Geologic Resource Evaluation Scoping Summary
Saratoga National Historical Park & Roosevelt-Vanderbilt National Historic Sites

Geologic Resources Division
National Park Service
US Department of the Interior

The Geologic Resource Evaluation (GRE) Program provides each of 270 identified natural area National Park Service (NPS) units with a geologic scoping meeting, a digital geologic map, and a geologic resource evaluation report. Geologic scoping meetings generate an evaluation of the adequacy of existing geologic maps for resource management, provide an opportunity for discussion of park-specific geologic management issues and, if possible, include a site visit with local geologic experts. The purpose of these meetings is to identify geologic mapping coverage and needs, distinctive geologic processes and features, resource management issues, and potential monitoring and research needs. Outcomes of this scoping process are a scoping summary (this report), a digital geologic map, and a geologic resource evaluation report.

The National Park Service held a GRE scoping meeting for Saratoga National Historical Park (SARA) and Roosevelt-Vanderbilt National Historic Sites (ROVA) on July 9, 2007 at the University of Massachusetts, Amherst. Tim Connors (NPS-GRD) facilitated the discussion of map coverage and Bruce Heise (NPS-GRD) led the discussion regarding geologic processes and features at the two units. Participants at the meeting included NPS staff from the parks, Northeast Region, and Geologic Resources Division, geologists from the University of Massachusetts, the New York Geological Survey (NYGS), and Vermont Geological Survey (VGS) as well as cooperators from Colorado State University (see table 1). This scoping summary highlights the GRE scoping meeting for Saratoga National Historical Park and Roosevelt-Vanderbilt National Historic Sites including the geologic setting, the plan for providing digital geologic maps, prioritized lists of geologic resource management issues, descriptions of significant geologic features and processes, lists of recommendations and action items, and a record of meeting participants.

Park and Geologic Setting

Both Saratoga National Historical Park and Roosevelt-Vanderbilt National Historic Sites lie along the Hudson River Valley in eastern New York State encompassing some 3,400 and 1,100 acres, respectively. Saratoga National Historical Park, authorized on June 1, 1938, commemorates the two Revolutionary War battles fought there three weeks apart in 1777. The park contains four separate units (the main battlefield, Saratoga Monument, “Victory Woods”, and the Schuyler House) and sits 60 km (40 miles) north of Albany, New York. Located between Albany and New York City in Hyde Park, Roosevelt-Vanderbilt National Historic Sites includes three separate park units – Vanderbilt National Historic Site (designated December 18, 1940), Eleanor Roosevelt National Historic Site (authorized May 26, 1977), and Home of Franklin D. Roosevelt National Historic Site (designated December 15, 1944). Saratoga National Historical Park covers portions of four 7.5’-quadrangles and Roosevelt-Vanderbilt National Historic Sites lie within one 7.5’-quadrangle.

In eastern New York State, the Hudson River cuts a valley through bands of Devonian-age marine sedimentary rocks deposited in an ancient basin prior to the Taconic orogenic event. At Saratoga, the river meanders across its valley with broad, flat floodplain areas alternating with steep cutbanks and bluffs. At the main battlefield unit, bluffs rise 70 m (240 ft) above the western bank of the Hudson River. Above the river valley are dissected upland areas with exposed bedrock, rolling hills, and narrow valleys draining west to east flowing streams. At Hyde Park, 160 km (100 miles) further south, the Hudson River is wider and affected by tidal fluctuations extending up the valley from the Atlantic Ocean. Bluffs flank both sides of the river. Vanderbilt National Historic Site sits on a high, steep bluff rising nearly 60 m (200 ft) above the river. Home of Franklin D. Roosevelt National Historic Site sits on a gentler slope rising 50 m (160 ft) above the river. A few small-scale streams dissect the bluff, creating isolated knobs. Further upslope at to the east, atop the bluff, Eleanor Roosevelt National Historic Site contains a portion of the marshy Fall Kill watershed. Rolling hills and low ridges characterize the surrounding landscape.

Relatively undeformed and unmetamorphosed layers of shale, greywacke, low grade slate, and sandstone comprise the geologic bedrock units of this stretch of the Hudson River. Units include the black shales of the Canajaharie Formation, the Mount Merino Formation of shales and low grade slate, and the Austin Glen Formation containing greywacke, turbidites, shale, and sandstone. At Hyde Park, the sandstone beds in the Austin Glen Formation support the high bluffs above the river. Surficial geology played an important role in the battles at Saratoga and influenced the Vanderbilt and Roosevelt settlements. Pleistocene Ice Age glaciers covered this portion of eastern New York. When the glaciers retreated northward, melting ice dumped vast deposits of till to blanket the landscape. During glacial retreat, a glacial lake formed, filling the Hudson River Valley. This lake drained 10-12,000 years ago and left abundant lacustrine clay and sand throughout the region. Due to a lack of stabilizing vegetation immediately following glaciation, winds transported fine sediments forming paleodunes locally. Local streams and rivers are constantly eroding through these unconsolidated sediments creating valleys, ravines, and notches along the banks of the Hudson River.

Geologic Mapping for Saratoga National Historical Park and Roosevelt-Vanderbilt National Historic Sites

During the scoping meeting Tim Connors (NPS-GRD) showed some of the main features of the GRE Program's digital geologic maps, which reproduce all aspects of paper maps, including notes, legend, and cross sections, with the added benefit of GIS compatibility. The NPS GRE Geology-GIS Geodatabase Data Model incorporates the standards of digital map creation set for the GRE Program. Staff members digitize maps or convert digital data to the GRE digital geologic map model using ESRI ArcMap software. Final digital geologic map products include data in geodatabase, shapefile, and coverage format, layer files, FGDC-compliant metadata, and a Windows HelpFile that captures ancillary map data. Completed digital maps are available from the NPS Data Store at http://science.nature.nps.gov/nrdata/.

When possible, the GRE program provides large scale (1:24,000) digital geologic map coverage for each park's area of interest, usually composed of the 7.5-minute quadrangles that contain park lands (figure 1). Maps of this scale (and larger) are useful to resource management because they capture most geologic features of interest and are positionally accurate within 40 feet. The process of selecting maps for management use begins with the identification of existing geologic maps and mapping needs in vicinity of the park. Scoping session participants then select appropriate source maps for the digital geologic data to be derived by GRE staff as well as determine areas in need of further mapping or refinement. Tables 2 and 3 (at the end of this document) list the source maps chosen for Saratoga National Historical Park and Roosevelt-Vanderbilt National Historic Sites as well as any further action required to make these maps appropriate for inclusion.

Saratoga National Historical Park and Roosevelt-Vanderbilt National Historic Sites expressed interest in obtaining geologic map coverage for all 7.5-minute quadrangles containing park lands and it was agreed that surficial and bedrock geologic maps would be most useful for park resource management.

At SARA, the four 7.5'-quadrangles of interest (Schuylerville, Quaker Spring, Schaghticoke and Mechanicville) have some geologic coverage, but many gaps in coverage seem to exist for large-scale quadrangle-based geologic data. (figure 1). Quaker Spring (74756) and Mechanicville (74760) have surficial map coverage at 1:24,000 scale by the U.S. Geological Survey, but David DeSimone felt there was better mapping for the area, and he supplied GRE staff with those citations.

For the Schuylerville 7.5', there is a Masters thesis on the surficial geologic mapping by DeSimone (GMAP 74987; DeSimone, David J., 1977, Glacial geology of the Schuylerville quadrangle, New York, Rensselaer Polytechnic Institute, Master's, 1:24000 scale). This map only exists in a paper and/or mylar format and still needs to be acquired by GRE staff.

For the Quaker Springs 7.5', it was suggested that a Masters thesis by Hanson (GMAP 74988; Hanson, E., 1977, Late Woodfordian drainage history in the lower Mohawk Valley, Rensselaer Polytechnic Institute, Master's, 1:24000 scale) might cover portions of this quadrangle. GRE staff need to acquire this publication for evaluation.

For the Schaghticoke and Mechanicsville 7.5' quadrangles there is a Masters thesis as well (GMAP 74989: Dahl, John, 1978, Surficial geology of the Mechanicville and Schaghticoke quadrangles, NY, Rensselaer Polytechnic Institute, Master's, 1:24000 scale). GRE staff need to acquire and evaluate this publication.

Small-scale digital surficial geology is available from GMAP 4552 (Cadwell, D.H., Dineen, R.J., Connally, G.G., Fleisher, P.J., and Rich, J.L., 1987, Surficial geologic map of New York: Hudson - Mohawk sheet, New York State Geological Survey, Map and Chart Series 40, 1:250000 scale).

Bedrock geologic map coverage for the four quadrangles at SARA may be limited to the 1:250,000-scale Hudson-Mohawk sheet for the Geologic Map of New York (GMAP 4555: Fisher, D.W., Isachsen, Y.W., and Rickard, L.V., 1970, Geologic map of New York-Hudson Mohawk sheet, New York State Museum, Map and Chart Series 15, 1:250000 scale). However, this may be based on 1:24,000-scale mapping. GRE staff are awaiting responses from the New York Geological Survey to determine extent of larger-scale bedrock geologic map coverage for SARA.

For ROVA, it was decided that geologic map coverage was only needed for the Hyde Park, New York 7.5' quadrangle. It is likely that there is adequate bedrock geologic map coverage, completed by the NYGS for the Hyde Park quadrangle of interest (figure 2). GRE staff are awaiting information on a citation and whether it is digital, etc. from Bill Kelly (NYGS). There is surficial geologic map coverage for the Hyde Park quadrangle (as part of the Lower Hudson sheet) at 1:250,000-scale by the NYGS. This scale may be too coarse for resource management. Tables 2 and 3 list the source maps chosen for Saratoga National Historical Park and Roosevelt-Vanderbilt National Historic Sites and mapping needs in certain quadrangles, in addition to a unique "GMAP

ID" number assigned to each map by GRE staff for data management purposes, map scale, and action items.

For the **Hyde Park** 7.5' quadrangle, GRE staff hope to use the following maps:

- (74990) Unknown author(s), unknown date, Bedrock Geologic Map of Hyde Park 7.5'-quadrangle, unpublished, New York Geological Survey (mylar).

- (1574) Cadwell, D.H., Connally, G.G., Dineen, R.J., Fleisher, P.J., Fuller, M.L., Sirkin, Les, and Wiles, G.C., 1989, Surficial geologic map of New York: Lower Hudson Sheet, New York State Geological Survey, Map and Chart Series 40, 1:250,000 scale

- (7288) Fisher, D.W., Isachesen, Y.W., and Rickard, L.V., 1970, Geologic map of New York – Lower Hudson Sheet. New York State Museum, Map and Chart Series 15, 1:250,000 scale

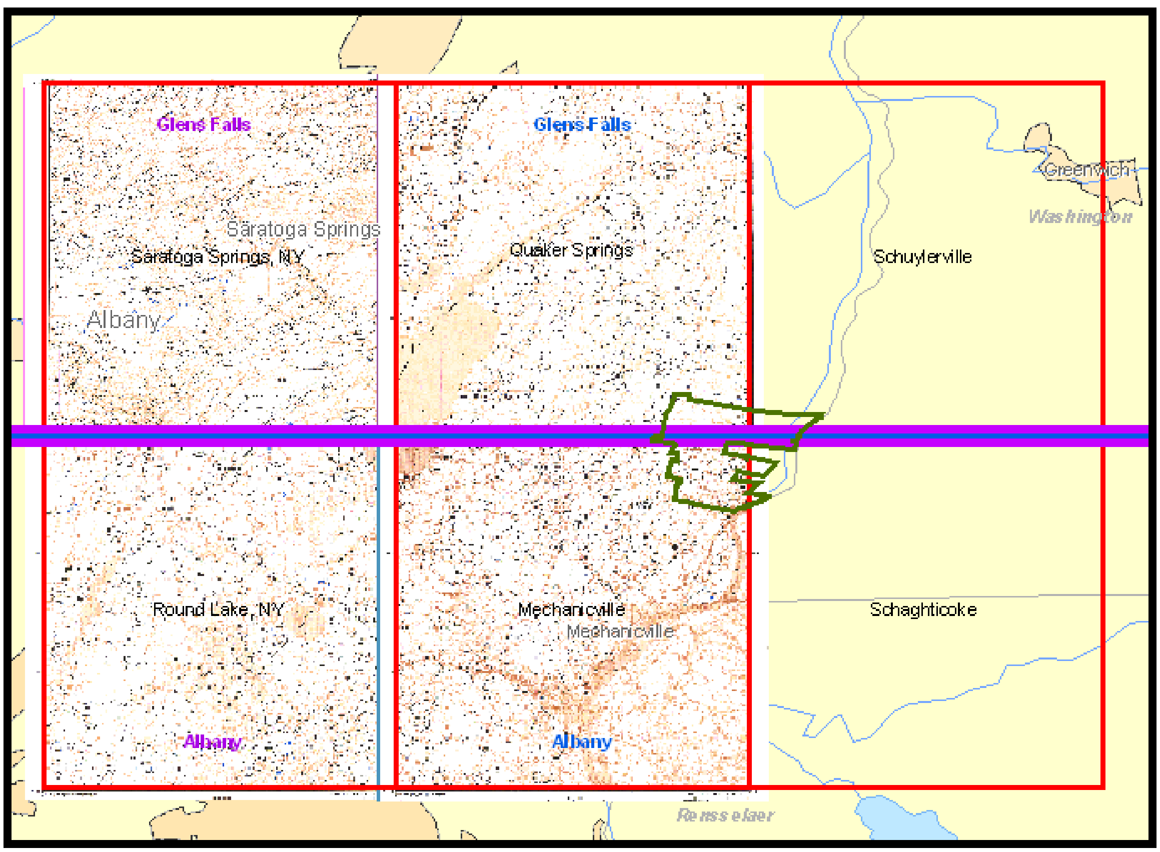

Figure 1. Quadrangles of interest for Saratoga National Historical Park. The figure shows USGS 7.5' quadrangles (red outline), 30' × 60' sheet (blue outline, blue font labels), and 1° × 2° sheets (purple outline, purple font labels). The green outlines represent park boundaries.

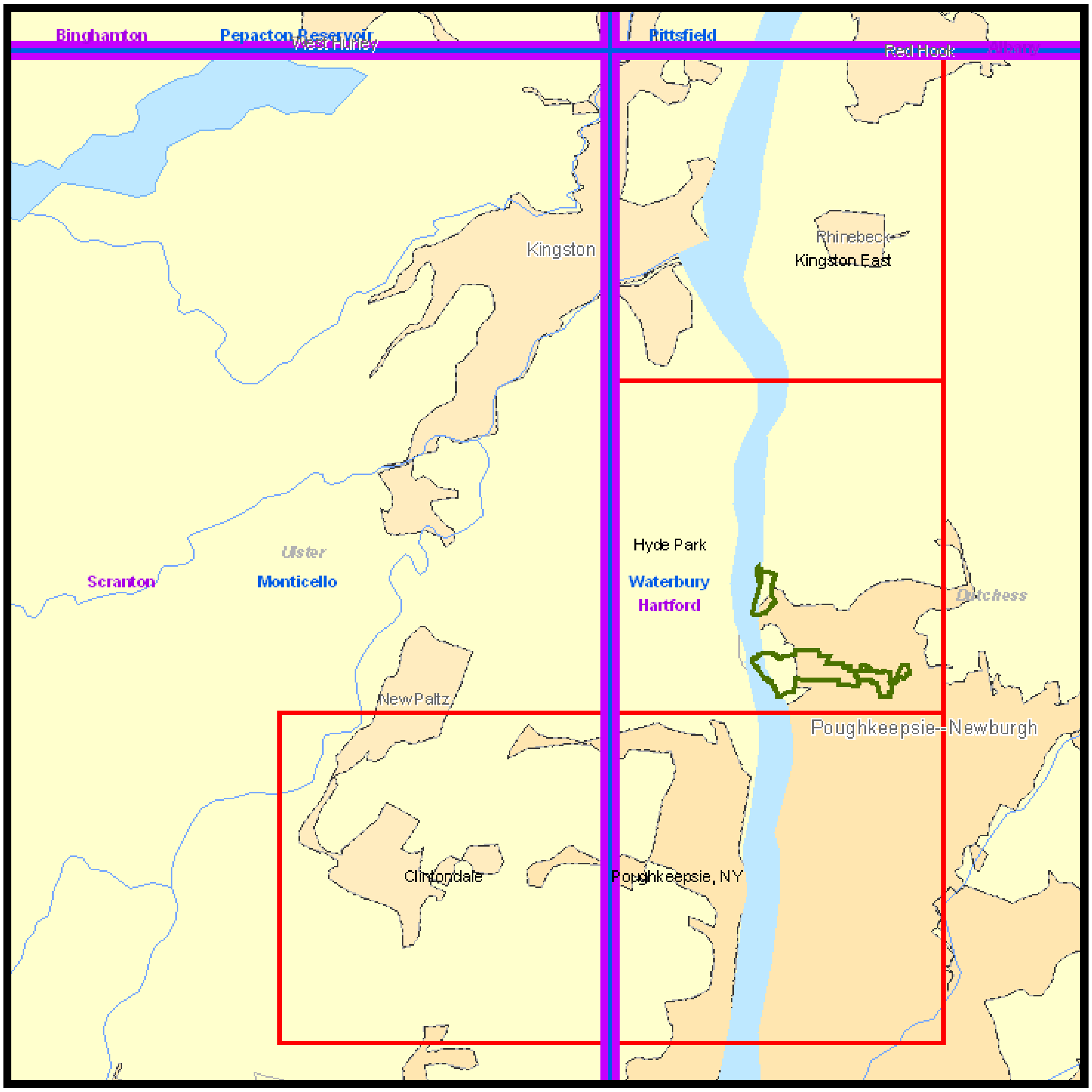

Figure 2. Quadrangles of interest for Roosevelt-Vanderbilt National Historic Sites. The figure shows USGS 7.5' quadrangles (red outline), 30' × 60' sheet (blue outline, blue font labels), and 1° × 2° sheets (purple outline, purple font labels). The green outlines represent park boundaries.

Additional items of interest pertaining to geologic mapping from the scoping

The parks have some interest in groundwater flow maps, landscape evolution maps, and mapping landslide areas. Because the local geology played such a key role in the Revolutionary War history along the entire Hudson River (Great Valley) a large regional derivative map showing key geologic factors in the evolution of the war campaigns would be a useful interpretive tool.

Geologic Resource Management Issues

The scoping session for Saratoga National Historical Park and Roosevelt-Vanderbilt National Historic Sites provided the opportunity to develop a list of geologic features and processes, which will be further discussed in the final GRE report. During the meeting, participants listed the most significant geologic issues as follows:

(1) Fluvial issues
(2) Mass wasting
(3) Lake maintenance
(4) Seismicity
(5) Tidal fluctuations
(7) Paleontological resources
(7) Disturbed lands
(8) Champlain Canal

Fluvial Issues

At Saratoga National Historical Park and Roosevelt-Vanderbilt National Historic Sites, the Hudson River dominates the fluvial system. The river is not within park boundaries, but fluvial processes such as erosion, flooding, and channel migration impact park natural resources. Flooding along the Hudson River frequently inundates the lowlying floodplain areas. This natural process rejuvenates the fertile floodplain soil, but can damage man made structures improperly sited near the high-water mark. Floodplain deposits along the Hudson River Valley contain elevated levels of PCBs. This contamination originated upstream at a GE dewatering facility (a Superfund site) where PCBs were historically dumped directly in the river and later were dumped in leaky shale-floored basements. Subsequent floods and dam removals flushed additional PCBs into the system. At one point, the local groundwater near the plant was 70% PCBs. Today, PCBs from this site are contained in contaminated bottom sediments along the Hudson River. The goal of the Environmental Protection Agency (EPA) is to dredge the river from Fort Edward to Troy, New York and reach acceptable concentrations of the contaminant in the river. At present, there is no plan to remove contaminated sediments from floodplain areas. There is an ongoing natural resource assessment at Saratoga National Historical Park to determine a remediation plan for the area where the Hudson River rises as high as the road surface of Route 4.

At Saratoga National Historical Park, in the northeastern portion of the park, the Kroma Kill is prone to flooding. Flooding along this stream damages park roads and culverts. During particularly high flood stages, culverts were completely destroyed by the strong flow.

At Roosevelt-Vanderbilt National Historic Sites, four large streams traverse the park units flowing northeast to southwest. At Eleanor Roosevelt National Historic Site, the flat-bottomed saddle area of the Fall Kill drainage has low water holding capacity and is subject to flooding. High flood stages threaten local structures, roads and bridges within park boundaries. Upstream of the park, high stages of the Fall Kill flooded structures. Fluvial issues at Roosevelt-Vanderbilt National Historic Sites also include riverbank and head-cutting erosion.

Increased sedimentation occurs in some streams near high use areas and recent ground surface disturbances. The deforestation and ground disturbances associated with local developments can cause increases in surface runoff and erosion. Subsequent accelerations in runoff and erosion locally increase sediment load and changes channel morphology of local streams.

Mass Wasting

The Hudson River cuts through steep slopes, terraces, bluffs, and alluvial fans along its long valley. Gravity, frost and plant root wedging, and differential erosion are primary natural causes of slope instability. As such, hillslope processes such as landsliding, slumping, and slope creep are a prevalent issue at both parks.

In Saratoga National Historical Park, slumping and slope creep occur along all bluffs areas along the Hudson River. Mass wasting has the potential to impact park roads, bridges, and trails as well as the important archaeological resources relating to the battlefield and early settlements. Earthworks and redoubts are slowly being leveled by geologic weathering. Damage to the park road near tour stop #9 occurred recently as heavy runoff washed away the road surface and the national historical park had to rebuild and stabilize the road. During road resurfacing, cores into local hillsides located a clay layer overlain by coarse sand. This layer provides a natural slip surface prone to fail, especially when water-saturated. When wet, this clay layer has an oatmeal texture and is unstable on slopes. Lacustrine clays along the entire Hudson River Valley are unstable causing region-wide slumping.

The slopes at Roosevelt-Vanderbilt National Historic Sites are relatively well-drained with wetland areas at the base of the bluffs and arid-loving vegetation at the top. Along the entrance road to Vanderbilt National Historic Site, slumping has necessitated road repairs. Slope failures along the steep bluffs of the Hudson River initiated the addition of fill that pre-dates the historic structures at Vanderbilt National Historic Site and Home of Franklin D. Roosevelt National Historic Site. Many of area’s roads and historic structures sit atop the scenic bluffs flanking the Hudson River. These are all at risk of being lost or damaged by slumping. Most of the bluffs are vegetated and seem stable, however cracking at the edge of the high bluffs attests to their vulnerability to mass wasting.

Colluvial fans composed of loose and jumbled deposits transported by gravity occur at the base of many slopes and bluffs along the river corridor and the narrower valleys of its tributaries. Old slides left scars along the slopes of the valleys that are now largely vegetated and considered stable in the short term. Any steep slope at the parks poses a landslide hazard and mass wasting is a threat along long stretches of the waterways. Anthropogenic changes to the hill slopes such as road and trail construction, mining, undercutting, and deforestation are the most common triggers of active sliding. Engineering structures designed to redirect water and stabilize riverbanks often lead to instability and reactivation of old landslides.

Lake Maintenance

On the higher uplands above the bluffs flanking the Hudson River Valley are natural and man made ponds and reservoirs. At Saratoga National Historical Park, three farm ponds, impounded by dams, are part of the historical context of the landscape and will not be remediated. There is one small natural pond in the Victory Woods unit.

At Roosevelt-Vanderbilt National Historic Sites, impoundments create several small pond features on the landscapes that the park considers historic resources. Some impoundments are concrete dams whereas others are earthen. They are all managed as cultural resources dating to the 1940s. At the Home of Franklin D. Roosevelt National Historic Site, a 4 m (14 ft) high dam impounds the ice pond. This is the largest dam of the three historic sites. At Fall Kill in Eleanor Roosevelt National Historic Site, dredging of sediments is an effort to keep excess deposition behind the impoundments from distorting the historic landscape. A 60 cm (24 inch) impoundment structure there created a historic swimming area at the retreat. Dredging of the pond is currently in the permit process and other ponds at Roosevelt-Vanderbilt National Historic Sites may soon be dredged as well.

Seismicity

Both parks are east of the Adirondacks Mountains and are subject to only minor seismicity. Many small earthquakes occur in the area each year, but are too small to be noticeable by humans. At Roosevelt-Vanderbilt National Historic Sites, magnitude 2 events occur monthly. A magnitude 5.1 earthquake in 2002 struck the Plattsburg, New York area (30 km, 20 miles north of Saratoga National Historical Park), and was felt in the parks. Though this quake caused local road collapse near the epicenter, threats to park infrastructure from seismicity is low. The nearest seismic station is at Columbia University (Lamont-Dougherty). Unusually large seismic events may trigger landslides, slumps, and damage park infrastructure. The U.S. Geological Survey monitors seismic activity throughout the region. Recent activity is available at the following earthquake-monitoring website: http://earthquake.usgs.gov/eqcenter/recenteqsus/.

Tidal Fluctuations

The Hudson River water level fluctuates regularly with the tides as far north as Albany. During the last ice age of the Pleistocene Epoch, glaciers scoured and reexcavated the Hudson River Valley. The paleo-Hudson bedrock channel stretched from Manhattan to Saratoga. The deepening of the channel during this event caused the area affected by tides to increase. This does not affect Saratoga National Historical Park, but two small stretches along the Hudson at Roosevelt-Vanderbilt National Historic Sites are impacted. The park boundary is at the high-water mark and the normal tidal range is slightly over 1 m (4 ft).

Paleontological Resources

The marine deposits of the Devonian Period are fossiliferous in eastern New York. The most common fossils in the bedrock at the parks include graptolites, trilobites, and scant conodonts in the Austin Glen and Mount Merino formations. The threat of theft by collectors is low; however a comprehensive inventory of the paleontological resources in the parks would be a valuable data set for resource management and potential interpretive programs at both parks. At Saratoga National Historical Park, an old map shows a location rich in fossils, but the park does not have the reference. A cut bank at the Schuyler House exposed fossils. The potential also exists for Pleistocene animal remains in the more recent, unconsolidated deposits. A mastodon was discovered in the Hudson River Valley near Eleanor Roosevelt National Historic Site and is in the possession of the state. No known Pleistocene megafauna remains have been discovered at either park unit.

Disturbed Lands

Minor historic quarries and other disturbed areas dot the landscape at Saratoga National Historical Park. Some of these disturbed features include battlefield remnants such as trenches and redoubts. These are cultural resources and are targets of preservation. In the northeast corner of the park, shallow aeolian deposits were mined for molding sand in factories in Troy, New York. Due to the presence of weathered feldspar clays, this sand was ideally suited to allow the sands to hold a molded shape. Frazier's grave may have been destroyed in these sand mining operations. Also present in the park are networks of old roads from the 18th and 19th centuries. After the park's establishment, some of these roads were removed, but many remained as part of the park's trail system. Former agricultural areas were naturally reclaimed.

At Vanderbilt National Historic Site, a water main break caused a gully to form within hours. Unconsolidated lacustrine clays, glacial outwash and deltaic deposits, and artificial fill underlie the bluffs at the site. These deposits are prone to mass wasting and any anthropogenic alterations to the landscape could potentially trigger slumping and erosion.

At Roosevelt-Vanderbilt National Historic Sites, minor gravel pits, used by local settlers, are not considered to need remediation. Several historic roads are present within all three units. These are trails and access roads at the parks and will not be restored to natural conditions. Contemporary logging roads are in lands recently acquired by the parks. There are no plans to restore them at present.

Increasing local populations and developments surround both Saratoga National Historical Park and Roosevelt-Vanderbilt National Historic Sites. Development and adjacent land use changes impact park resources. Both units are concerned about changes in viewshed as a result of increasing development. For areas such as Vanderbilt National Historic Site and Home of Franklin D. Roosevelt National Historic Site, the natural view of the Hudson River Valley is part of the cultural landscape.

Champlain Canal

The Champlain Canal, hand-dug in the early 1800's, served as a transportation corridor between Whitehall and Waterford. Today, the canal is in ruins along stretches of the Hudson River at abuts the battlefield unit. At Saratoga National Historical Park, only portions of the canal still hold water whereas others were filled. There are inadequate culverts and causeways across the canal. This canal structure interrupts drainage off the highlands toward the Hudson River. Issues associated with this structure include flooding, sedimentation, debris accumulation, and potential hazards of the walls spalling and cracking. Route 4 can flood each spring. Adjacent to this canal is private property and jurisdiction of the canal is complicated. At present, the New York Department of Transportation is proposing to reestablish a drainage pattern around the canal (now on the National Register of Historic Places) and restore portions of it. Water would run towards the southeast corner of the battlefield unit to one large culvert. Resource management has concerns over the potential impacts of this change to cultural and natural resources at the national historical park.

Features and Processes

Paleodunes

As described below, glacial ice covered the Hudson Valley area during the Pleistocene Epoch. Once the glacial ice melted and retreated northward and the ensuing glacial lake (glacial Lake Albany) drained down the valley, the stark landscape was devoid of any stabilizing vegetation. The prevailing winds picked up the sand and silt from glacial lake deposits, transporting them on currents to create loess deposits. At Saratoga National Historical Park, paleodunes formed after the latest glacial retreat are comprised of sand and silt as remnants of an aeolian dune field that blanketed the entire area. This is historically significant in that these deposits supplied molding sand for local industry. Lacustrine clays provided brick making material.

Geology and History Connections

The Hudson River Valley courses through the Great Valley Region, one of the northeast-southwest trending physiographic provinces of the Appalachian Mountain system. The Great Valley sits between the Blue Ridge-Piedmont (to the east) and Valley and Ridge (to the west) physiographic provinces. A chain of valley lowlands characterizes the Great Valley which trends approximately 1,100 km (700 miles) from Canada to Alabama. Other notable portions of the Great Valley include Champlain Valley, Mohawk River Valley, Wallkill Valley, Kittatinny Valley, Hagerstown Valley, Shenandoah Valley, Roanoke Valley, and the East Tennessee Valley.

The geologic units underlying the Great Valley formed approximately 540-470 million years ago during marine deposition on a great limestone platform along the eastern edge of the North American continent. As highlands rose to the east during the Taconic orogeny, sediments shed from those highlands included sandstones and shales that now comprise the Austin Glen Formation. The limestone and other sedimentary rock units eroded relatively easily forming lowland areas. The Great Valley provided important north-south transportation and trade routes for Native Americans and European settlers. It also served as an important thoroughfare for military campaigns throughout history including the Revolutionary War and American Civil War. Revolutionary War sites including Saratoga National Historical Park run up and down the Great Valley.

People settled within the Hudson River Valley for its abundant natural resources. The landforms of this area had significant impacts on the historic events occurring up and down the river's corridor. Glacial drumlins were ideal locations for local homesteads with upland areas and well-drained soils. At Saratoga National Historical Park, the local topography and underlying geology are very significant to the battles fought there. The battle was concentrated where the Hudson River narrows and bends at the base of high bluffs. The only road from Albany to Fort Edward passed through here. The passage was too narrow to allow the British to transport cannon and heavy artillery. The Americans chose this site for its strategic importance, vantage points (Willard Mountain), and cover. The regional clay layers overlain by sands (described above in mass wasting section) also provided local spring horizons, which were used by soldiers in the battle (Goings Camp in the northeast corner of the park) and possibly by earlier Native American groups. Originally, the land was more forested than today. The national historical park aims to restore the landscape to battle-era conditions necessitating reclaiming agricultural land from the 1940s and reestablishing local forests. Much of this reforestation occurred naturally.

Affluent people such as Frederick Vanderbilt were drawn to the scenic views of the valley from the 60 m (200 ft) high bluffs flanking the Hudson River. This view attracts many local residents to recreate at the national historic site. Franklin D. Roosevelt's father purchased the property at Hyde Park where the president was born, raised, and died. The nation's first presidential library is there. There is a need to interpret the natural features and evolution of the landscape at Roosevelt-Vanderbilt National Historic Sites. Visitors wish to understand why the landscape looks the way it does.

Glacial Features

During the Pleistocene Epoch, more than 10,000 years ago, glacial ice sheets descended from the north over the Hudson River Valley, covering the landscape. Glaciers are effective agents of erosion, beveling hills and other topographic highs while transporting vast amounts of sediments picked up en route. Glaciers excavated the Hudson River Valley, making it wider and deeper and leaving remnants of its former channel stranded as paleochannel deposits. When the glacial ice melts and retreats, these sediments remain and may cover the underlying landscape. If glacial retreat is rapid, the sediments once entrained in the glacial ice are relatively unsorted and contain fragments of various sizes ranging from the smallest clay to boulders. Outwash streams typically accompany glacial melting by draining downslope away from the melting ice front. These sediment choked streams leave sorted channel, delta, and floodplain deposits. Immediately following glacial retreat and scouring, the re-excavated Hudson River drained a much larger area. This glacio-Hudson River carved the present course and transported sediments to Long Island Sound. At that time, the Hudson River Valley resembled a canyon.

At Saratoga National Historical Park, glacial features include drumlins, rock drumlins, striations, and glacial lake features. A series of glacial lakes named for the location of the impoundment such as Glacial Lake Albany, Glacial Lake Quaker Springs, and Glacial Lake Coville formed in front of the retreating glacial ice edge in the Hudson River area. Associated with this lake are clay, sand, beach, and shoreline features throughout the park area. When the lake's impoundment was breached, torrents of water flushed southward and lake bottom sediments including sand, silt and clay were available to prevailing winds. In the Saratoga area, these deposits accumulated into dune fields.

Thin glacial deltaic and outwash deposits mantle the bedrock at Roosevelt-Vanderbilt National Historic Sites. Deltaic deposits formed by water flowing from melting glaciers and outwash streams into Glacial Lake Albany whose impoundment was located south of Hyde Park at Hells Gate in Manhattan. The parks may sit near a threshold of an intermittent glacial lake level. When the lake's impoundment was finally breached, the roaring flood stripped much, but not all of the previous sediments from the landscape at Roosevelt-Vanderbilt National Historic Sites. Exposed in the bluffs flanking the Hudson River Valley are eroded glacial channels and outwash deposits covered by lacustrine clay related to the glacial lake, which are in turn covered by coarse sand. This setting is prone to mass wasting in the Vanderbilt and Home of Franklin D. Roosevelt National Historic Sites.

Recommendations

(1) Complete road logs and walking tours focusing on the geology and geologic resources of the area as they influence landscape evolution and historical events at both SARA and ROVA.
(2) Perform a comprehensive paleontological inventory of the river corridor. At SARA, attempt to locate historic map reference showing fossiliferous area.
(3) Locate and inventory paleontological resources, archaeological and cultural remains vulnerable to being lost to erosion in the parks.
(4) Study sedimentation patterns and distribution along the Hudson River and local stream corridors noting areas of sediment loss and gain.
(5) Increase awareness of and monitor seismic activity through the website managed by the U.S. Geological Survey.
(6) Gather baseline information for contamination research and future monitoring.

(7) Interpret the geologic maps for both parks for visitors focusing on evolution of the landscape, geologic resources, historic battle campaigns and settlement patterns. Create a regional map of the Great Valley highlighting the geologic controls on its evolution and its historical significance.

Action Items

(1) GRE staff will consult the NY State GIS clearinghouse for map information. Also consult Willie Rodriguez and Allen Ellsworth (both with the USGS) regarding map coverage for ROVA.
(2) GRE will produce digital geologic map for Saratoga National Historical Park and Roosevelt-Vanderbilt National Historic Sites including bedrock and surficial map coverage (see above geologic mapping section).
(3) GRE report author will consult the report by Frimpter (1972) for a regional geology reference.
(4) GRE will obtain GIS coverage for all four units of SARA.
(5) GRD will consider a possible paleontological inventory for the parks.
(6) GRE report writer will obtain a copy of David DeSimone's MS Thesis from Rensselaer Polytechnic Institute Library.
(7) GRE report writer will obtain report regarding cores from Saratoga battlefield during the construction of the 1960-1961 visitor center.
(8) GRE report writer will consult the Office of General Services for New York regarding tidal fluctuations along the Hudson River .

References

www.nps.gov/sara (accessed July 20, 2007)

www.roosevelt-vanderbiltplan.org/ (accessed July 20, 2007)

www.topozone.com (accessed July 21, 2007)

Table 1. Scoping Meeting Participants

Name	Affiliation	Position	Phone	E-Mail
Connors, Tim	NPS – GRD	Geologist	303-969-2093	Tim_Connors@nps.gov
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Table 2. GRE Mapping Plan for Saratoga National Historical Park

Covered Quadrangles	GMAP[1] ID	Reference	GRE appraisal	GRE Action	Scale
Quaker Springs	74756	Heisig, Paul M., 1994, Quaker Springs 7.5' Quadrangle; Surficial Geology and Locations of buried bedrock channels and ground-water pumping facilities, Saratoga County, New York IN Generalized stratigraphy, surficial geology, types of aquifers, and 1988-89 ground-water pumpage in eastern Saratoga County, New York (plate 2/8), , Water-Resources Investigations Report 93-4029, plate 2/8, 1:24000 scale	2007-0808: SARA qoi; use for surficial; not sure if digital. Dave DeSimone says there are likely better unpublished MS theses to use for this quad; he will supply references to GRE	??	24000
Mechanicville	74760	Heisig, Paul M., 1994, Mechanicville 7.5' Quadrangle; Surficial Geology and Locations of buried bedrock channels and ground-water pumping facilities, Saratoga County, New York IN Generalized stratigraphy, surficial geology, types of aquifers, and 1988-89 ground-water pumpage in eastern Saratoga County, New York (plate 6/8), , Water-Resources Investigations Report 93-4029, plate 6/8, 1:24000 scale	2007-0808: SARA qoi; use for surficial; not sure if digital. Dave DeSimone says there are likely better unpublished MS theses to use for this quad; he will supply references to GRE	??	24000
Schuylerville	74987	DeSimone, David J., 1977, Glacial geology of the Schuylerville quadrangle, New York, , Master's, 1:24000 scale	2008-0707: got reference from georef after David DeSimone suggested; he says he has colored mylar copy, but it's not in digital format. GRE needs to acquire and evaluate	Needs acquired and evaluated	24000
Quaker Springs ??	74988	Hanson, E., 1977, Late Woodfordian drainage history in the lower Mohawk Valley, , Master's, 1:24000 scale	2008-0707: suggested by David DeSimone; got from georef; not in ngmdb. might cover Quaker Springs NY 7.5' (??); need to obtain copy and evaluate	Needs acquired and evaluated	24000 ?
Mechanicsville Schuylerville	74989	Dahl, John, 1978, Surficial geology of the Mechanicville and Schaghticoke quadrangles, NY, , Master's, 1:24000 scale	2008-0707: suggested by David DeSimone; got reference in georef because not in ngmdb	Needs acquired and evaluated	24000
All SARA qoi's	4555	Fisher, D.W., Isachsen, Y.W., and Rickard, L.V., 1970, Geologic map of New York - Hudson Mohawk sheet, New York State Museum, Map and Chart Series 15, 1:250000 scale	2007-0613: looks to be same as GMAP 74111 (NY state geology from USGS); likely will use as best available digital bedrock geology; counterpart for surficial is GMAP 4552	Conversion	250000
All SARA qoi's	4552	Cadwell, D.H., Dineen, R.J., Connally, G.G., Fleisher, P.J., and Rich, J.L., 1987, Surficial geologic map of New York: Hudson - Mohawk sheet, New York State Geological Survey, Map and Chart Series 40, 1:250000 scale	2007-0613: might be best available digital surficial even though it's coarse; completely covers all 6 QOIs for SARA and is digital	conversion	250000

[1]GMAP numbers are unique identification codes used in the GRE database.

Table 3. GRE Mapping Plan for Roosevelt-Vanderbilt National Historic Sites

Covered Quadrangles	GMAP [1] ID	Reference	GRE appraisal	GRE Action	Scale
Hyde Park	74990	New York Geological Survey, 2008, Bedrock Geologic Map of the Hyde Park New York 7.5' quadrangle, , , 1:24000 scale	2008-0708: awaiting citation and any other relative information from NYGS Bill Kelly	Acquire and evaluate	24000
Hyde Park	1574	Cadwell, D.H., Connally, G.G., Dineen, R.J., Fleisher, P.J., Fuller, M.L., Sirkin, Les, and Wiles, G.C., 1989, Surficial geologic map of New York: Lower Hudson sheet, New York State Geological Survey, Map and Chart Series 40, 1:250000 scale	2007-0613: use for ROVA (VAMA-) with GMAP 7288 bedrock; crop to ROVA qoi's; Do analysis to see if simpler to convert entire sheet rather than cropping down based upon other parks it covers	Convert	250000
Hyde Park	7288	Fisher, D.W., Isachsen, Y.W., and Rickard, L.V., 1970, Geologic map of New York - Lower Hudson Sheet, New York State Museum, Map and Chart Series 15, 1:250000 scale	2007-0613: use for ROVA (VAMA-) with GMAP 7288 bedrock; crop to ROVA qoi's; Do analysis to see if simpler to convert entire sheet rather than cropping down based upon other parks it covers	convert	250000

[1]GMAP numbers are unique identification codes used in the GRE database.