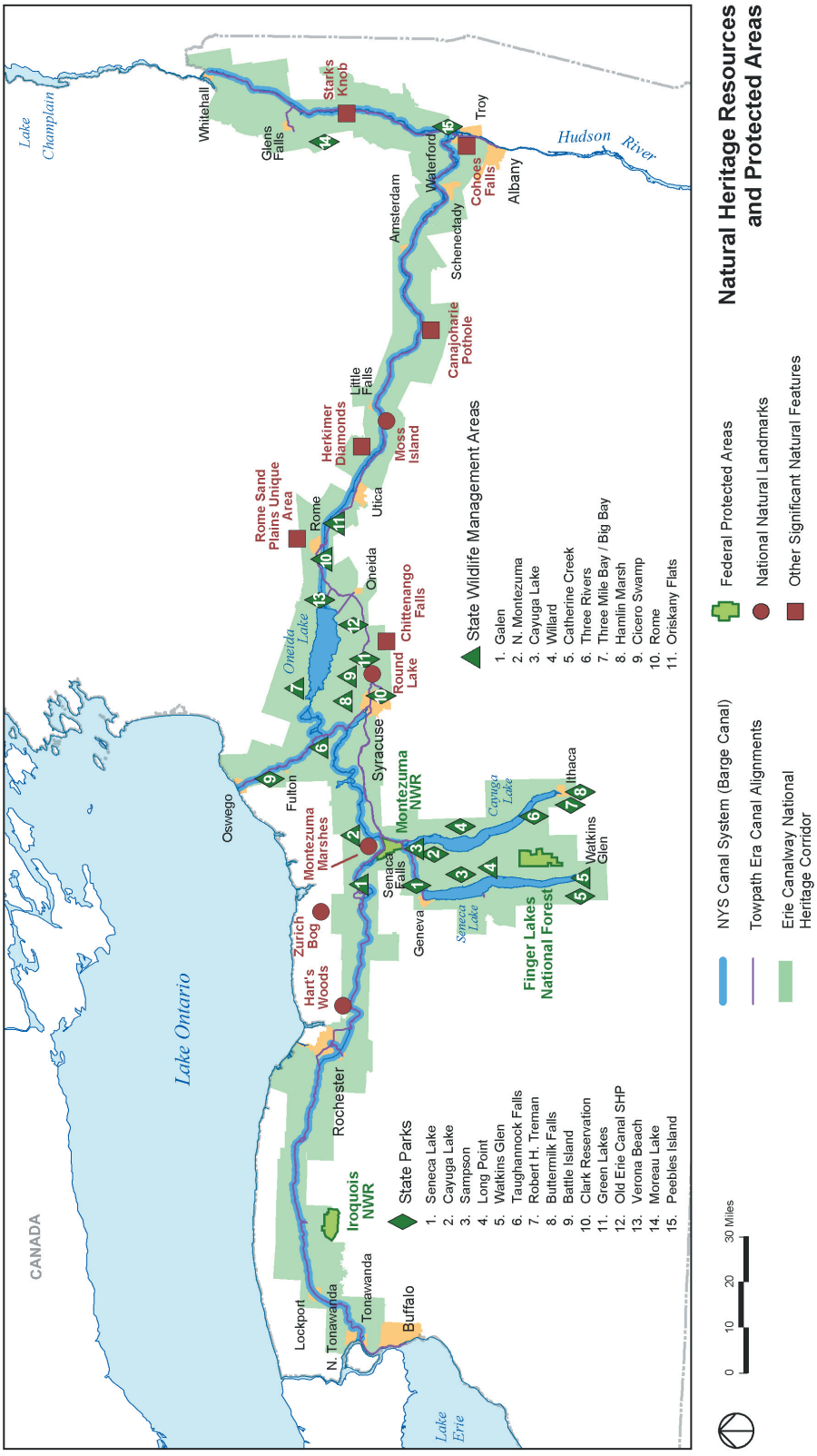
Photo:
Cohoes Falls

OVERVIEW

Natural resources were integral to the historical and cultural development of the Erie Canalway National Heritage Corridor. Today, they serve as the foundation for the success of the region's tourism, recreation, and quality of life for residents. While the focus of this Preservation and Management Plan is on the protection of historic and cultural resources, natural resources also form a compelling story that can be used to interpret many elements of the Corridor.

The form and character of the land in the Corridor create a setting that is distinct from other regions in the country. The geology, soils, and landforms shaped the alignment and construction of the canals and provided the economic base for centuries of continuous settlement. Water resources weave through every portion of this landscape, including dramatic rivers, the marvel of the canals, a multitude of lakes, and underground aquifers. Within this climate, the vegetation is varied, including hardwood forests, wetlands, bogs, sweeping agricultural fields and orchards. The available water and variety of vegetation provide habitat for fish, waterfowl, upland forest species, and a number of threatened and endangered species.

These resources are the basis for a host of recreational activities and provide the essential ingredient for the quality of day-to-day life in the Corridor, attracting businesses, residents, and tourists to enjoy the natural beauty of the region. Although the Corridor's natural resources have benefited from extensive investments in conservation, they remain sensitive to the adverse effects of uncontrolled development. The increased demand for residential development and related shoreline modifications along the canal system and other water bodies can significantly impact Corridor ecologies and natural systems, contributing


Natural Heritage Resources and Protected Areas
Lake Champlain
Hudson River
Lake Ontario
Lake Erie
CANADA
Whitehall
Glens Falls
Starks Knob
Troy
Waterford
Cohoes Falls
Albany
Amsterdam
Schenectady
Canajoharie Pothole
Little Falls
Herkimer Diamonds
Moss Island
Utica
Rome
Rome Sand Plains Unique Area
Oneida
Oneida Lake
Chittenango Falls
Round Lake
Syracuse
Fulton
Oswego
Montezuma NWR
Montezuma Marshes
Seneca Falls
Cayuga Lake
Seneca Lake
Geneva
Ithaca
Watkins Glen
Finger Lakes National Forest
Zurich Bog
Hart's Woods
Rochester
Iroquois NWR
Lockport
N. Tonawanda
Tonawanda
Buffalo
State Parks
1. Seneca Lake
2. Cayuga Lake
3. Sampson
4. Long Point
5. Watkins Glen
6. Taughannock Falls
7. Robert H. Treman
8. Buttermilk Falls
9. Battle Island
10. Clark Reservation
11. Green Lakes
12. Old Erie Canal SHP
13. Verona Beach
14. Moreau Lake
15. Peebles Island
State Wildlife Management Areas
1. Galen
2. N. Montezuma
3. Cayuga Lake
4. Willard
5. Catherine Creek
6. Three Rivers
7. Three Mile Bay / Big Bay
8. Hamlin Marsh
9. Cicero Swamp
10. Rome
11. Oriskany Flats
NYS Canal System (Barge Canal)
Towpath Era Canal Alignments
Erie Canalway National Heritage Corridor
Federal Protected Areas
National Natural Landmarks
Other Significant Natural Features
0 10 20 30 Miles

to flooding, erosion, point and non-point source pollution, and habitat disruption. Land use regulations remain an important tool for balancing public conservation goals with the needs of residents and businesses attracted to the Corridor's natural resources.

Although the Corridor's natural resources have benefited from extensive investments in conservation, they remain sensitive to the adverse effects of uncontrolled development.

Enhanced stewardship of the Corridor environment will involve increased understanding of these natural resources and their interrelationship with each other and with the other goals of the National Heritage Corridor. Efforts to protect the region's scenic value will enhance understanding of the historical and economic movements that have transformed the Corridor's geology and hydrology into cultural landscapes (see Chapter 3, *Protecting Our Heritage*). At the same time, stronger relationships between recreational and natural resources, appropriately managed, can increase awareness of the delicate balance of the ecosystem (see Chapter 5, *Promoting Recreation*).

GOALS

The conservation goal for the Erie Canalway National Heritage Corridor is that *the Corridor's natural resources will reflect the highest standards of environmental quality.* Two objectives have been identified as milestones toward this goal:

Increase public awareness and support for conservation and enhancement of critical natural resources

One of the primary objectives of the Corridor is to raise public awareness of the tremendous natural resources in place. There is a wealth of available information in the public domain that describes the value of conserving and enhancing natural resources. This information should be conveyed to a wide public audience with a minimum of scientific and regulatory terminology. Public awareness is key to engaging broad support for conservation initiatives.

Encourage quality stewardship practices

Open space conservation; enhancement of water and air quality; integrated regional management of natural resources, including waterfronts; and partnerships with other organizations and agencies are necessary to sustain natural resource protection in the Corridor.

CONTEXT

New York State has a long history as a leader in conservation activities, including a number of remarkable public-private partnerships that have served as national models for reconciling the needs of recreation and clean air and water with the needs of economic growth. Increasingly, individual communities are acting to conserve the natural resources they have recognized as critical to local character and quality of life. Ironically, enhancements such as newly protected areas, revitalized natural habitats, and cleaner waterways are sometimes threat-

ened by the new growth they help to attract. As more people decide to live in and visit the Erie Canalway National Heritage Corridor, it is imperative to educate the public about local and state initiatives responsible for restoring and protecting the region's natural resources.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (DEC)

The department is responsible for the conservation and protection of the state's environment and natural resources. DEC plans for the future use of state lands and protection of the state's open space; advises watershed planning efforts; administers management of water quality, air quality, environmental remediation, and solid waste; develops Watershed Restoration and Protection Action Strategies (WRAPS); manages the state's fish, wildlife, and marine resources; and oversees local administration of the State Environmental Quality Review Act (SEQRA), a significant tool for influencing all development actions that require government permits. Among DEC's water quality initiatives are the State Pollutant Discharge Elimination System (SPDES) for control of industrial discharges and combined sewer outfalls, stormwater regulations and Concentrated Animal Feeding Operations (CAFO) regulations for control of non-point source pollution and agricultural runoff.

NEW YORK STATE OPEN SPACE CONSERVATION PLAN

Jointly administered by DEC and the New York State Office of Parks, Recreation and Historic Preservation (OPRHP), this plan sets forth the state's policy priorities and recommendations for open space conservation, preservation, and acquisition. It acts as a clearinghouse for information that local governments can use to pursue technical assistance and grants from other sources. It also guides the state's efforts to become a more effective partner with local governments, conservation organizations, and private land owners to conserve important open space resources. The 1998 plan was credited with guiding conservation of more than 394,000 acres of land with $378 million from the Environmental Protection Fund and Clean Water/Clean Air Bond Act. The plan is updated every three years with input from nine regional advisory committees and the general public.

The 2002 plan, based on input from the regional advisory committees, includes guiding principles, a summary of resource inventories and assessment of needs, project eligibility criteria and definitions, and a resource value rating system. The plan's priorities are to protect water quality, habitat, and open space to meet the needs of residents, recreational users, resource-based industries, researchers, and ecological diversity. Recognizing the need to fit appropriate strategies to different resources, the plan calls for cost/benefit analyses of conservation methods and a policy of fair and open negotiation with local governments and private property owners on a willing seller/willing buyer basis.

NEW YORK STATE ENVIRONMENTAL PROTECTION FUND (EPF)

Created in 1993 by the Environmental Protection Act, this fund provides mechanisms for open space conservation, land acquisition, waterfront revitalization, water quality projects, farmland protection, and special areas planning. EPF Title 3 provides funds for OPRHP to undertake open space land conservation projects in partnership with local governments and nonprofit organizations. Title 9 provides funds for OPRHP, local governments, and nonprofit organizations to purchase, preserve or improve park lands, historic resources, and state-designated heritage areas and corridors. Title 11 provides funds for waterfront revitalization plans, watershed management plans, and coastal rehabilitation projects.

REGIONAL PLANNING BOARDS/COUNCILS AND COUNTY PLANNING AGENCIES

The National Heritage Corridor intersects seven of New York State's nine regional planning jurisdictions and four unaffiliated counties: Erie and Niagara Counties, which share many planning functions; Tompkins County; and Montgomery County, which participates in the Mohawk Valley Economic Development District. The multi-county regional councils and county planning agencies provide technical assistance to municipalities and develop regional plans addressing land use, economic development, transportation, watershed management, and open space. The New York State Association of Regional Councils administers the Statewide Water Resources Management Program, which facilitates water quality planning that, like the state's major drainage basins, crosses regional and other jurisdictional boundaries.

NEW YORK STATE DEPARTMENT OF STATE – DIVISION OF COASTAL RESOURCES

Through the Local Waterfront Revitalization Program, the Division of Coastal Resources encourages communities to guide the beneficial use, revitalization, and protection of their waterfront resources and watersheds by preparing Local Waterfront Revitalization Plans or intermunicipal watershed protection plans. In partnership with the Division, a municipality or inter-municipal region develops community consensus and policies to address issues including waterfront redevelopment; harbor management; public access; erosion hazards management; water quality protection; habitat restoration; and historic maritime resource protection. The resulting comprehensive framework must indicate what local implementation measures are needed, specific projects that will advance the program, and state and federal agency actions necessary for the program's success. Once approved by the New York State Secretary of State, the framework serves to coordinate state actions needed to achieve the goals of the community or region. Over the past eight years, over 90 grants totaling more than $6 million have been awarded to municipalities along the canal system, through Title 11 of the Environmental Protection Fund, for waterfront and watershed projects supported by the 1995 Recreationway Plan.

BROWNFIELD OPPORTUNITY AREAS PROGRAM

This program, administered by the Department of Environmental Conservation and the Department of State, provides municipalities and community organizations with assistance to return contaminated and dormant areas back to productive use while restoring environmental quality. The program works with communities to build consensus on the future uses of strategic brownfield sites and establish the multi-agency and private sector partnerships necessary to leverage assistance and investments to revitalize multiple brownfield sites.

NEW YORK STATE DEPARTMENT OF AGRICULTURE AND MARKETS

The Department operates two matching grants programs under the Farmland Protection Program. The Farm Protection Planning program assists county governments in developing agricultural and farmland protection plans to maintain the economic viability of the State's agricultural industry and its supporting land base. The Farmland Preservation program assists local governments in implementing their farmland protection plans and has focused on preserving the land base by purchasing the development rights on farms using a conservation easement. The purchase of development rights can help preserve open space and continued agricultural use where the benefits and protections available through agricultural districting and other planning tools may not be sufficient to overcome local development pressure and other issues affecting farmland.

QUALITY COMMUNITIES INITIATIVE

The Quality Communities Task Force, comprised of 25 State agencies and academic partners, was created by executive order in 2000 to assist New York communities in implementing effective land development, preservation and rehabilitation strategies that promote both economic growth and environmental protection. The Quality Communities Initiative focuses on revitalizing town centers, protecting open space, and improving the use of technology in ways that complement the priorities of individual communities. Conservation-oriented recommendations by the Task Force include: continued funding of open space and farmland conservation programs; providing a tax credit to encourage donation of property interests to nonprofits or government agencies for conservation purposes; authorizing the creation of local open space districts; funding a pilot project to encourage the voluntary transfer of development rights; and continued funding for the Agricultural Environmental Management program to assist farmers with addressing water quality concerns. Twelve pilot communities across New York, including Rome and Lockport, have received focused financial and technical assistance from state agencies to help develop and implement revitalization strategies based on the Task Force recommendations.

NEW YORK STATE HERITAGE AREA SYSTEM

The Heritage Area System (formerly known as the Urban Cultural Park System), administered by the New York State Office of Parks, Recreation and Historic Preservation, is a state-local partnership established to preserve and develop areas that have special significance to the state. Eight state heritage areas and two state heritage corridors, each guided by its own management plan, lie within or overlap the boundaries of the Erie Canalway National Heritage Corridor. Many of the heritage area management plans explicitly address preservation of canal-related resources, along with the overall goals of conservation, recreation, education, and economic revitalization.

Specifically, the management plans for both the Mohawk Valley and the Western Erie Canal State Heritage Corridors recognize the close connection between the natural and built environments and the importance of the canal system's natural setting for recreation and tourism development. The interpretive plan for the Mohawk Valley Heritage Corridor cites geography as a major theme, noting that the valley's rich alluvial flats, limestone caves, natural diamonds, rock formations, and waterfalls created the conditions for all subsequent and future development. The management plan for the Western Erie Canal Heritage Corridor includes a model compact to be adopted by its partner communities, including a pledge to develop a community ethic of stewardship for natural as well as historic resources.

ERIE CANAL GREENWAY

A state agency task force is developing the concept for a legislatively designated state greenway along the Erie Canal, proposed by the Governor in 2005. The Erie Canalway National Heritage Corridor Commission was invited to participate as a member of the New York State Canal Corporation Interagency Task Force. The Commission will cooperate with the Canal Corporation and any entity created to help achieve compatible and complementary goals.

HUDSON RIVER VALLEY GREENWAY / HUDSON RIVER VALLEY NATIONAL HERITAGE AREA

The Greenway Act of 1991 created two organizations to facilitate the development of a voluntary regional strategy for preserving the Hudson River Valley's scenic, natural, historic, cultural, and recreational resources while encouraging compatible economic development and maintaining the tradition of home rule for land use decision-making. The Greenway Council, a state agency, works with local and county governments to enhance local land use planning and create a voluntary regional planning compact for the Hudson River Valley. The Greenway Conservancy, a public benefit corporation, works with local governments, organizations, and individuals to establish a Hudson River Valley Trail system, promote the Hudson River Valley as a single tourism destination area,and assist in the preservation of agriculture, and, with the Council, works with communities to strengthen state agency cooperation with local governments. The Greenway is the management entity of the Hudson River Valley National Heritage Area, created in 1996 to recognize, preserve, protect, and interpret the nation-

ally significant cultural and natural resources of the Valley for the benefit of the nation. The Greenway works in partnership with the National Park Service to promote the National Heritage Area management plan themes of Freedom & Dignity, Nature & Culture, and Corridor of Commerce.

LAKES TO LOCKS PASSAGE

Designated an All-American Road – among the best of the nation's scenic byways – Lakes to Locks Passage was created by merging the Champlain Canal Byway and the Champlain Trail (along Lake Champlain) for community revitalization and tourism development. The Byway's Corridor Management Plan, developed through a partnership of the public and private stewards of the historic, natural, cultural, recreational and working landscape resources along the Champlain Canal, Upper Hudson River, Lake George and Lake Champlain regions, provides a structure to unify the communities along the interconnected waterway. Lakes to Locks Passage works with private landowners and non-profit organizations to steward the region's natural resources, recognizing that a viable rural economy is the best tool to maintain the scenic qualities of the working landscape.

FEDERALLY PROTECTED NATURAL RESOURCES

Two federally protected areas – the Finger Lakes National Forest, administered by the U.S. Department of Agriculture's Natural Resources Conservation Service, and the Montezuma National Wildlife Refuge, administered by the U.S. Department of the Interior's Fish & Wildlife Service – are within the Corridor boundary. In addition to conserving and interpreting critical habitat, open spaces, and water resources, these federally protected areas offer extensive recreational opportunities. The National Heritage Corridor will work closely with the managing entities of both areas to collaborate on enhanced outreach and interpretation activities.

NATIONAL NATURAL LANDMARKS

Established in 1962 and administered by the National Park Service, this program aims to encourage and support voluntary preservation of sites that illustrate the geological and ecological history of the United States, and to strengthen the public's appreciation of America's natural heritage. The program affords recognition to what may otherwise be underappreciated sites, and helps the public and private stewards of National Natural Landmarks to find technical specialists who can advise them on how to care for the resources they own or manage. Five National Natural Landmarks, some open to public access, are within the Corridor: Hart's Woods, Zurich Bog, Montezuma Marshes, Round Lake, and Moss Island.

RESOURCE ANALYSIS

GEOLOGY AND SOILS

The Canalway Corridor takes advantage of the most significant gap in the Appalachian Mountain range, providing a natural avenue between the eastern seaboard and the Great Lakes. The engineering and construction of the canals responded to the unique topographic and geologic features of the region. The agricultural soils provided the basis for development along the Corridor, and unique attributes of the soils, minerals and stone sustained the economy over time. Today the shape of the land, lush vegetation, diverse habitat, and unique geological attractions offer a striking setting for tourists and other visitors.

The Canalway Corridor takes advantage of the most significant gap in the Appalachian Mountain range, providing a natural avenue between the eastern seaboard and the Great Lakes.

Bedrock Formation

A shallow sea covered upstate New York during the period from 450 to 390 million years ago. Over time layers of shells and silt were deposited on the sea floor and were later compressed by overlying new sediments. In this process, sand was solidified into sandstone, thick layers of mud became soft shales, and dissolved shells and calcium carbonate formed thin layers of resistant dolomite and limestone. In shallow embayments, the seawater evaporated, leaving concentrations of dissolved minerals such as salt and gypsum. These ancient deposits provided the resources that later launched Syracuse's salt trade in the nineteenth century.

When the geologic events of the Alleghanian Orogeny, or mountain-building episode, thrust up the Appalachian Plateau during the period from 320 to 250 million years ago, the sedimentary rocks west of the Hudson were tipped gently to the south, exposing a cross section of layers. The tipped layers blocked the prevailing northward flow of water and redirected the streams into east-west channels that cut down into the softer layers. The Mohawk, Seneca, and Clyde Rivers follow this east-west pattern, granting the Erie Canal an ease of construction and operation unknown to any other canal that attempted to unite the interior of the continent with the eastern seaboard. Some layers of bedrock were quarried and used as building stone in towns and cities across the corridor; Lockport dolomite, Medina sandstone, and Onondaga limestone were notable products.

As the streams cut down through the limestone caprock and tipped shale, they etched the surface into relief, leaving a pattern of steep slopes or escarpments facing north, and gentle slopes facing south. These escarpments extend east-west in bands across upstate New York. Along most of its length, the Erie Canal's alignment took advantage of the east-west orientation of the underlying bedrock and the softer shales. Crossing an escarpment, however, posed a major challenge, as evidenced in Lockport, where the Flight of Five locks climbs approximately 60 feet to ascend the Niagara Escarpment.

Glacial Period

During the period from approximately one million to 10,000 years ago, successive waves of glaciers moved across the bedrock formation and shaped other distinctive landforms through processes of erosion and deposition. The glaciers eventually moved south as far as Pennsylvania, scouring material from the Laurentian Shield and mountains to the north and depositing a glacial till of cobbles, pebbles, sand, clay, and other material as they receded. The glaciers also shaped many unique glacial features that form the characteristic landscape of upstate New York.

In the area between Rochester and Syracuse, drumlin fields are prevalent. The drumlins record the direction of the glaciers' flow from Lake Ontario in the north toward the Finger Lakes in the south with characteristic spoon-shaped hills. The Corridor is studded with kettle lakes, depressions formed when blocks of ice, surrounded and/or buried by glacial outwash, melted after the glacial retreat. Another glacial landform is the esker, a sinuous linear ridge created by sediment-laden streambeds flowing under the glacial ice. The canal builders took advantage of the Cartersville Esker to build the 70-foot-high Great Embankment across the Irondequoit Valley.

As the glaciers migrated southward, they flowed first into the existing stream valleys, carving a series of deep troughs. As they retreated northward, the receding edges of the glaciers deposited moraines of glacial outwash that dammed the flow of meltwater, creating finger lakes. Seneca Lake and Cayuga Lake are excellent examples of this landform, with their north-south orientation parallel to the glacial movement. The glaciers also scoured the edges of pre-existing east-west valleys, transforming them into a broad, gentle U-shape, as seen along the Mohawk River today.

As the glaciers receded, huge pools of melt water formed between the high ground to the south and the face of the ice sheet to the north. With few outlets, the early lakes had high water levels, well above today's levels of the Great Lakes and Finger Lakes, and extended to the ridges south of the Finger Lakes. As new outlets were created, each successive lake became lower and smaller. The now-vanished glacial Lake Warren, Lake Dana, Lake Dawson, and Lake Iroquois represented early lake levels before the current water level of Lake Ontario was established. Traces of these prehistoric lakebeds can be seen in the flat, low lying land around Syracuse and north of the Finger Lakes, such as beach deposits (Ridge Road) and delta deposits or kames (sand and gravel pits around Rochester).

Channels, following the course of the softer shale sediments extending from the Fairport area, through Palmyra, Newark, Lyons, and Clyde, to the Mohawk River Valley, drained the glacial lakes. Glacial erosion breached the high point at Little Falls, which had previously been a divide between east and west flowing rivers, and provided an outlet to the east for glacial meltwaters. As the lakes lowered, the Rome area was established as a new ridge point dividing the east-west flow.

With each new breach, water levels dropped suddenly in glacial lakes and deeper valleys, leaving tributary streams and rivers perched at a higher level. These hanging valleys were eroded back into gorges or, where the streams encountered resistant rock, became falls such as Watkins Glen, Enfield Falls, Ithaca Falls, and Taughannock Falls. Cohoes Falls follows this pattern at the juncture of the Mohawk and Hudson Valleys, where a cumulative drop of 170 feet posed one of the greatest challenges for the canal builders.

As the Corridor was settled, the many waterfalls throughout the region created multiple locations for power generation. Today, some of these unique geologic features are destinations, such as Canajoharie Pothole, where Canajoharie Creek scoured out a hole 20 feet in diameter and eight feet deep. At Moss Island in Little Falls, near Lock E17 of the Barge Canal, a National Natural Landmark marks the eastern United States' best exposure of glacial age potholes eroded by meltwater floods.

Topography and Soil Formation

The 20th century Erie Canal climbs 570 feet from the Hudson River to Lake Erie, with a saddle in the middle where the land drops west of Rome (elevation 420 feet above mean sea level) down to a low point near Syracuse (elevation 360 feet) before climbing steadily to Rochester and the escarpment at Lockport. An extensive rock excavation west of Lockport (the Deep Cut) created a level section between Lockport and Buffalo. While this cut allows some of the water from Lake Erie to enter the system, the total quantity is limited by the flat slope from the lake to the escarpment (see *Canal System Profiles*, page 4.13).

The 19th century canal alignments followed a more circuitous path between Rome and Newark, following the contours as closely as possible. The low points were at Syracuse and Montezuma (elevations around 390 feet) and a summit, known as the Jordon Level, was introduced between them. At Newark (elevation 400 feet), the historic canal alignment is largely coincident with the 20th century canal alignment as it climbs in steps toward Lake Erie.

Rome, a high point in the east-west passage of the Erie Canal, is lower than any other point along the entire east coast mountain chain between the St. Lawrence River and Birmingham, Alabama.

Rome is strategically located at the headwaters between the east flowing Mohawk River and Wood Creek, which flows west to Oneida Lake and its outlet to the Oswego River. The advantage of the Erie Canal as a pass through the mountains is underscored by the fact that Rome, a high point in the east-west passage, is lower than any other point along the entire east coast mountain chain between the St. Lawrence River and Birmingham, Alabama. Fort Stanwix was built in the eighteenth century to defend this important pass.

The fertility of the soils in the region is attributed to the permeability of the alluvial soils and the presence of calcium carbonate, or lime, from the dolomite and limestone bedrock, which balances the otherwise acidic soils. Historically, the agriculture of the region provided an economic base that fed the canal workers and their families, led to the settlement of towns and villages, and allowed for exports to the cities. Under the climatic influence of Lake Ontario, the lake plain and Niagara Escarpment made ideal locations for orchards, grain (thus Rochester's early nickname, the "Flour City"), and later nurseries and seed companies

(Rochester as the "Flower City"). Today, the climate and soils continue to support plant nurseries, orchards, dairy and vegetable farms and are the basis for newer agricultural endeavors such as vineyards and specialty produce.

Shales between the Lockport Dolomite and Onondaga Limestone bedrock ridges were exposed and eroded following the last Ice Age (ending about 14,000 years ago), creating a low-lying area. In this region water flows from upland streams to the Finger Lakes, then to the canalized Seneca and Oswego Rivers, and finally into Lake Ontario.

Large wetland areas persist along the east-west band of the Canalway Corridor, most notably in the Montezuma National Wildlife Refuge. These wetlands provide water purification, flood protection, and wildlife habitat in the region.

During the waning stages of the glacial period, the land along the face of the receding ice sheet was generally low-lying, flat, and subject to frequent flooding. These areas, representing the vestiges of the final glacial lakes such as Lake Iroquois, collected organic debris that was slow to decompose in the high water table and led to the formation of bogs. The mucklands of the central region were well suited to root vegetables and produce that could be shipped to urban markets. Large wetland areas with poor drainage persist along the east-west band of the Canalway Corridor, most notably in the Montezuma National Wildlife Refuge. These wetlands provide water purification, flood protection, and wildlife habitat in the region.

As the last glaciers melted northward, ocean waters flowed through the St. Lawrence River Valley and into Lake Champlain, forming the short-lived Champlain Sea. Erosional processes of the glacial sea created the low-lying areas where the northern portion of the Champlain Canal flows today.

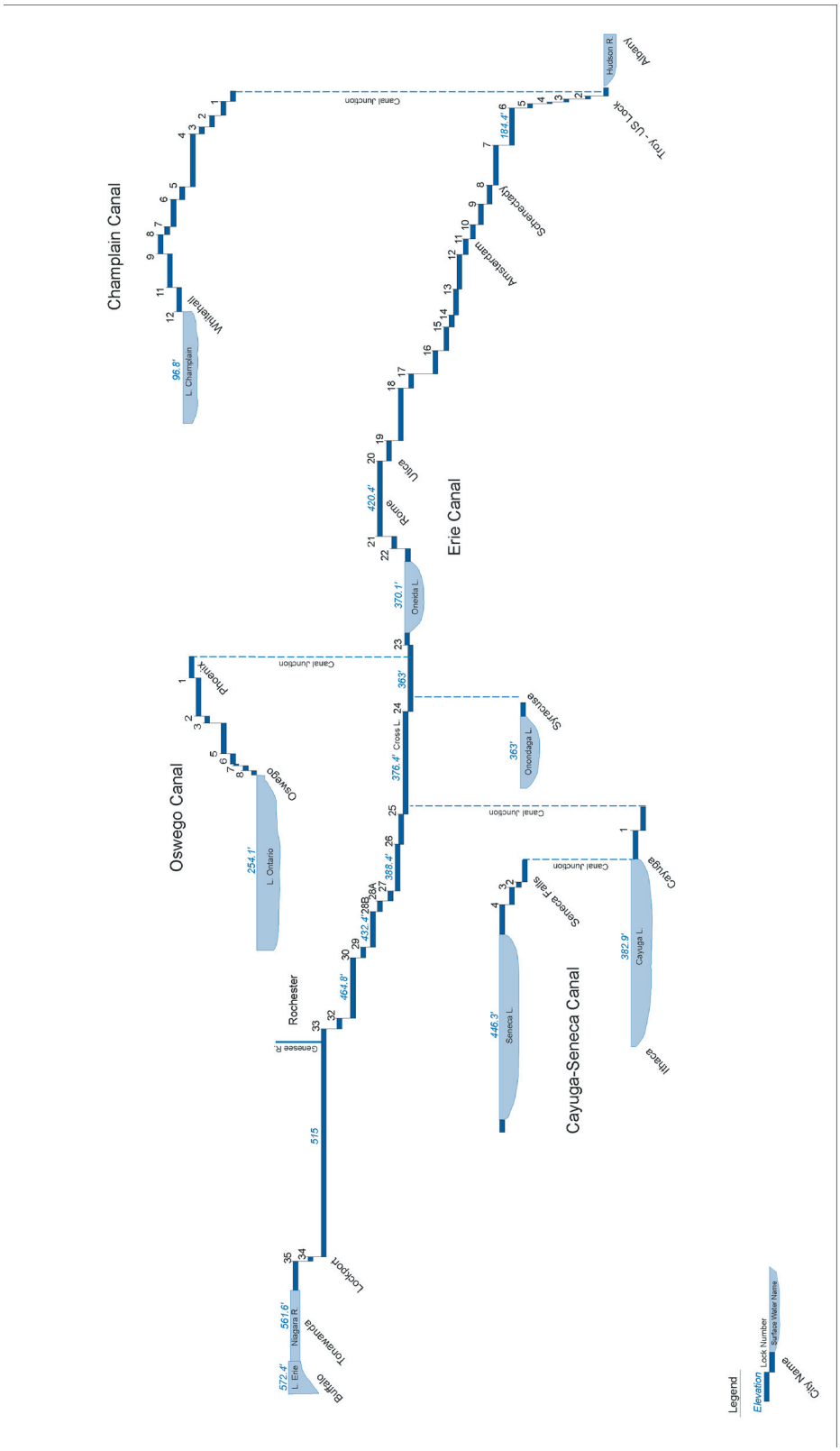
Water

The Corridor's waterways include approximately 40 percent of New York State's freshwater resources and drain nearly half of the state's total area. The quality and quantity of the water are essential for navigation, drinking, recreation, irrigation, and a healthy ecosystem for plants and animals. Precipitation varies within the state and across the seasons, with a typical monthly precipitation rate of one to six inches. The amount and pattern of distribution typically supports the state's needs. Snowfall is significant and varies widely across the Corridor, with an average annual range from 70 to 165 inches per year. Due to its expansive geography, the Corridor's water resources are managed by a number of different entities (see *Water Supply and Management*, page 4.15).

Water Resources

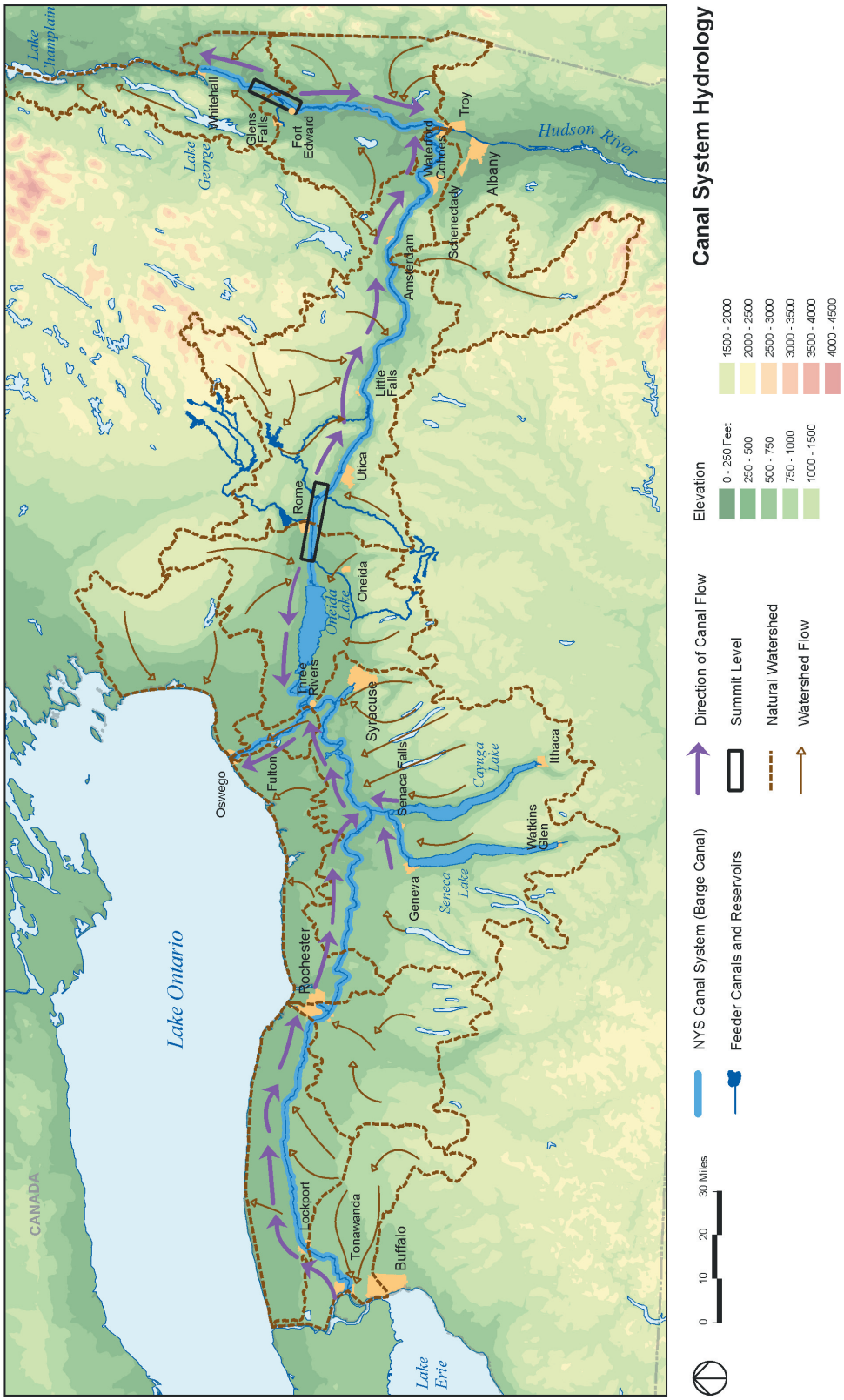
The Corridor cuts across five major drainage basins (see *Canal System Hydrology*, page 4.14):

- Lake Champlain and its tributaries flow north to Canada and the St. Lawrence River.
- The Hudson-Mohawk River system flows east from Rome and south from the Adirondack Mountains to the Atlantic Ocean at New York City.
- The Oswego River flows north to Lake Ontario, draining the Ganargua Creek, Clyde River, and the Finger Lakes by way of the Seneca River from the west and Wood Creek, Oneida Lake, and the Oneida River from the east.



Erie Canalway National Heritage Corridor
New York State Canal System Profiles

Note: Modified from *Cruising Guide to the New York State Canal System*


Canal System Hydrology
Elevation
0 - 250 Feet
250 - 500
500 - 750
750 - 1000
1000 - 1500
1500 - 2000
2000 - 2500
2500 - 3000
3000 - 3500
3500 - 4000
4000 - 4500
Direction of Canal Flow
Summit Level
Natural Watershed
Watershed Flow
NYS Canal System (Barge Canal)
Feeder Canals and Reservoirs
0
10
20
30 Miles
Lake Champlain
Whitehall
Glens Falls
Lake George
Fort Edward
Hudson River
Troy
Waterford
Cohoes
Albany
Schenectady
Amsterdam
Little Falls
Utica
Rome
Oneida
Oneida Lake
Three Rivers
Syracuse
Fulton
Oswego
Lake Ontario
CANADA
Seneca Falls
Cayuga Lake
Ithaca
Watkins Glen
Geneva
Seneca Lake
Rochester
Lockport
Tonawanda
Buffalo
Lake Erie

- The Genesee River flows north to Lake Ontario.
- The Lake Erie drainage area flows west to the Niagara River, which flows north to Lake Ontario.

The canals in the region closely follow the natural waterways, crossing from one divide to the other with locks. While the towpath canals of the nineteenth century avoided the riverbeds, significant segments of the 20th century Barge Canal are coincident with the Oswego, Mohawk, Seneca, and Hudson Rivers as well as Oneida and Cross Lakes. Over time, the canals have become integral to the hydrology of the region and they now carry much of the water moving through upstate New York. The Oswego River drains the entire central region of New York and its canals, from Rochester to Rome and from the Finger Lakes to Lake Ontario.

Over time, the canals have become integral to the hydrology of the region and they now carry much of the water moving through upstate New York.

Twenty-one reservoirs help maintain water flow in portions of the canal system. The largest of these are the Hinckley Reservoir (7,542 acres) north of Herkimer and Delta Reservoir (3,137 acres) north of Rome. Delta Reservoir conveys water from the Adirondack Mountains via a system of upstream reservoirs. Portions of several towpath-era canals have been maintained as feeders to carry water from the reservoirs to the navigable canals, including sections of the Erie, Black River, Chenango, Champlain, and Glens Falls Feeder. Most reservoirs and segments of the Black River and Chenango feeder canals fall outside the Corridor's boundary. While it is beyond the authority of the Corridor Commission to provide material support for the conservation of these important resources, it will work with others to ensure that these feeders and reservoirs continue to support the canal system's water supply and water quality.

The permeable strata of the region's glacial outwash store groundwater in aquifers that supply potable water for some of the urban areas along the Corridor. Primary water supply aquifers provide significant support for public water supplies in Fulton and Tonawanda, and a sole source aquifer provides drinking water for Schenectady. The region's many lakes and reservoirs supply potable water for other towns and cities along the Corridor.

Water Supply and Management

During the navigation season, from early May to mid-November, the New York State Canal Corporation maintains navigable water depths in the canals by means of a range of water supply sources, appropriate lock and dam levels, and dredging. Adequate water supply is necessary to fill the canal prism at the beginning of the navigation season; to ensure adequate water for lock operation throughout the season; to replace water lost during the season (primarily in the land cut sections) to seepage through embankments, evaporation, and waste over spillways; and to generate hydroelectric power in certain locations.

Multiple sources ensure that the supply of water to the canal system is usually adequate for navigation. However, localized needs and the unique geography and engineering of the canal system require constant fine-tuning of the regulation of water flow through dams, guard gates, locks, and spillways. Providing water for the canal system's summit levels, especially at Rome, has always been

While some water management decisions are made on a region-wide basis, others are made by upstream entities or by a large number of different parties, requiring considerable coordination.

a challenge. Three Rivers Point, a major confluence of the Finger Lakes and Oneida drainage basins, and the surrounding low-lying areas are often subject to flooding. While some water management decisions are made on a region-wide basis, others are made by upstream entities or by a large number of different parties, requiring considerable coordination.

Grants are available from the New York State Department of State, Division of Coastal Resources through the Environmental Protection Fund for the preparation and implementation of inter-municipal watershed protection plans. These plans identify threats to water quality and establish a consensus on actions needed to protect water quality, such as stormwater management projects, education, training, and strengthening local and state development controls. Within the Corridor, one such plan has been completed for the Cayuga Lake watershed, while another is nearing completion for the Oneida Lake watershed. Both used substantial funding from the Environmental Protection Fund.

The water supply for the various canal sections is as follows (see *Canal System Hydrology*):

- Western Erie Canal: The flow is generally eastward from Lake Erie and Niagara River down to Three Rivers Point, with contributions from the Genesee, Clyde, and Seneca Rivers. East of Fairport, the watersheds of the Ganargua River, Canandaigua Lake Outlet, and Clyde River contribute to the eastward flow. From Mays Point to Three Rivers Point, supplemental water is provided by Cayuga and Seneca Lakes via the canalized Seneca River.
- Cayuga-Seneca Canal: Water from Seneca and Cayuga Lakes flows north through the Cayuga-Seneca Canal/Seneca River to meet the Erie Canal at Mays Point.
- Oswego Canal: The natural watershed of the canalized Oswego River, flowing from the confluence of the Oneida and Seneca Rivers at Three Rivers north to Lake Ontario at Oswego, is supplemented by water flowing east from Lake Erie and the Seneca River/Erie Canal and west from the Rome summit and the canalized Oneida River.
- Eastern Erie Canal: Several sources are necessary to supply the Rome summit, between Lock 20 at Whitesboro and Lock 21 at New London, that straddles the drainage divide between the Mohawk-Hudson and the Oneida-Oswego-St. Lawrence drainage basins. The sources include Delta Reservoir, north of Rome, which stores water of the upper Mohawk River and taps into the Black River watershed via the Forestport Feeder Canal; West Canada Creek, which flows from its watershed in the Adirondack Mountains into Hinckley Reservoir and is then diverted downstream to Ninemile Creek to enter the Erie Canal just above Lock 20; a remnant of the Enlarged Erie Canal, which taps the watersheds and 19th century feeder reservoirs of Butternut, Limestone, Chittenango, Oneida, and Cowassalon Creeks south of the Erie Canal. East of the summit, most of the water is provided by the flow of the Mohawk River and its tributaries down to the Hudson, supplemented by discharges through remnants of the Chenango Canal and Oriskany Creek from reservoirs originally built to supply the summit level of the Chenango Canal, along with water from the summit of the Erie passing through Lock 20.
- Champlain Canal: The summit is just north of Fort Edward, where the canal crosses the drainage divide between the Hudson and Champlain-St. Law-

rence basins. The southern portion is fed naturally by the watershed and flow of the canalized Hudson River. The northern land-cut portion is fed by diverting water from the Hudson upstream of Glens Falls via the 12-mile Glens Falls Feeder Canal, supplemented, north of Fort Ann, by diversions from Wood and Halfway Creeks.

In the winter, land-cut sections of the canal system are closed and most are drained to prevent ice damage and blockages. Certain river sections, whose levels are regulated during the navigation season, are returned to a free-flowing condition in winter by raising the moveable dam gates. Much of the Canal Corporation's maintenance occurs during the winter season, which requires draw down of water levels at the locks. In the spring, the canals carry significant snowmelt and other runoff, sometimes leading to flooding and bank erosion. The canal system receives sediment from tributaries which extend well beyond its confines; increased land development in the region has caused the sediment loads carried by these tributaries to increase significantly in recent years.

Canal dredging, an historically performed operation which is vital to the continued success of the canal system, poses several challenges to balancing the needs of maintaining a navigable waterway with environmental concerns. Concerns related to dredging in the Corridor may include: proper control of dredging operations to limit turbidity and the degradation of aquatic environment; timing of dredging activity in relation to the propagation of fish and other aquatic species; and proper disposal and management of dredge materials. The Canal Corporation's dredging operations are coordinated with the New York State Department of Environmental Conservation and the United States Army Corps of Engineers to minimize the effect on the environment.

There are several chemically contaminated sections of the canal system that have not been dredged due to the lack of suitable options for managing the toxic materials. Without attention, this issue may eventually pose a hazard to the navigation and use of these sections. Long term management of dredge spoils, both contaminated and uncontaminated, is also a concern.

In addition to the Canal Corporation, other entities involved in water management at a significant scale on tributaries to the New York canal system include the Canada-United States International Joint Commission; United States Army Corps of Engineers; United States Fish and Wildlife Service; Hudson River-Black River Regulating District; New York City Board of Water Supply; and New York Power Authority.

Water Quality

The abundance and high quality of the water resources in the Corridor and upstate New York fostered the agricultural industry and population growth in the early canal days. Over the years, industry has also thrived on the abundance and the power provided by the region's waters. Today, the quality of the region's water resources continues to support people and agriculture, and has also become the basis for recreation, tourism, and sport fishing, while also providing valuable habitat for aquatic plants and animals. The focus of State efforts

in the last three decades has been on recognizing and addressing the industrial pollution that threatens the quality of the water resources.

New York State supports the United States Environmental Protection Agency (EPA) initiative of categorizing water quality relative to the uses it supports (e.g., drinking, fishing, and swimming). Currently, only 17 percent of New York State river and stream miles has been documented and assessed for water quality. Significant advances have been made to address the region's pollution problems, with a focus on the following categories:

- Industrial discharges: Historic and uncontrolled industrial discharges have contaminated many sites within the Corridor, polluting groundwater as well as the soil and air. Federal, state, and local governments have various authorities to permit, monitor, and enforce compliance with environmental laws and regulations to minimize new discharge and address the contamination caused by historic discharges. The State's Department of Environmental Conservation and the federal Environmental Protection Agency have the ability to access various funds for remediation of contaminated sites where there is no willing or able responsible party. The State's Superfund and Brownfields Program was amended in 2004 to allocate additional funding and mechanisms to address such sites.
- Combined sewer outfalls: Historically, sewer systems in many communities were designed to carry stormwater runoff from streets, parking lots, and rooftops as well as domestic waste and industrial discharges. During heavy storms, sewage treatment facilities are unable to handle the increased flow, and the system overflows directly into watercourses, carrying bacteria from the untreated sewage as well as other pollutants in the stormwater. This condition can dramatically lower the fishing, swimming and drinking water quality of rivers and waterways. Projects are currently underway along the Corridor to eliminate combined sewer outfalls.
- Urban and agricultural runoff: Non-point source pollution from urban and agricultural lands is often too diffuse to be regulated or controlled by federal, state, or local governments. However, in the collective, urban and agricultural runoff constitutes broad-based challenges to the region's water quality and can adversely impact the environment. Municipalities and the agricultural community can access current stormwater management regulations and existing programs at the State's Department of Environmental Conservation, the U.S. Department of Agriculture's Natural Resource Conservation Service, and the state/county Soil and Water Conservation Districts to address runoff issues.
- Hydroelectric power facilities: Twenty-seven hydroelectric plants, owned by a number of corporations and public agencies, are located in the Corridor, ranging in size from 0.3 to 20.4 megawatts. Water discharged from hydroelectric plants can promote erosion, increase turbidity, and reduce dissolved oxygen levels. Some projects dewater significant lengths of natural riverbeds, diminishing aquatic habitat and impeding movement and migration of fish. Hydraulic turbines can injure or kill fish. Dams collect silt and debris, which accumulate toxic heavy metals and other pollutants and hold back vital nutrients that would otherwise flow with the watercourse and redirect the natural movement of fish. The Federal Energy Regulatory Commission

(FERC) licenses hydroelectric facilities, with input from other federal agencies, the New York State Department of Environmental Conservation (DEC), host municipalities, and non-governmental organizations. Hydroelectric power generation is one of the canal system's historic uses, and is generally compatible with navigation as long as careful attention is paid to water levels and flows; balancing the allocation of the system's water resources for power generation, navigation, and maintenance of aquatic habitat is a continuing challenge (see *Water Supply and Management,* page 4.15).

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Vegetation and Wildlife Habitat

While much of the Corridor environment has lost its original distinctive ecological character, many acres remain undeveloped. Protected areas include forest and natural preserves, freshwater wetlands, lands under conservation easement, and federal, state and local wildlife management areas and parks. Though significantly modified, the vast canal waterway system and the continuous public lands that adjoin it provide an important habitat for the natural flora and fauna of upstate New York.

Vegetation in the region generally consists of mixed deciduous forests (beech-maple, oak-hickory, and hemlock-northern hardwood), swamp forests and bogs. Beech-maple forests are climax communities that thrive in the glacial till and create deep shade. Oak-hickory forests tend to do well in the drier soils of the sandy outwash plains; with less shade, these forests allow for a greater diversity of plant material and produce nuts that provide a basis for excellent wildlife habitat. Bogs are found in kettles and low-lying areas formed by glaciers and vestigial glacial lakes. Extensive areas of the region's fertile soils have been cleared for agriculture to support meadows, orchards, and produce farms. In many areas suburban development has replaced both native forests and agricultural uses.

The following natural resource areas under federal and state jurisdiction, in addition to the canals themselves, are outstanding due to their ecological and wildlife profile, and/or innovative management (see map on page 4.2). Their conservation is key to preserving habitat areas and diverse native plantings.

- Montezuma National Wildlife Refuge: 6,400 acres with extensive marshes and a variety of other habitats; home to waterfowl, shorebirds, songbirds, white-tailed deer, and occasional eagles. Owned and controlled by federal and state governments, conservation groups, and private individuals in the region between Rochester and Syracuse. Ongoing restoration programs and studies are sponsored; limited public access is currently offered for recreation. Managed by the U.S. Fish & Wildlife Service.
- Iroquois National Wildlife Refuge: Nearly 11,000 acres, partly outside the National Heritage Corridor; approximately 1/3 forested wetland, 1/3 marsh, and the remainder grass, forest and brush uplands. Home to eagles, more than twenty species of ducks, land animals, and an important stop on annual migrations of Canada geese. Managed by the U.S. Fish & Wildlife Service.
- Catherine Creek Marsh Complex: A 1,000-acre marsh complex located at the southern end of Seneca Lake, this area offers a rich and diverse habitat that is treasured by bird watchers and anglers.

- Cayuga Lake State Wildlife Management Area: Located at the northern end of Cayuga Lake and comprising 225 acres of cattail marsh and wooded swamps, this area offers an outstanding, diverse ecosystem and includes areas for public recreation.
- Willard State Wildlife Management Area: This 135-acre parcel is a model for agricultural use combined with recreation. Leases collected from the agricultural use of the land are reinvested in the property to finance improvements to serve recreational activities.
- Finger Lakes National Forest: The only national forest in the state, the Forest encompasses approximately 13,200 acres of high land between Seneca and Cayuga Lakes, with woodlands, pastures, and ponds.
- The Northern Montezuma and Galen State Wildlife Management Areas extend the wildlife habitat in the low-lying area around the Montezuma Swamp.
- In the flat lands around Oneida Lake are a number of other swamps and State wildlife management areas including Three Mile Bay/Big Bay, Hamlin, and Cicero Swamp, and to the east, the Rome Wildlife Management Area.
- State fish hatcheries are located on Oneida Lake, where warm-water species and walleyes are hatched, and in Rome, where brown, lake, and rainbow trout are hatched.

Between these areas, large undeveloped private land holdings contribute toward a continuous natural landscape and wildlife corridor, but there are few safeguards to maintain their long-term character (see *Guidelines for Heritage Development* section, page 4.21).

Invasive plants and aquatic species are not unknown to the canal system or upstate New York. Invasive species common to the area include zebra mussels, Eurasian water milfoil, water chestnuts, and purple loosestrife. Many of these species are carried and transferred through the system by boats. Some invasives impact water clarity, water quality, recreation activity, aesthetics, and the health of native species. Municipal water systems and other infrastructure can also be impacted by species such as the zebra mussel. Control and reduction of invasive species is an important economic and ecological goal for the Corridor region.

Numerous efforts are underway to address both the introduction of invasive species and the management of invasives already impacting the state's waterways. In 2003, the state created an Invasive Species Task Force, co-chaired by the Commissioner of the Department of Environmental Conservation and the Commissioner of the Department of Agriculture and Markets, to address prevention, detection, monitoring, research, and public education to reduce the impacts of invasive species.

GUIDELINES FOR HERITAGE DEVELOPMENT

New York State has a long history of public leadership in conservation activity and a robust system of incentives, programs, and regulations to protect and enhance the natural environment. For the Erie Canalway National Heritage Corridor, the key to maximizing the benefits of this system lies in strengthen-

ing public awareness and engagement, encouraging continued quality stewardship, and coordinating existing conservation efforts in a way that recognizes the interrelationships of the region's geology and soils, water supply and water quality, vegetation and wildlife habitat. For these reasons, the guidelines provided here are general and strategic in nature.

Certain existing policies and practices are of particular benefit to the conservation and enjoyment of the Corridor's natural resources and should be encouraged, accelerated, or expanded as feasible. To underscore mutual support for conservation goals and allow for appropriate support such as technical assistance, education, and outreach, the Corridor could pursue cooperative agreements to review or comment on the land conservation or disposition policies of the agencies (see *Context* section, page 4.3) responsible for the following activities:

- Open space conservation: Open space is a critical and potentially endangered Corridor resource that is central to the region's distinctive cultural landscapes (see Chapter 3, *Protecting Our Heritage*), recreational opportunities (see Chapter 5, *Promoting Recreation*), attractiveness to tourists, residential quality of life, and the preservation of habitat and water quality described above. While initiatives to protect open space in New York are necessarily generated and approved at the local level, where land use controls and community interest operate, the opportunity exists to multiply the effects of individual initiatives through coordinating tools such as the state's Open Space Conservation Plan. The Corridor will seek to work with the Regional Advisory Committees that guide the plan in order to ensure that key lands within the Corridor are considered for protection. Corridor support of open space initiatives could provide for waterfront parks, buffer zones for flooding, and phytoremediation – the use of plants to filter and clean chemically contaminated soils and water.

- Sustainable growth: "Greenfield" development that builds on uninhabited open space is a major factor affecting conservation of the Corridor's natural resources. In addition to stressing the environment through increased pollution, rapid water runoff, and loss of habitat, greenfield development can decrease the efficiency of municipal services, increase reliance on individual automotive transportation, and erode the historic character of the Corridor's cities, villages, and agricultural areas. Through the lens of heritage development, many people are beginning to understand that sustainable alternatives to greenfield development are not only compatible with economic growth, but can also attract more residents, visitors, and businesses by enhancing quality of life. The Corridor supports sustainable growth policy tools that incentivize infill development, brownfield remediation, and adaptive reuse, or link new development approvals with commitments to preserve historic properties and conserve open space (see Chapter 3, *Protecting Our Heritage*). These tools can help communities and developers build on the value of heritage resources, including the Corridor's natural heritage, by channeling new development into existing communities and infrastructure and encouraging preservation and conservation activity. Restrictive land use tools, such as transfer or purchase of development rights, conservation easement pro-

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grams, and cooperative agreements, should be carefully considered by communities where incentive tools are not enough to protect important natural areas, open space, and greenway linkages.

- Agricultural lands: The preservation and development of agricultural economies, and conservation of the region's prime and unique farmlands, is an important preservation and conservation goal for the Corridor (see Chapter 3, *Protecting Our Heritage*). A number of state programs assist local governments in the use of comprehensive planning, incentives, and the purchase of property interests to support rural landscapes and active agricultural use. They also assist in the marketing and promotion of New York State agricultural products and the establishment of new farms. Particularly important are the state's incentive programs to promote voluntary environmental stewardship, and grant programs to reduce and prevent non-point source water pollution from agricultural activities. Preservation of agricultural lands is particularly important where they abut canals and natural waterways, recreation facilities and parks, and wildlife management areas, or where they constitute part of a continuous corridor of natural areas and open space.

- Intermunicipal/interagency planning for waterfronts and watersheds: As described above, the watersheds overlapping the Corridor's boundaries are huge areas presenting complicated, interrelated water management needs. Local waterfronts are similarly connected by the canal, river, or lakefront they share. Planning for watersheds is most effective when it acknowledges that the movements of water and related natural resources such as riparian wildlife do not respect jurisdictional boundaries. In particular, long-term region-wide efforts to reduce rapid stormwater runoff and seasonal flooding by replacing deteriorated bulkheads with semi-natural water edges, remediating degraded shoreline vegetation, and expanding the use of permeable paving surfaces, can help reduce localized needs for flood and erosion control. The continuation of the state's initiative to eliminate combined sewer outfalls is crucial to the improvement and enhancement of water quality within the canal system. Planning for waterfronts should take into consideration the heritage development guidelines for Barge Canal landcuts and riverways (see Chapter 3, *Protecting Our Heritage*).

Planning for watersheds is most effective when it acknowledges that the movements of water and related natural resources such as riparian wildlife do not respect jurisdictional boundaries.

In addition to the relatively widespread policies and practices noted above, some more focused approaches to conservation deserve special attention from the Corridor:

- Ecological restoration – the science of reintroducing and/or fortifying native plants and animals as self-sustainable communities that persist over time – can restore the native biodiversity of aquatic and upland biota and arrest or reverse the challenges caused by invasive species. These efforts measure success in terms of species reproduction, plant and animal population growth, and changes in the structures of complex systems such as woodlands and meadows. Public support for ecological restoration activities can be bolstered by community outreach and the involvement of universities, colleges, and high school science programs.

- Natural resource buffer areas can mitigate flooding and non-point source pollution. These buffers, typically located between developed areas and natural areas or water bodies, can filter excess nitrogen and phosphorous from fertilizers and sewer discharges; reduce erosion from seasonal flooding; and host diverse biotic communities. In supporting increased use of buffer areas, the Corridor should also work to ensure that they do not compromise the integrity of existing cultural landscapes, and that they conform with provisions of state and federal regulations for the protection of wetlands and floodplains.

- Although viewsheds provide crucial windows into the historic and evolving relationships between geology, hydrography, and patterns of human settlement and land use, they remain an underappreciated resource in the Corridor. Protection of viewsheds through land use tools, landscaping, and provision of roadside pulloffs, canal bulkheads, and other viewing platforms should focus on views identified by the cultural landscape assessments recommended in Chapter 3, Protecting Our Heritage. Viewshed protection and mitigating measures should be included in the impact statements of potentially disruptive land uses such as new landfills, industrial sites, greenfield developments, cell towers, and wind turbines. The New York State Scenic Byways program, which encourages the designation and management of viewsheds from several roadways within the Corridor, is one potential resource for this effort (see Chapter 6, Interpretation and Orientation).

- The Corridor should support specific actions to reduce or prevent invasive species, including efforts to encourage routine boat maintenance and rinsing to reduce transfer; biological and chemical treatment to curtail growth; public outreach through interpretive displays, advertisements, articles in targeted publications and recreational guides, and other educational devices; and comprehensive planning to coordinate the efforts of state agencies, regional planning organizations, and municipalities to address specific invasions and apply the guidelines set forth by the New York State Invasive Species Task Force. Due to the expansive nature of this problem and its causes, an increased federal commitment to invasive species management is also warranted.

- The Canal Corporation should continue to work with all appropriate agencies and interested parties to minimize the effects of dredging on natural resources. Winter dredging and partial drawdowns should be considered in targeted locations where they may have the greatest benefit to natural habitats. Since the canal system receives sediment from tributaries which extend well beyond its confines, a regional watershed management program should be developed to reduce the sediment load prior to deposition in the canals, thereby reducing the need for dredging.