

**Historic Bluestone Industry**



**Geoarchaeology of the Stony Hollow Wagon**

**Road and Quarry Network (circa 1830 - 1905);**



**Ulster County,**

**New York**

**Dec. 7, 2020**



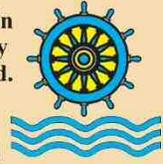
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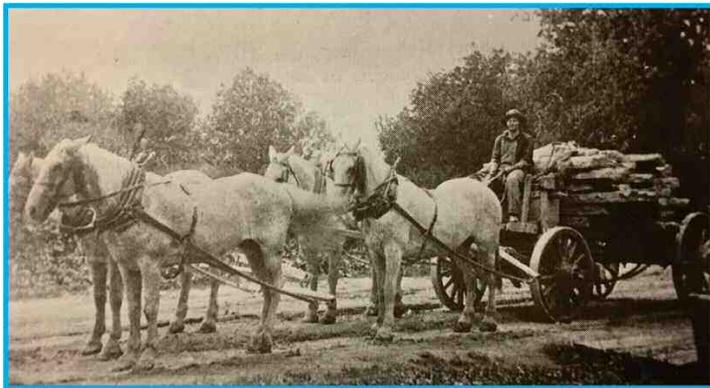
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## Geoarchaeology of the Stony Hollow Wagon Road and Quarry Network (circa 1830 - 1905); Ulster County, New York December 7, 2020



Recent investigation within Bluestone Wild Forest has found and documented dozens of bluestone quarries interconnected by a network of engineered wagon roads - all within a 2000-acre area. Other features connected by these wagon roads include building foundations at quarries and of a former railroad station, stone-walled farm fields, and a bluestone house. They indicate interrelated day to day life activities and early industrial operations, possibly under the guidance of a single quarry master or land lessee.

*Teamster hauling bluestone to market. Photograph from Harry Siemsen; reproduced from Evers (1972)*

### Introduction

Throughout much of the 19<sup>th</sup> century, the bluestone industry employed thousands of Irish immigrants and others in sandstone quarrying operations. Small, large, thin, and thick bluestone slabs were painstakingly extracted from quarry faces, largely by hand and non-motorized hoisting methods. While many quarry operations exploited single quarries, field investigation and geologic mapping in the Bluestone Wild Forest in Ulster County, New York have identified dozens of quarries connected by an 18-mile integrated network of engineered wagon roads. Detailed examination of quarries is currently underway to elucidate mining methods used in different geologic settings interspersed amidst a varied and rugged topography within a sculpted landscape of glacial landforms. Some of the many identified quarries are uniquely different from others and, as such, are valuable treasures from which we can glean new insight into preferred geologic features, extraction techniques, and engineered uses of waste rock.



Field investigation has revealed that wagon roads within and beyond Bluestone Wild Forest also served to connect important cultural features, including finding and recognition of a long-lost railway station, building foundations, stone walled pasture lands, and a superb bluestone house

dating back to at least 1845. Document investigation may reveal that these features were related to a major quarry owner family, perhaps to the Fitches renowned in the Kingston-Wilbur, New York area bluestone industry. It is highly likely that owners or lessees of this house were quarry owners or renters and/or quarry masters that oversaw quarry operations and wagon road construction throughout the research area delineated on Figure 1. The physical location of this house, adjacent quarry areas, nearby pastures, and wagon roads are analogous to the hub of a wagon wheel with spokes (aka wagon roads) extending outward to numerous quarries. This largely intact network of relict wagon roads, quarries, and related cultural features may be unique within the United States. Together, they provide an important opportunity to expand our knowledge of an interconnected cultural resource that thrived during the early industrialization of the United States. Preservation and interpretation of this cohesive, interconnected, historic resource provides unique and important archaeological, geological, educational, recreational, and ecotourism opportunities. **The one-page Fact Sheet at the end of this report and Figure 2 summarize key findings of this report.**

### **Field Reconnaissance, Field Mapping, and GIS Map Construction**

HydroQuest is investigating geologic, landscape, and historic cultural features present within Bluestone Wild Forest. Geologist Paul Rubin, President of HydroQuest, worked as an archaeologist prior to completing a Master's degree in geology. The geologic field component portion of this work entails identifying, locating, and interpreting geologic features including elongate glacial meltwater channels, rock-jumbled knolls, kettle depressions left by melting glacier ice, boulder trains, and recessional moraines characterized by boulder ridges. The physical character and locations of these features influenced the constructed wagon road pattern and bluestone quarry locations, as did the varied physical nature of the quarried bedrock. Many knolls and kettles were identified and targeted using a combination of 2-foot elevational contours derived from a 2014 LiDAR dataset and 2015 topographic 1-meter Digital Elevation Model data provided by Ulster County Information Services. In the Bluestone Wild Forest, a Global Positioning System (GPS) receiver was used to obtain knoll, kettle, quarry, and wagon road coordinates for spatial plotting within an ESRI-based Geographic Information System (GIS) database. Feature coordinates were entered into database tables for geospatially referenced plotting and GIS map construction.

Numerous quarries, large and small, were identified during expansive on and off-trail bushwhacking treks conducted throughout Bluestone Wild Forest. They are plotted on Figure 2. There is little doubt that additional quarries and wagon road segments are present on private property that have not been mapped. The locations of pastures, building foundations, bluestone working areas, and a lost railway station were also recorded using a GPS receiver. For protection purposes, most building foundations are not plotted on GIS maps contained within this report.

### **Importance of Empirical Geospatial Data and Factual Presentation: An Example**

Unfounded statements were made that infer that HydroQuest’s geospatial assessment regarding the location of the historic Waughkonk Road erroneously and “conveniently” place it over the proposed 850 Route 28 project area. It is important to recognize that the high level of location plotting presented on HydroQuest GIS maps in this report, such as for miles of wagon roads (e.g., Waughkonk Road; Figure 2; Photos 13, 24, 26), reflects many hundreds of empirical, field-collected, data points brought into a spatially accurate and georeferenced GIS database for plotting. This modern means of locating cultural and geologic features far supersedes the generalized line plot of the 1875 Beers map. Furthermore, the technologies used to locate and plot wagon roads on publicly accessible lands within Bluestone Wild Forest go beyond and dismiss an unfounded statement (below) presented in the Diamond report (2020) while bringing into question the rigor of all other report statements:

*“On another note, the ‘Waghkonck Trail’, as noted in the HydroQuest Report (2020:Figure 1) is conveniently located directly over the APE. From my reading of Evers (1972; 1987:8) it appears that the “trail” is located to the east of, and well outside of the project area.” (Diamond; 10-06-20)*

Evers (1972, 1987) provides scholarly history throughout a broad Catskill Mountain area, with much emphasis on the Woodstock area. He made no attempt via maps or physical description to accurately locate the Waughkonk Road relative to the proposed 850 Route 28 industrial site. His 1987, pages 8 and 33, descriptions follow. Evers’ 1972 book does not detail the Waghkonk Road.

*“Some Indians who lived on the fertile plains near Kingston made their way to Woodstock over a trail which followed the route now known as the Waghkonk Road, past a spot still called the Indian Spring, and then joined the Sawkill trail. (page 8) ... The Wagonck Road, taking off from Route 28 at Stony Hollow, is the only surviving reminder of the old Indian name.” (page 33)*

In this report, HydroQuest GIS maps accurately portray the physical location of the old Waughkonk Road to the north end of the now paved Waughkonk Road and the south end at a northern 850 Route 28 property border. The dashed wagon road route through the 850 Route 28 property closely matches the old Waughkonk Road portrayed on the 1875 Beers map (Rubin, 2020b) and reasonably links known southern and northern wagon road locations. Thus, this major historic wagon road goes directly through the 850 Route 28 industrial site, not off to the east as erroneously attributed to Evers. Project construction would remove portions of the Waughkonk Wagon Road.

## **Narrative Description of Broad Research Area**

HydroQuest's research area is depicted on Figure 1. This area lies within an upturned Tennessee-shaped 2,000-acre area bounded by the following present-day roads: Moray Hill, Sawkill, Zena, Rt. 28, Beesmer, and Rt. 28A. These boundaries were selected because most of these roads served as major wagon road routes used by bluestone laden wagons after they left numerous quarries contained within this research area. Of these roads, Rt. 28A served as the preferred transport route to the docks in Wilbur (near Kingston), some six miles to the southeast, where stone was shaped and shipped to clients. This research area includes both public and private lands. Permission is being sought to advance research on private properties through which historic wagon roads are known to be present, as well as one or more bluestone quarries.



The 850 Rt. 28 site is a private landholding within this research area and is central to New York State protected Bluestone Wild Forest, much like a hole surrounded by a doughnut. At least three historic wagon roads traverse through it, including the Waughkonk Wagon Road. State forest lands surround this property where owners propose significant expansion of 1970s bluestone removal, construction of two large industrial buildings, and removal of existing historic resources (i.e., approximately 1,000 feet of the Waughkonk Wagon Road and blasting removal of half of Hemlock Quarry). Removal of these valuable historic resources will irreversibly destroy them. This is inconsistent with preservation tenants put forth by the New York Archaeological Council and the New York State Historic Preservation Act [NYSHPA]) discussed in the Regulatory Framework section below.

## **Narrative Description and Significance of Proposed Archaeological District Boundaries Accessible on Public Land**

To date, field reconnaissance within the broad research area has been limited to 1,000 acres of protected New York State and Town of Woodstock properties, illustrated on Figure 1 as a yellowish green subset of the broader 2,000-acre area. The bulk of this report focusses on geological and archaeological findings within this 1,000-acre area. It boasts the glacially sculpted basins of Onteora Lake and Pickerel Pond, deep elongate bedrock channels that once rushed with glacial meltwater beneath icy caps, unique boulder studded knolls, vernal pools in kettle holes, deep valleys, wetlands teeming with wildlife, and public trails winding under a peaceful forest canopy.

This relatively small area provides an unprecedented snapshot in time, a time capsule, that preserves the rigorous inner workings of an early industrial enterprise that was almost certainly spearheaded by a single quarry master or bluestone company. An intricate network of skillfully engineered wagon roads weaves amidst an exquisite geologic backdrop, skirting cliffs, deep

valleys, rock strewn glacial mounds, wetlands, and lakes. Today, many of these wagon roads appear as distinct, well-worn, rutted roadways sometimes incised through soil to underlying bedrock. Quarry workers traversed all of the research area, chiseling and drilling into exposed cliffs and soil covered bedrock, searching for ideally spaced vertical fractures and horizontal bedding planes best suited to meet flagstone dimensions of burgeoning market demand in the 1830 to 1905-time range. The very best bluestone exposures were extensively developed along and into cliff faces, casting huge quantities of waste rock aside. Other quarry works were enlarged from small trench excavations, sometimes into pit quarries that required dewatering during exploitation. Relict stone foundations associated with some of the larger quarries will, when excavated, provide valuable insight enabling interpretation of this important phase of early industrial development in the United States. They may have served as blacksmith shops to sharpen tools, offices, and as explosive storage sheds. Shaped flagstones, stone workshop areas, laid stone quarry side pedestals, and readied bluestone exposures suggest rapid abandonment in the shadow of a blossoming cement industry. Teams of horse drawn wagons traversed over 18 miles of interconnected wagon roads within this archaeological area. This area once resounded with the clatter of wagon wheels grinding into bedrock tramways and of men drilling and hammering rock. For many, especially Irish immigrants, these quarries provided a means to support their families.



This 1,000-acre area rich in historic cultural resources could be considered for designation as an archaeological district on the National Register of Historic Places, much like the Fitch Bluestone Company Office in Kingston, New York.

## **Regulatory Framework**

New York State's Professional Standards for Cultural Resource Investigations (NYAC, 2000) involve a process of identification, evaluation, and protection of significant cultural resources mandated by a variety of state, federal, and local laws (e.g., State Environmental Quality Review Act [SEQRA]; New York State Historic Preservation Act [NYSHPA]). The NYS review process includes consideration of the potential impact of projects on cultural resources and features, including historic standing structures greater than 50 years old.

*“Preventing the destruction of these resources ensures the continued use and enjoyment of them by present and future generations. ... Cultural resources are non-renewable parts of our environment. Once a site is destroyed, it is lost forever. The importance of cultural resources to preserving our national heritage has been recognized by all levels of government in the United States and around the world. ... Cultural resources warrant informed preservation so that they will be available for future study and analysis of the past as well as the future (NYAC, 2000).”*

The Hemlock Quarry site (Rubin, 2020b) embodies distinctive characteristics of mineral/bluestone extraction used prior to technological advancements that led to changes in quarrying methods around 1860, followed by gradual industry collapse after 1880 with the discovery of Portland cement. Figure 1 shows that proposed construction of the 850 Route 28 Site will impact the integrity of the historic Hemlock Quarry. This quarry, associated rubble piles, stone works, and foundations comprise a significant cultural resource/archaeological site that has not been previously recognized.

### **Historic Wagon Roads and Quarries in Bluestone Wild Forest**

Historic bluestone quarries in Bluestone Wild Forest, dating back about 190 years, were connected via a tributary wagon road network. Until recently, 19<sup>th</sup> century bluestone quarries were viewed in isolation within the forest. However, all quarries were connected along a road network on which heavily laden horse drawn wagons transported stone to docks in Wilbur. The Figure 2 GIS map depicts reconstruction of this relict wagon road network, over 18 miles to date. Reconnaissance, field mapping, and topographic analysis were used to identify relict wagon roads based on one or more of the delineating features listed in bullet format in the section below. Portions of the main stems of these roadways exhibit heavy use, particularly that of the Waughkonk Wagon Road. Metal rimmed wagon wheels wore grooves in roads still visible today, some deeply cut into bedrock (to 1.2 feet) while others etched only shallow ruts on glacially straited bedrock (Photo 51). At least three of these old wagon roads project into the proposed 850 Route 28 development property site. Many of these old wagon roads have become trails used today.



*Deep wagon wheel ruts in bedrock.*

Roadway reconstruction work within Bluestone Wild Forest has revealed four, or possibly five, distinct and subparallel forest roadways, each with multiple tributary spur roads leading to more distant quarry operations. These are 1) the old Waughkonk Wagon Road that is depicted on an 1875 Beers Atlas map (shown on Figure 2), 2) a north-northeast to south-southeast roadway situated west of Onteora Lake, 3) a south trending wagon road linking quarries near the 850 Route 28 site, extending past Pine Quarry to the old Plank Road (Rt. 28A), 4) a generally north to south trending roadway extending southwest from Duck Quarry and then around the western side of a large wetland that is a remnant of a relict proglacial lake, then extending southward to Moray Hill Road, and, possibly (yet to be determined), 5) a fifth wagon roadway (aka tramway) extending from a quarry located near the northeastern tip of the same wetland, extending north-northeast beyond the boundary of the Bluestone Wild Forest, possibly also to Moray Hill Road. At least the first four roadways traverse to Old Route 28, the original route to Wilbur docks along the Rondout.

Clearly, over the span of about 75 years, Bluestone Wild Forest was alive with 19<sup>th</sup> century industrial quarrying. Ongoing reconstruction of this 115 to 190-year old wagon roadway network reveals the nature, extent, and scope of bluestone quarrying operations at the market's source. This

interconnected roadway network between the workings of early bluestone quarries may be unique and undocumented elsewhere. From a cultural/industrial archaeological standpoint, this reconstruction documents an integrated network of quarry workers/owners who developed, used, and maintained a transportation network for their mutual benefit.

### **Identification of Historic Wagon Roads: Delineating Features**

Clearly, heavy stone slabs extracted from Bluestone Wild Forest quarries required well-constructed and maintained roadways for horse drawn wagons. Every significant bluestone quarry had a wagon roadway or tramway to connect it to well established roadways to deliver stone to market at the loading docks in Wilbur. The HydroQuest research area (Figure 1) is bounded by these roadways that are paved and used today.

Bluestone Wild Forest historic findings include dozens of quarries and, importantly, an incredibly well preserved and likely unique wagon road network nestled within an upturned Tennessee-shaped 2,000-acre area bounded by the following present-day roads: Moray Hill, Sawkill, Zena, Rt. 28, Beesmer, and Rt. 28A (Figure 1). Within these bounding roadways, some 18 miles of wagon roads have now been identified, located with a GPS receiver, and plotted on GIS maps in this report. In the forest, many of these relict wagon roads are readily identified while others are harder to recognize and follow. Portions of some are now part of a public trail complex. Long and short sections of wagon roadways (e.g., Photos 23, 46, 47) including indistinct portions, were identified on foot through recognition of one or more of the following delineating features:

- Roadway proximity to major or minor quarry workings (leading to and from);
- Distinct, well-worn, roadways sometimes incised through soil to underlying bedrock;
- Distinct parallel wagon wheel ruts notched downward into surrounding soil cover;
- Ruts worn/grooved into bedrock, sometimes with beveled sides;
- Roadways constructed of quarry rubble;
- Roadways constructed proximal to quarry rubble;
- Clear, well-worn, roadway intersections (often angled indicating use direction);
- Presence of old foundations proximal to wagon roadways;
- Constructed stone walls present next to roadways for bank support;
- Roadbed is built above grade on one or both sides;
- Wagon roadway extends through an engineered opening in a stone wall, sometimes with squared stone wall ends;
- Presence of shaped/worked flagstones discarded alongside wagon roads;
- Presence of small or large piles of rocks and soil placed, and often mounded, parallel to wagon roads during construction;
- Notched knolls or hillslopes to permit roadway construction;
- Roadway routing necessary to connect quarries to main wagon road segments;
- Ramps constructed across low lying areas, between physically/topographically separated areas, and to quarry workings;
- Leaf accumulation and wadding in elongate parallel ruts;
- Faint parallel grooves visible beneath leaf cover; and
- Physical location constrained by rugged topography, cliffs, or boulders to either side.

## Eloquent Description of the Old Waughkonk Wagon Road

Reference to a walk taken along the old Waughkonk Wagon Road belies the deep history still there with a, at present, relatively minor diversion required to skirt around the 850 Route 28 mined quarry area. In this eloquent hand-written description, believed to be authored by Tom Tobler, photograph numbers have been added that correspond to some of the features mentioned. These photographs appear at the end of the text portion of this report.

*“Walking from old route 28 up and along Waughkonk rd. one can only imagine the trail, blazed by the first Americans, then later used by wagon and stage coach riders Crossing the 4 lanes of 28 and continuing up past the old stone house on the right (stone house shown later in report), its quieter now with the hum of the highway behind, now the road narrows to pass into the woods. Then it becomes obscure for some time as it passes through the quarry. One can roughly trace its ground as it caresses the ridge of the deep 1970 quarry pit. It is not the original trail for these few hundred feet, though along the ridge with the view of the mountains are a good alternative. Then the deep routed trail emerges again and strait into a forest glade of hardwoods and grasses. On the left straddle’s remnants of a stone wall (Photo 14) and then a stone foundation of a stage coach house stop (Photo 15) perched on a small hill 15 ft from the trail. Strait it passes between the contours of the stratified landscape and the bodies of water into a low lying marsh area. Then up it winds between rock outcroppings and fallen timber (Photos 16 and 17). Now quarries are on both sides of the trail (Photos 33 and 34) as it winds up the hill (Photos 28 and 27), with rock formations and tons of left abandon bluestone slabs now overgrown with dense oak, maple, hemlock. At the top of the hill is a large flattish 100 ft crest stone that the trail mounts. This bedrock stone exposed is the high point and halfway point between 28 and Sawkill. The use of sub surface stone at places throughout the trail is apparent. The trail had been carved 2 - 3 ft down to expose the bedrock for a smother riding surface for the wagons. Strait the trail opens up again to expose the view of a trail framed with trees and bushes on both sides into the distance. As the trail increases its pitch down it exposes deep groves in the bedrock (Photo 25). In 2 - 3 places the exact distance between groves show where the wagon and carriage wheels would fit and the erosion ensued.”*

## Wagon Road Engineering

Quarry workers went to great effort to engineer roadbeds suitable for heavy wagon traffic. A discerning eye will notice short and long road sections filled, graded, or entirely constructed with quarry rubble (to 250+ feet, Photo 43), ramps (Photos 49, 50 and photo to right) crossing low wetlands (Photos 44 and 45) and grading to quarry exposures (right), notched hillslopes, and loops constructed to connect quarries and direct wagon flow.



Ramp construction to quarry faces and across wetlands was sometimes substantial. Perhaps one of the most interesting and well-constructed ramps is found crossing a wetland situated at the north end of Onteora Lake (Figure 3, Location 25, Photos 44 and 45). This ramp has a maximum height and central width of six and sixteen feet, respectively with a length of about 70 feet. At its lowest point, it extends only one foot above the elevation of the wetland. Interestingly, this ramp might be referred to as “*the ramp to nowhere*” as there is no wagon road continuing off its eastern end. It is possible that a small amount of quarry stone was rolled down a cliff to it. Alternately, and more likely, it may have served as a wagon staging area along a heavily used wagon road. Further investigation is warranted.

## Geology and Operating Dates of Stony Hollow Bluestone Quarries

The physical character of the sandstone bedrock made it attractive for structural and ornamental purposes. Within Bluestone Wild Forest, the many cliff exposures and thin soil mantle made it readily accessible for extraction. Sometimes this necessitated the removal of weak overlying shale “*top*” beds. The landscape was sculpted by glaciers a number of times during the last two million years. Vestiges of the most recent glaciation (Wisconsin Glacial Episode) formed obstacles around which wagon roads were constructed: mounds of bedrock blocks (knolls), shallow depressions (kettles), deeply scoured valleys, and long cliffs.

While the exact date of opening of the first bluestone quarry in Ulster County may be lost in history, De Lisser (1998) provides a reasonable approximation. One holds that a man named Moray opened the first quarry at Moray Hill in 1826. Another is that the first quarry was opened near Sawkill. Yet another suggests that the first quarry was opened near Coeymans in Albany County in 1830. Hemlock, Oak, and a number of other quarries depicted on Figure 2 are in the Moray Hill area, as is a beautiful stone house on nearby Waughkonk Road that dates back to at least 1845. Thus, bluestone quarrying in the research area may date back some 190 years. By the early 1900s, the bluestone industry had reached its peak and had started to decline (Rowe, 1999). Dickinson (1903) and Rowe (1999) reference active quarry operations in Stony Hollow in 1903 and 1905, respectively.

## Glacial Geology

The research area is centrally located within a unique and unusually well protected geological/glacial landform that was first documented in May 2020 (Rubin, 2020a). This area exhibits well-defined features characteristic of both an advancing and retreating glacier. The presence of large sandstone boulders scattered throughout Bluestone Wild Forest provide evidence that the most recent glacier was debris-mantled (i.e., much rock material). Geologically, little is known about glacial drainage and glacial positioning at low elevations along the eastern Catskill front during the waning stages of the last glaciation (Wisconsin). Ongoing field reconnaissance being conducted by HydroQuest documents the presence of multiple glacial meltwater channels and a knoll and kettle landscape positioned well above Glacial Lake Albany which formerly occupied the Hudson Valley. A lobe of a large glacier that once occupied the Hudson Valley, impounded the southeasterly flowing Sawkill resulting in drainage of a glacial lake south-southwestwardly out of the Sawkill Valley. The May 2020 study documents relict meltwater channels that drained this proglacial lake and a melting glacier, perhaps during multiple glaciations. As the last glacier stagnated and melted, large isolated ice blocks melted from amidst till and rock debris, resulting in hummocky topography with hollows (kettles) and surrounding mounds (knolls). Large boulders that comprise, drape, and cap some of the knolls are chaotically distributed, indicating assorted melt out scenarios during melting of glacier ice. Other knolls are rounded and smooth with a superficial carapace of till most likely over boulder till. Additionally, small and large sandstone boulders perched atop melting stagnant ice were lowered onto the land surface. They are widely scattered throughout the Bluestone Wild Forest. Exemplary geological features not documented elsewhere in the Catskills extend around, through, and over the proposed project site. Additional geologic discussion is found in Rubin (2020a, 2020b). It is likely that detailed examination of the proposed 850 Route 28 project site would document more glacial features, quarries, and wagon roads than those described here.



*Bouldery knoll.*

Four outstanding and interrelated geological features make the Bluestone Wild Forest particularly worthy of recognition and preservation. The first is a series of glacial meltwater channels (Figure 4). For example, the furthest western channel is a nearly level, steep-walled, 3,345-foot long gorge (i.e., “Onteora Channel”) that is elevated some 160 feet above and 2,200 feet away from the nearest river capable of carving it. This glacially-carved channel served as a spillway that drained a glacial lake. The second outstanding Bluestone Wild Forest geological feature is the knoll and kettle topography that has largely not been altered by anthropogenic activities. The third glacial feature of significant note is a series of arcuate recessional moraine ridges riddled with chaotic jumbles of boulders marking temporary standstills along glacier fronts (aka snouts). They are not plotted on Figure 4 as they are beyond the scope of this report. Excellent examples of these arcuate boulder-rich recessional ridges are found along the Yellow Trail (south end area), in the broad Relict Pro-

Glacial Lake area (south to north), and in the northeastern end area of Pickerel Pond depicted on Figure 4. The fourth geologic feature of particular importance is glacially carved valley bottom areas that are now occupied by lakes (i.e., Onteora Lake, Pickerel Pond), wetlands, and a deeply incised stream channel. When these glacial features are viewed within their full interrelated context, their geologic significance provides rationale for preservation, as well as a unique educational opportunity for schools, colleges, and the public.



*Bouldery ridge flank.*

Together, these glacial features are of great significance relative to the historic bluestone quarry industry present in the Bluestone Wild Forest. Their presence required those constructing the wagon roads to avoid hummocky terrain characterized by knolls and kames, steep-walled glacial meltwater channels and bedrock promontories, and elongate lakes and wetlands. It is within the context of this rugged terrain that wagon road engineers laid out the interconnected roadway pattern. Not surprisingly, the parallel north-northeast to south-southwest alignment of major wagon road segments, as well as meltwater channel and lake/wetland orientation, correlates with the south-southwesterly glacier advance direction and bedrock sculpting. In places, roadway engineers spearheaded construction of ramps and fill to overcome steep inclines and low-lying wetlands. The magnitude of these efforts is well preserved in a number of locations within the Bluestone Wild Forest.

### **Bedrock Geology**

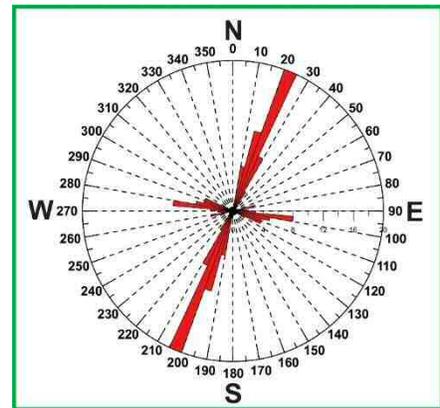
Flat-lying sedimentary bedrock of the Catskill Mountain is of Devonian age, having been deposited between approximately 419 and 365 million years ago (Ver Straeten, 2013). In the Bluestone Wild Forest, the bedrock is comprised of sandstone, shale, siltstone, mudstone, and some conglomerates of the Ashokan and Plattekill formations. The bluestone extracted by quarry workers is a fine-grained sandstone, so named because it commonly has a bluish or bluish gray tinge. Other general names for this sandstone include Hudson River bluestone, Hudson River flagging, and North River bluestone. The stone was quarried for flagging, retaining walls and bridge stone, sidewalks, crosswalks, curbing, gutters, stepstones, flooring, vault covers, bases of tombstones, porch and hitching posts, and house trimmings, such as platforms, steps, door and window sills, lintels, and caps (Day, 1891).

A number of geologic factors influence the suitability and, thus, quarry selection and the marketability of bluestone. These include the following factors: thickness of sandstone beds, the grain size of various horizontal sandstone beds, the bed thickness, whether shaly or “*top*” material must first be stripped and removed prior to sandstone extraction, and the spacing between vertical

fractures referred to as joints. Quarry workers referred to the thickness of extracted sandstone between bedding planes as lifts. During extraction, the size of dimension stone was limited by “side seams” and “heads”, stone workers terms for vertical joints. During later quarry years, some enormous platforms or big stones were extracted. Rowe (1999) discusses a quarry owned by James E. O’Neil and a new horse powered derrick: “In May of 1903 he set a record with it, by lifting a piece of stone measuring 26 feet long, 6 feet wide, and 18 inches thick, and weighing an estimated 16 ton.” Additional geologic detail is provided by Rubin (2020a, 2020b).

### Rose Diagram

Geologic characterization of fracturing within the Bluestone Wild Forest reveals the presence of two distinct joint sets. The orientation of numerous vertical fractures (i.e., joints) was measured with a compass and plotted in Rose diagram format. Geologists use Rose diagrams to graphically portray dominant fracture (bedrock joint) orientations within 360-degree compass-like figures. Geologically, major vertical or near-vertical joint orientations in an area normally occur in two distinct directions roughly 90° apart from each other. On the Rose diagram below the longer spokes represent greater fracture frequency and prominence. Note that the prominent joint orientation is approximately N22°E, but commonly ranges between N10°E and N35°E. Quarry workers took advantage of this joint alignment, as it provided a natural break or terminus for bedrock slabs thereby negating the need to drill the far northwestern end of slabs. Glacial striations or scratches left on exposed bedrock as rocks on the bottom of glaciers are dragged forward (Photo 51) show that the most recent glacier that flowed through the Bluestone Wild Forest did so almost exactly along the same orientation as the prominent joint set (i.e., N22°E to S22°W ± 5°). This coincidence almost certainly increased plucking or removal of bedrock both within glacial meltwater channels and along bedrock exposures. The resultant cliffs were then favorably exploited by quarry workers.



*Joint orientations within Bluestone Wild Forest.*

The secondary east-west joint alignment illustrated in the Rose diagram also provided a natural north-northeast to south-southwest break for bluestone slabs. The spacing between both joint sets controlled the potential size of quarry slabs, potential uses, and profitability. Similarly, the distance between horizontal bedding planes (see photo to right) also controlled the thickness of bedrock slabs. Some quarries were favorable for thick and expansive bluestone slabs (e.g., Hidden Quarry) while others were



only suited to thin flagstone exploitation. Some quarries were of limited utility for either, thereby resulting in business losses. The physical nature and quality of bedrock joints and bedding planes directly correlated with marketability success or failure. Bedrock exposures that produced desirable bluestone were extensively quarried and expanded into cliff (e.g., Hemlock Quarry) and pit quarries (e.g., Sycamore and Duck quarries), and occasionally into widened trench quarries (e.g., Pine Quarry). Additional geologic assessment of quarries in Bluestone Wild Forest will facilitate interpretation of marketable geologic characteristics.



*Bedrock faces exhibiting the two prominent joint orientations shown above on the Rose diagram.*

## Quarry Types

Geologic assessment of quarries in Bluestone Wild Forest reveals four distinct types ranging from most to least productive. Foremost are long cliff quarries ranging from those with sandstone from the ground surface downward to those with a thick crumbly shale overburden “top” requiring removal prior to reaching marketable underlying sandstone beds. Two of the very best examples of no overburden vs. shale overburden are found in the Hemlock (left photo below) and Oak (middle photo) cliff quarries, respectively. Cliff quarries are depicted in Photos 8 - 12, 34, 40, 41, 42, and 48. Sandstone was also exploited from open pit quarries (Photos 20, 21, 22, 29, 30, 31), long and short trenches (right photo below and Photos 52 and 53), and from boulders either excavated from within glacial deposits (Photo 39) or found loose on the ground surface. Some of these quarry types are gradational in nature. Numerous small excavations might be termed “wildcat quarries” as they were exploratory in nature and are generally located close to wagon roads. Most expansive quarries are preferentially oriented along prominent fracture directions. Sometimes knolls and isolated boulders were exploited for flagstones.



*Excavated knoll with superficial carapace of till over boulders.*



*Hemlock cliff quarry.*



*Oak cliff quarry.*



*Small trench quarry.*

### **Quarry and Waughkonk Wagon Road Highlights**

A key goal of the research presented in this report is to establish systematic, high-quality methods for the identification, evaluation, interpretation, protection, and preservation of culturally significant resources. This goal is consistent with New York Archaeological Council Standards Committee (NYAC, 2000) cultural resource standards:

*“In recent years, cultural resources also have been incorporated into heritage tourism projects throughout the United States. ... These sites and the artifacts and features contained within them are valuable parts of our regional and national heritage. ... When interpreted for the general public, prehistoric and historic sites are valuable educational tools for schools, and a vehicle for enhancing economic development through tourism.”*

Different quarries have different physical aspects that can be investigated to assess quarrying operations, methods, and geologic conditions. Detailed geologic characterization is warranted. Some initial findings specific to some of these quarries follows. Quarry names were selected based on attributes or features observed when examining them. Future research efforts may link individual quarries to documented historic names. For example, Rowe (1999), in notes provided from the Kingston Argus provides an entry from April 22, 1903: “*James M. Burger will occupy Clarence Rowe’s place as engineer at Candee’s bluestone works in Stony Hollow.*” Another similar newspaper entry on June 17, 1903 states: “*George Rowe has rented his residence to a family from New York by the name of Rand for the season. He will move and live at Stony Hollow near Candee’s stone work, as he has a good position there.*”

### **Hemlock Quarry and the Waughkonk Wagon Road**

This approximately 1,100-foot long quarry unquestionably provides the best research area example of an expansive cliff quarry in direct association with massive rubble piles, cartway ramps to tailings piles, and building foundations (Figure 2; Photos 8 - 12). Among other Bluestone Wild

Forest quarries, this one stands out as unique because of its long, worked, cliff face and primarily because it is the only quarry to have extensive extraction of predominantly shale beds beneath overlying targeted sandstone beds. It provides an exceptional industrial resource and opportunity to reconstruct and interpret historic stone quarrying methods and, possibly, material usage in wagon road construction. Archaeological examination of two quarry related buildings may provide important insight into the magnitude and daily functioning of this Hemlock Quarry operation. This quarry has an 11-foot thick fine-grained sandstone caprock overlying 19+ feet of interbedded shale with thin sandstone beds. Much has yet to be learned from detailed geologic and cultural assessment of this historic quarry site. Furthermore, a portion of it directly abuts a Bluestone Wild Forest trail – thus providing an excellent, albeit undeveloped, opportunity to showcase this unique historic resource. A substantial portion of this quarry extends into the proposed 850 Route 28 industrial development site. Details and photographs are reported in a May 26, 2020 report titled: *Preliminary Cultural/Archaeologic Resource Investigation: Hemlock Quarry* (Rubin 2020b).

While this report provides additional descriptive information regarding this quarry, it is important to recognize that investigation to date has been very limited. For example, the portion of the quarry on the 850 Route 28 site has not been thoroughly investigated for interpretive working areas, physical geology, quarrying methods used, cultural artifacts, and archaeological context (see location on Figure 1). The two Hemlock Quarry building foundations on New York State land have not been excavated to determine their uses (e.g., offices, explosive storage, blacksmith shop) and relationship to Hemlock Quarry operations. Similarly, wagon road ingress and egress routes have not been identified. This superb cliff quarry requires detailed study throughout its entire length to understand and interpret its role in the early bluestone industrial network.

Construction of the 850 Route 28 manufacturing facility would irreparably compromise the integrity of Hemlock Quarry. Project plans show that blasting and site grading would occur through the southwestern end of Hemlock Quarry for construction of a large parking area and diversion and drainage swales (Figure 1). Detailed cultural resource investigation and preservation is warranted.

Proposed industrial development of the 850 Route 28 site would require removal of about half of this cliff quarry, as well as a substantial portion of the watershed tributary to Pickerel Pond (Rubin, 2020a). Adverse hydrologic and environmental impact to Pickerel Pond (Photo sets 18 and 19) should not be overlooked when assessing adverse impact to Hemlock Quarry via demolition. Preparation for proposed 850 Route 28 industrial development may require years of significant expansion of the footprint of the main 1970s quarry area, expanding it from its' present size of approximately 7 acres (depicted as grayed "1970s Quarried Area" on Figure 1) outward into the Proposed Industrial Development Area also depicted on Figure 1. In addition, the footprint of the proposed expanded quarry area would remove approximately 1,000 feet of the historic Waughkonk Wagon Road situated north and south of the 1970s Quarried Area (at least any remaining undisturbed sections). The 1970s quarried area (Figure 1) removed approximately 400 feet of the

original Waughkonk Road (described in underlined cursive writing on page 8 above), essentially leaving most of the original topography intact.

Reconstruction of Hemlock and other quarry workings is best viewed and interpreted in the context of a cohesive enterprise conducted during an important time period in our developing country. Every portion of Hemlock Quarry may contain important clues regarding both quarry-specific industrial operations and its broader relationship to the functioning industrial network. Destruction of half of Hemlock Quarry and an existing portion of the Waughkonk Wagon Road for construction of industrial buildings would require major quarry expansion via bedrock blasting, rock removal, and grading within the proposed development area over an additional area (beyond the now quarried 7-acre area) of about 20 acres – essentially a three-fold increase in mined area. Site preparation of this magnitude and duration with long operational hours should be reviewed by NYSDEC from the perspective of a mining permit.

Figure 1 in the October 6, 2020 Diamond report references items and features commonly associated with active mine sites: crusher, screener, washer, stone washing, sedimentation basins, rock processing area, blasting, excavation, and truck scale. With this base site preparation, it would not be difficult to seek a mining permit to expand existing quarrying operations outward to the south and east sometime in the future. Should this occur, it would adversely impact historic resources there. Many outstanding questions accompany the concept of photographing and removing one-half of Hemlock Quarry as a “*mitigation*” measure (Diamond, 2020). A first 27 of them follow:

- How does removal of an historic resource fit within the Regulatory Framework discussed above where the New York Archaeological Council Standards Committee (NYAC) and the New York State Historic Preservation Act (NYSHPA) seek to prevent the destruction of non-renewable cultural resources to preserve our national heritage, thereby preserving them so that they will be available for future study and analysis?
- Is it reasonable and legal to irreversibly destroy a significant portion of an historic cultural resource on private property, half of which extends into New York State land?
- Did Hemlock Quarry once extend further to the southwest prior to 1970s quarrying operations? Has a portion of it already been compromised, thereby accenting the need to preserve all that remains?
- Has a comprehensive analysis been conducted of all relict bluestone quarries within the research area of this report to document that there are others of a similar geologic and operational nature? [This study reveals that there are not.]
- Where did wagon roads enter and exit Hemlock Quarry and what major wagon road was followed to Rt. 28?
- What is the relationship between the two Hemlock Quarry foundations, the quarry operations, and extraction methods and appropriate uses on the portion slated for destruction?

- Are there telltale markings present on the quarried cliff face that provided insight into bedrock extraction methods used?

- How, for example, do the large bluestone blocks illustrated on Diamond photographs 4 and 5 relate to quarrying methods used along the Hemlock Quarry working face? Are they merely “*rubble*” or are they large rough-cut blocks staged for removal by derrick for later shaping to fit a particularly desirable marketable size range controlled by geologic structure? [The size of these blocks is substantially different from the much smaller quarry rubble found in spoil piles.]

- Is the bedrock geology similar throughout all of Hemlock Quarry or are there significant differences that dictated extraction methodology and appropriate uses (e.g., joint and bedding plane spacing, grain size, presence of sandstone interbeds in lower shaly facies)?

- Why is it that quarrying of Hemlock Quarry extended significantly downward into underlying shale beds when marketable bluestone was readily accessible at and just below the ground surface? Was it worth the huge effort to remove underlying shaly beds to, perhaps, drop overlying bluestone beds for ease of extraction and shaping? Were the shaly beds targeted for an altogether different use, perhaps for aggregate for constructing and maintaining the interconnected wagon road network?

- Were the lower Hemlock Quarry shale beds used to construct, raise, and maintain the major Waughkonk Wagon Road situated only a short distance to the northwest (400 to 500 feet)? Are there short wagon road segments present supportive of this possible interpretation?

- Are there a sufficient quantity of thin sandstone beds present in the lower portion of Hemlock Quarry to warrant massive extraction of 11 plus feet of shale? If not, could geologic assessment of basal Hemlock Quarry beds provide evidence for extraction for nearby Waughkonk Road improvement and maintenance?

- Is there evidence of shale waste disposal in nearby rubble piles?

- Are there historic archaeological artifacts present below leaf and rock/soil cover?

- What is the nature of the spoil or rubble material discarded to the southeast of the main quarry working face? How is its placement linked to cliff side quarrying operations? Was quarry rubble moved via hand carts, hoists, or other means? What is the supportive evidence?

- As research progresses relative to Hemlock Quarry and its relationship and cultural context within the broader early industrial quarrying operation that worked within Bluestone Wild Forest, will additional questions surface that can only be answered through examination of the existing Hemlock Quarry?

- How does the proposed removal of half of Hemlock Quarry correlate with the New York State Parks, Recreation, and Historic Preservation’s Office’s (OPRHP) letter of August 7, 2020 that rescinded their October 31, 2019 No Impact letter and opines:

*“ ... that the early to mid 19th century Hemlock Historic Quarry District is eligible for the National Register of Historic Places under Criteria C (Design/Construction) and D (Information Potential) for its potential to inform our understanding of historic bluestone quarrying methods and the organizational principals that characterized this industrial site. The Hemlock Historic Quarry District includes an intact quarry cliff face, workshop areas, a historic quarry road, stone walls and building foundations.”*

- Owner willing, could preservation of this valuable industrial resource someday be enhanced with an interpretive historic spur trail with signage set back from the worked cliff face (Photo set 9, right photo)?



*Diamond (2020) photographs of Hemlock Quarry cliff and foreground area. Left: view looking north-northeast. Right: view looking south-southwest.*

Clearly, the answers to these and other questions must be considered in an area wide comprehensive manner. Knowledge of the physical relationship of this quarry relative to other wagon road and quarry network features may provide important factors needed to fully understand Hemlock Quarry activity. Destruction and removal of half of this historic resource may needlessly compromise important cultural and industrial interpretations.

The largely undisturbed nature of Hemlock Quarry and working area provide an outstanding opportunity for geologists and cultural archaeologists to study and interpret historic quarrying methods and the historic quarry’s functioning infrastructure. In essence, Hemlock Quarry reflects a time capsule of early industrial quarrying methods.

## Hidden Quarry

This impressive cliff quarry contains some of the largest and thickest bluestone slabs that were either discarded or, more likely, not yet shaped (Figure 2; Photos 36 - 38). The main worked quarry face trends N27°E with a maximum exposed quarry height of 18 feet. The spacing between vertical joints in this quarry ranges from 6.0 feet to 15 feet. The measured spacing between horizontal bedding planes here ranges from 0.40 feet to 2.05 feet. Old newspaper accounts address some massive bluestone blocks moved to market (Evers, 1987). This quarry may be the source of such slabs that quarry workers referred to as platforms or big stones.

## Oak Quarry

Oak Quarry is positioned nearly along a northern border of the proposed 850 Route 28 development site (Figure 2). Its low cliff quarry face was worked in a westerly direction (Photos 6 and 7). East of the worked face there is a narrow landing situated immediately adjacent to a steep and expansive rubble pile. Horse drawn wagons almost certainly traversed in one direction, picking up bluestone slabs, prior to continuing around a loop that must extend southwesterly into and through the 850 Route 28 site to join a wagon road that passes close to a stone house as labeled on the 1875 Beers Atlas map (Figure 2) and discussed below. A quarried area is visible a short distance south of the 850 Route 28 property line near this quarry.

Oak Quarry is cliff face quarry exploited for dimension stone along its 950-foot length. It is characterized by an average of 10 feet of friable or crumbly shale overburden (i.e., stripping rock) overlying 7+ feet of bedded sandstone. Eighty measurements of joint (i.e., fracture) orientations at and near this quarry revealed the presence of two prominent joint orientations along bedrock exposures, as depicted on the Rose diagram elsewhere within this report. The longer spokes represent greater fracture frequency and prominence. While a number of joint orientations are present, the two most dominant joint orientations are north-northeast (~N22°E) to south-southwest and east-southeast to west-northwest (~N82°W). These vertical joint planes were advantageously used by quarry workers, thereby requiring less drilling and blasting. The nearly right-angled intersection of joints provided a natural terminus to cut flagstones. The photograph to the right shows this nearly right-angled joint intersection of sandstone that quarry workers exposed by removing overlying shaly beds. This is an excellent example of the quarrying process in-situ.



The 1903 New York State Museum Bulletin 61 – Quarries of Bluestone and Other Sandstones in the Upper Devonian of New York State by Harold T. Dickinson describes eleven quarries in the West Hurley/Stony Hollow area. The geologic features of two of them may match the quarry labeled Oak Quarry on Figure 2. Further historic investigation may verify this correlation.

## **Pine Quarry**

This quarry provides one of the very best examples of a widened trench quarry (Figure 2; Photos 52 and 53). Significantly, worked bluestone faces are well exposed in this quarry. It is 131 feet long, has a maximum width of 28 feet, and a maximum quarry face height of 4.5 feet. The orientations of 18 worked joint faces were measured. Seventy-eight percent (14) of them aligned with the north-northeast to south-southwest range of joints depicted on the Rose diagram, with 22 percent (4) trending east to west. Industrial bluestone extraction exploited the dominant joint trend present with slab width being controlled by the spacing of east-west oriented joints.

## **Other Features Connected by Wagon Roads**

Not only did wagon roads connect quarries, but they also connected quarry buildings, perhaps a stagecoach stop along the old Waughkonk Wagon Road (Photo 15), stone-walled pastures, a beautiful bluestone house, and a railroad station. In places, vestiges of quarrying operations provide glimpses into day to day operations.

## **Relict Quarry Related Artifacts**



Artifacts found within this historic quarry area include wagon roads, quarries, vast rubble piles, building foundations (Photos 15, 32, 57, and 58), laid stone pillars (Photos 21 and 22), cut dimension stones (Photos 55 and 56), wagon wheel parts, and a 46-inch long, flat-bladed, pry bar used to split bluestone along bedding plane partings (see photo above). The right-most photograph below shows a wagon wheel hub and hub bands that were found along the access ramp to Hidden Quarry. Their presence suggests that someone overloaded a wagon, leading to wheel failure.



*Laid stone pillar alongside a water-filled pit quarry*



*Cut dimension stone.*



*Wagon wheel parts discarded near quarry.*

In addition, this road network linked stone wall enclosed pastures (Photos 1-5), an early 1800s bluestone house, and an historic railway station. Clearly, wagon roads and quarries extend throughout the proposed development site and beyond, requiring broad oversight by a quarry master, landowner, or lessee quarryman who paid quarry rent based on the amount of marketable bluestone that was taken.



*Laid stone foundation near historic quarry.*

### **Stone House on Waughkonk Road**

A beautiful bluestone house is present along Waughkonk Road (Figures 2 and 3). This house may have served as a headquarters for the entire network of quarry operations depicted on Figure 2. Perhaps a quarry owner, engineer, or other quarry-related person rented or owned this house. Figure 2 shows that it is located directly along a major wagon road and in close association with quarries and stone-walled pastures. It is centrally located and well interconnected by wagon roads to quarries north, northwest, and northeast of the homestead. For example, bluestone from all Oak and northern Pickerel Pond area quarries had to directly pass by this house. Furthermore, the proximity to pastures with wagon road ingress and egress into and through them strongly supports

contemporaneous use from a nearby location. It is likely that this homestead served as a base from which to oversee and inspect multiple active quarry operations with hundreds of quarry workers.

The house dates back to at least 1845 and is likely constructed of bluestone from local quarries. This house location, or at least one very close to it, appears on the 1875 Beers Atlas map with a label of “*P. Fitch*” with a parcel listing date of 1800. It is likely that P. Fitch was related to Simeon and W.B. Fitch of the Fitch Brothers Bluestone Company that opened business in 1839 and continued beyond 1880 (the copyright date of the History of Ulster County by Nathaniel Bartlett Sylvester). The Fitch Brothers were recognized and prosperous stone dealers who likely controlled, leased, and possibly owned many of the Bluestone Wild Forest quarries. Sylvester (1880) addresses the Fitch bluestone business: “*The quarries from which the main supplies of stone are drawn are located in the towns of Hurley, Marbletown, and Woodstock, at distances of from eight to twelve miles from the yard. Fifteen hundred men and 100 teams are employed in getting the stone out and in transporting it from the quarries to the wharf.*” Additional research is required to verify, or not, whether the Fitch Brothers had business interests in Bluestone Wild Forest quarry operations.



*Google Earth photograph of house at or near the location portrayed on the 1875 Beers Atlas map of the area.*

## **Pastures and Agriculture**

Four pasture areas have been mapped in the southeastern portion of the research area (Figure 2), totaling approximately 5.8 acres in areal extent. Their elevational range is from 498 ft msl to 562 ft msl. They have been extensively cleared of stones that now comprise surrounding stone walls

(Photos 1 and 2) which, where intact, range up to about 4.2 feet in height (Photo 4). What may have been additional pastures are present on private lands adjacent to Waughkonk Road. An old wagon road extends through a stone wall there, trending southwest directly toward a bluestone house identified by a yellow star on Figure 2.

The wall enclosed pastures had a number of possible uses, including grazing for sheep or young dairy or beef cattle, possibly overnight grazing of quarry horses, or cultivation of small grains or hay. A moderate 3.5-foot stone wall height (Photo 5) is marginal for containment of active horses, other than draft horses (Vinyard, pers. comm.). While the soil mantle present within the stone walls is likely thin and of poor quality, it is possible that grain crops were cultivated within them, although constructed enclosed stone walls are not required for this purpose. The pastures lack any water for animal use. The nearest permanent water source is located some 520 feet (as the crow flies) southeast of what appears to be a designed gap between stone wall segments in the easternmost pasture. Water is found in a glacial kettle pond (Figure 2) about 86 feet down a rounded, but steep, slope that has no walls to potentially contain livestock. Perhaps wire fencing was once present for this purpose or perhaps dogs herded animals.

There are constructed openings in the pasture walls that allowed passage of horse drawn wagons. They are aligned with relict wagon roads, **thus documenting and correlating concurrent pasture and/or farming use and bluestone quarry industry use.** No evidence of wooden gates remains. Additional support indicating association between farmed pasturelands and quarries to the east that connect via wagon road to Moray Hill Road is found in the dashed wagon road that must have connected pastures to eastern quarry works (Figure 2). One reasonable interpretation for the presence of this linking wagon road holds that a quarry master living in the stone house used this shortcut route to first check on his fields and then oversee eastern quarry operations.

It is highly likely that agricultural activities once associated with these pastures relate to the nearby stone house that dates back to at least 1845. Pastures, especially those without a water source, were and are generally located reasonably close to barns (Vinyard, pers. comm.). The distance from the four pastures to the stone house on Waughkonk Road is roughly 1,500 feet by wagon road. It is likely that some of the pastures were used for sheep grazing and others for crop production. In places, the outer portions of the original stone walls are draped with large accumulations of smaller stones suggesting repeated field clearing and cultivation (Photo 3).

Clearly, pastures, pasture wall openings, and interconnected quarry roads indicate contemporaneous usage, quite likely under the guidance and control of a single person, family, or firm. The fact that many of the quarry and pasture roads flow directly by a single historic stone house on Waughkonk Road strongly suggests that this house was likely central to much or all of these activities.

## **Stony Hollow Railroad Station and Building Complex**



A large foundation area and associated stone wall were found after following a deeply rutted wagon road south of Route 28 and Pine Quarry (Figure 2). Research established that this and a related building complex were the remains of the long defunct Stony Hollow Railroad Station (Photos 57 and 58). The original name of the railroad that traversed from Kingston to Pine Hill was the Rondout & Oswego Railroad. This was renamed the New York, Kingston, and Syracuse Railroad, followed by Ulster & Delaware Railroad in 1875 (Evers, 1972; Rowe, 1999).

The Stony Hollow Railroad Station opened in 1868 and closed in the 1920s. Based on “STAPLES” labeled bricks present within one of the foundation areas, the original station was added to sometime after 1905 when Alvah Sherwood Staples began manufacturing bricks along the Hudson River at Malden. Bricks at this location document a third location where these bricks have been found, along with Pelham Manor and Rosendale.



An approximately 420-foot long, 5-foot high, stone wall with a 10 to 11-foot wide flat landing area is present immediately west of the railroad station foundation (Photo 54). This wall may have served a number of purposes, possibly as a railway station waiting area, as an area to hitch horses, or for something else.

### **Cut Flagstone Area at Stony Hollow Railroad Station**

A small area of nicely cut flagstone blocks is present immediately southeast of the Stony Hollow Railroad Station (beneath the star of photo location 33 on Figure 3; Photo 55). These flagstones may have been extracted from either Pine Quarry or smaller quarries directly north of Pine Quarry. At least eight cut flagstones are present. They measure 2.9 ft x 3.3 ft x 1.5 ft; 6.0 ft x 3.75 ft x 0.75± ft; 3.1 ft x 2.4 ft x 0.95 ft; 2.4 ft x 1.85 ft x 0.85 ft; 2.8 ft x 2.6 ft x 1.0 ft; 2.5 ft x 4.45 ft x 0.97 ft; 2.3 ft x 2.2 ft x 0.9+ ft; and 2.7 ft x 2.2 ft x 1.8 ft. The spacing and depth of drill holes used to shape these blocks provides insight into the technology used (Photo 56). Drill hole depths range from 0.23 to 0.46 feet in depth, averaging 0.31 feet. The spacing between drill holes ranges from 0.57 feet to 1.55 feet. Hole diameters are ¾ inch in width.

This block area provides excellent examples of local flagstone products transported to the Wilbur docks, all in one nice little area. A few smaller and thinner cut blocks here and there scattered throughout the Bluestone Wild Forest, but this accumulation is noteworthy. Drill holes present along some block faces attest to part of the block shaping process. The presence of these heavy flagstones here raises questions. These include: Why were they left there? Were they discarded there due to flaws or are they simply rough cut and staged there in preparation for additional shaping by stonecutters and dressers at the Wilbur docks? Does their presence at the Stony Hollow Railroad Station imply that at some point in time after 1868 flagstones were transported via rail to Wilbur (vs. on the old Plank Road composed of planks and later stone trams; Rowe, 1999), being a cheaper alternative to wagons and teamsters? Use of the railway to transport flagstones to market once it was available seems highly likely. The presence of these large blocks there, with no nearby bluestone quarry, provides evidence for this. Rowe (1999) states that bluestone made up a large percentage of the outgoing freight from the nearby West Hurley Railroad Station. He also provides old newspaper accounts that document teamsters taking loads of stone to the Wilbur loading docks into 1905. It appears that both modes of stone delivery were utilized.

Care must be taken when examining “rubble” associated with relict quarry operations. While bedrock blocks do sometimes fall from cliff faces due to freeze-thaw mechanisms, quarry operators sometimes stage large bluestone blocks for hoisting, processing, and transport to market. Staged bluestone may be discerned from natural rockfall by such features as clusters of large flagstone blocks set back from cliff faces, shaped blocks, and drill holes on one or more faces. While investigation is warranted, staged flagstone blocks of this nature may be present southeast of the Hemlock Quarry cliff face. Interpretation of features such as these provide important operational information needed when seeking to reconstruct quarrying methods used.

Comparison of the flagstone block size dimensions described above with those illustrated in Diamond (2020) Hemlock Quarry photographs 4 and 5 (depicted below) suggests that some may not be “*large stone rubble at base of cliff*”, but rather rough-cut flagstones being staged for additional shaping and transport. It is likely that Stony Hollow Railroad Station flagstone blocks and some of the Hemlock Quarry blocks were staged prior to transport. The position of the Hemlock Quarry blocks directly in front of a working cliff face and their large size compared to much smaller disposed rubble may represent a snapshot of former quarry operations. Further examination of the assorted blocks present, context interpretation, and preservation are warranted vs. demolition for modern industrial buildings.



*Diamond (2020) photographs of large bluestone blocks at base of Hemlock Quarry cliff. Right photograph enlarged. These blocks may have been staged for shaping and transport as part of active quarry operations.*

## Conclusion

This report documents integral links between quarrying, wagon roads, agriculture, and an historic railway station. It documents that historic quarries and wagon roads both surround and extend through the proposed 850 Route 28 industrial site and establishes the importance of protecting and preserving historic and unique resources present. The sophisticated wagon roadways and, in places, massively engineered roadbeds document a networked quarry operation requiring broad oversight. Research may document that the quarry masters carry the Fitch or other prominent quarry owner name.

Bluestone Wild Forest historic findings include dozens of quarries and, importantly, an incredibly well preserved and likely unique wagon road network nestled within an upturned Tennessee-shaped 2,000-acre area bounded by the following present-day roads: Moray Hill, Sawkill, Zena, Rt. 28, Beesmer, and Rt. 28A. This research area is best viewed in the context of an integrated district that encompassed an interconnected wagon road and quarry network, agricultural/farming activities, and a railway station that likely was used for flagstone transport in the late 1800s. A proposed industrial site is centrally situated within this complex. While a portion of the original Waughkonk Wagon Road was mined away in the 1970s, the 850 Route 28 site area still hosts a significant portion of this wagon road, as well as at least two other wagon roads and assorted historic quarries. These features should be retained intact within their full cultural, industrial, and historic context. Overall, the proposed industrial site location is analogous to the hub of a wagon wheel, with essential spokes (aka wagon roads) emanating outward to quarries, pastures probably grazed by sheep, to a key “lost” railway station, and to an 1800’s bluestone house that may have served as a headquarters building for area quarry operations. Together, these geologic and historic cultural features, all present within a geographically small area, may be used to define and interpret the day to day workings of an early industrial era quarry operation not fully chronicled elsewhere. The grand, largely intact, historic picture presented by these interrelated cultural and landscape features sheds new light on the complexities and operational nature of the bluestone industry. These features should be preserved, fully intact, for future study, interpretation, education, and historic recognition.

A key finding stemming from the work conducted to date is the recognition that interpretation of the full historic context of this archaeological network requires detailed examination, analysis, and interpretation of all of the parts (e.g., variable geology in quarries, comparison of quarry workings, interrelationship of wagon roads and quarries, historic buildings, pasture lands).

This report should be viewed as just the beginning of a new chapter in an American history book that seeks to unravel geoarchaeological facets of the bluestone industry. Much has yet to be added.

### **Nomination Potential for State and National Registers of Historic Places**

Much of the research area examined and discussed in this report and a previous Hemlock Quarry report (Rubin, 2020b) meets the procedural and professional criteria for evaluation set forth for nomination on the National Register of Historic Places. Specifically, OPRHP (2020) recognizes the Hemlock Historic Quarry District as being “... *eligible for the National Register of Historic Places under Criteria C (Design/Construction) and Criteria D (Information Potential) for its potential to inform our understanding of historic bluestone quarrying methods and the organizational principals that characterized this industrial site.*” At a minimum, additional findings shared in this report provide justification for delineating the Hemlock Historic Quarry District to include that area encompassed within the 1,000 acres of New York State and Town of Woodstock protected land portrayed on HydroQuest Figure 1 in a yellow-green hue. In keeping with National Register of Historic Places categories of historic properties, this “...*district possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.*” These 1,000 acres of protected lands may also be eligible for the National Register of Historic Places under Criterion A because the site area (i.e., historic landscape) is associated with events that made a significant contribution to the broad patterns of the early industrial history of the United States (e.g., growth of the bluestone industry gave rise to prominence of Ulster County shipping ports and development of a maritime economy). Important benefits stemming from potential designation on State and National Registers of Historic Places include heritage tourism and recreational enhancement, historic preservation, fostering pride in community history, fostering awareness of historic properties, and providing historic material that can be incorporated into school curricula.



## **Anecdote: Study Background – Recognition of Geologic and Historic Resources in Bluestone Wild Forest – The Importance of Interpretation Based on Comprehensive Study**

Let it suffice to note that this research started with the field examination of long linear features that appear on satellite imagery. Despite great effort to verify that these features were major faults, field assessment and analysis of LiDAR derived elevation contours revealed that they were actually long, bedrock-walled, channels that once surged with glacial meltwater (shown on Figure 4). Upon reaching the southern end of one of these glacially scoured channels a round mound capped with large boulders presented itself (photo below). Indeed, this was not a burial mound. More and more treks throughout the area revealed a glacial landscape rich in rugged knolls of jumbled boulders, kettle holes, and arcuate boulder-draped moraine ridges - a geologist's dream landscape. Before long, it became obvious that early quarry workers toiled in numerous bluestone quarries throughout the forest. Huge rubble piles and scattered stone foundations whispered of bygone glory days and the thundering of heavily-laden horse drawn wagons. It followed that removal of large quarried stone blocks required serious roadways for transport. Suddenly, with newly opened eyes, traces of relict wagon roads appeared – mile after mile each one was mapped and plotted. There are more. Hemlock Quarry was one of the first quarries found. As it turns out, it is one of few large quarries to have associated foundations waiting for detailed archaeological study and interpretation. Continued wagon road and quarry mapping on long forest treks unexpectedly found stone walled pasture lands, a long-lost railway station, and a beautiful bluestone house situated near the epicenter of the wagon road network. As this grand historic picture broadened it became clear that the full context of the cultural resource must be viewed and preserved not solely on the basis of single quarries (e.g., Hemlock Quarry), but instead as one cohesive integrated network that with continued study will fill a chapter on the early bluestone industry of the United States.

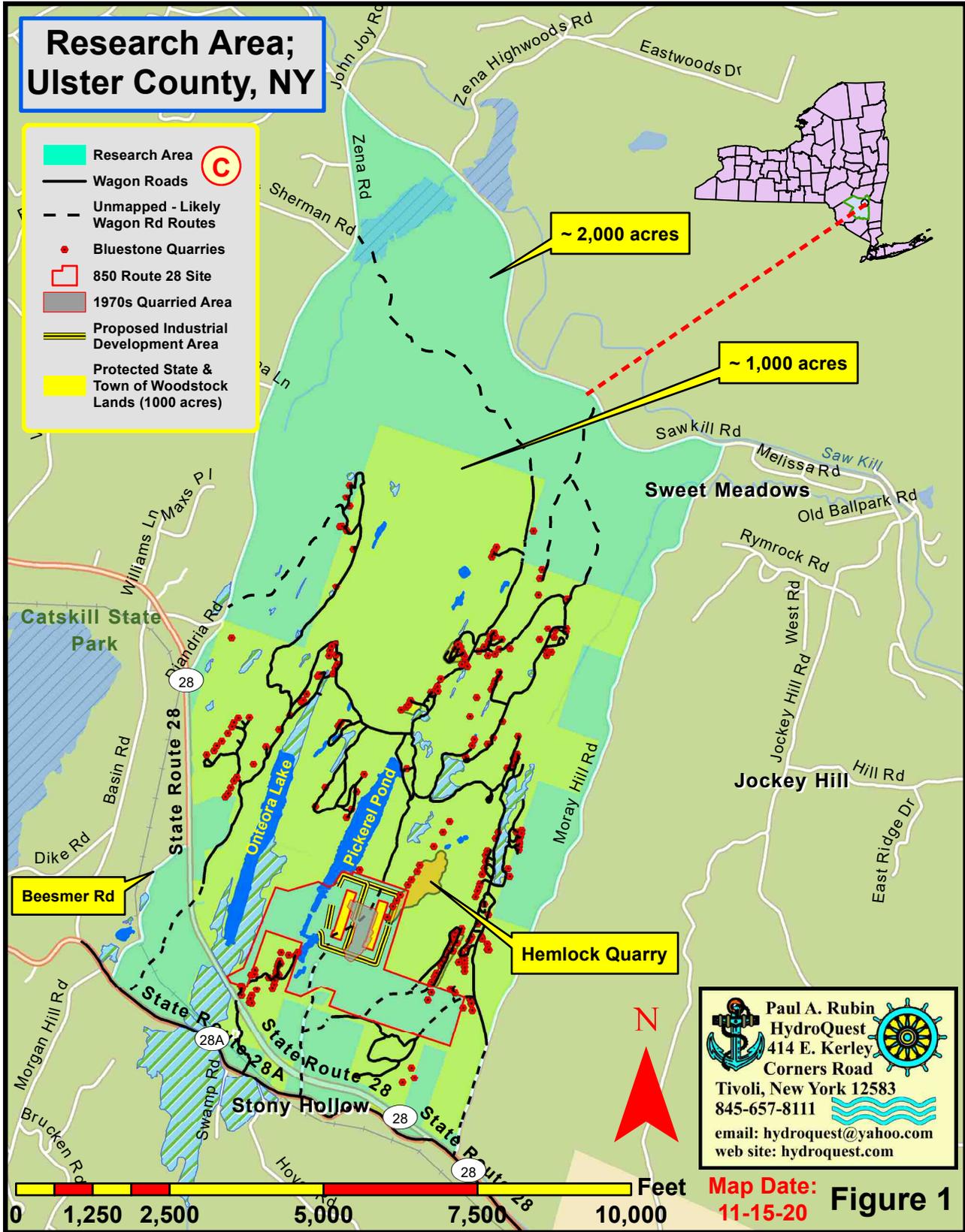


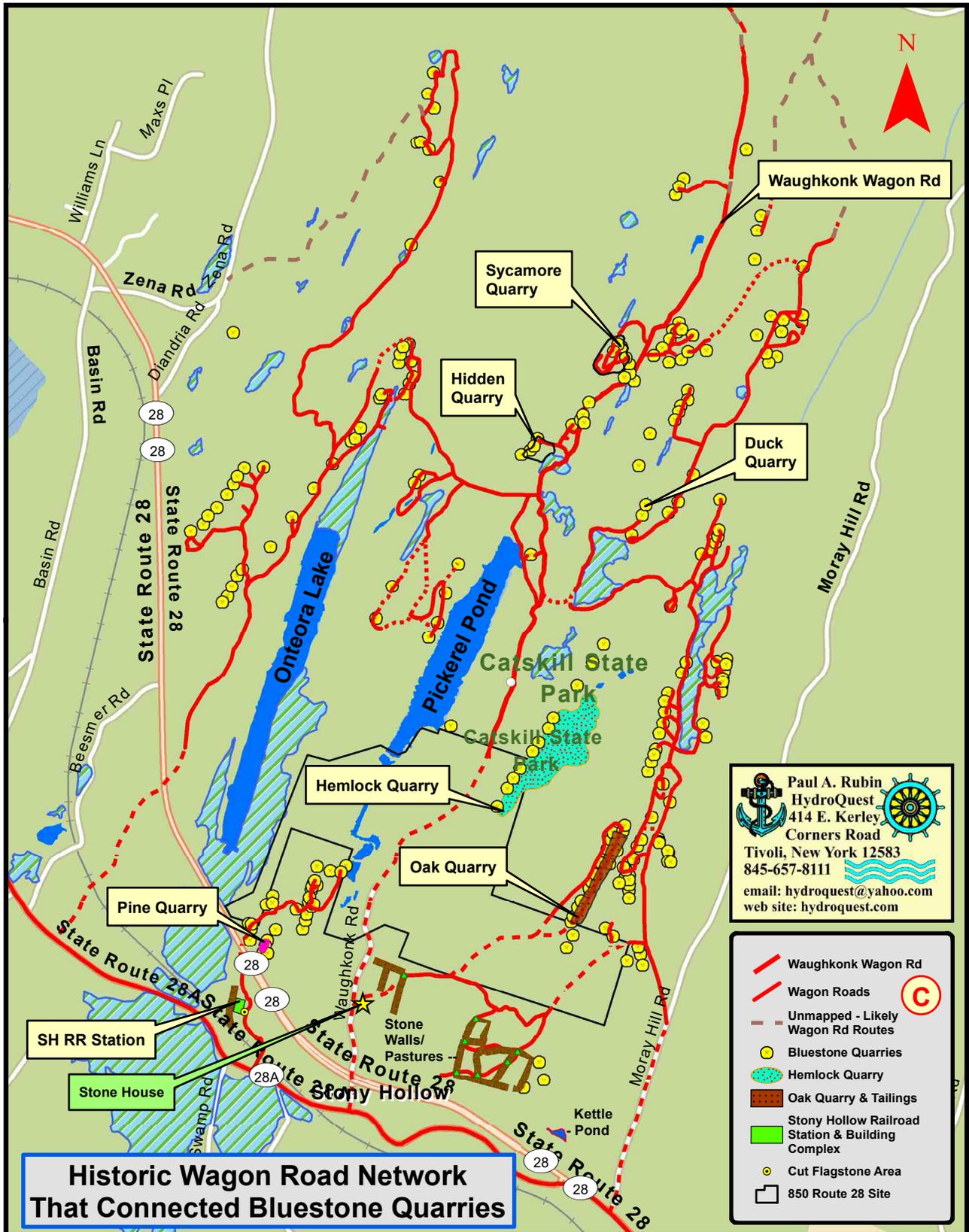
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# Research Area; Ulster County, NY

- Research Area C
- Wagon Roads
- Unmapped - Likely Wagon Rd Routes
- Bluestone Quarries
- 850 Route 28 Site
- 1970s Quarried Area
- Proposed Industrial Development Area
- Protected State & Town of Woodstock Lands (1000 acres)

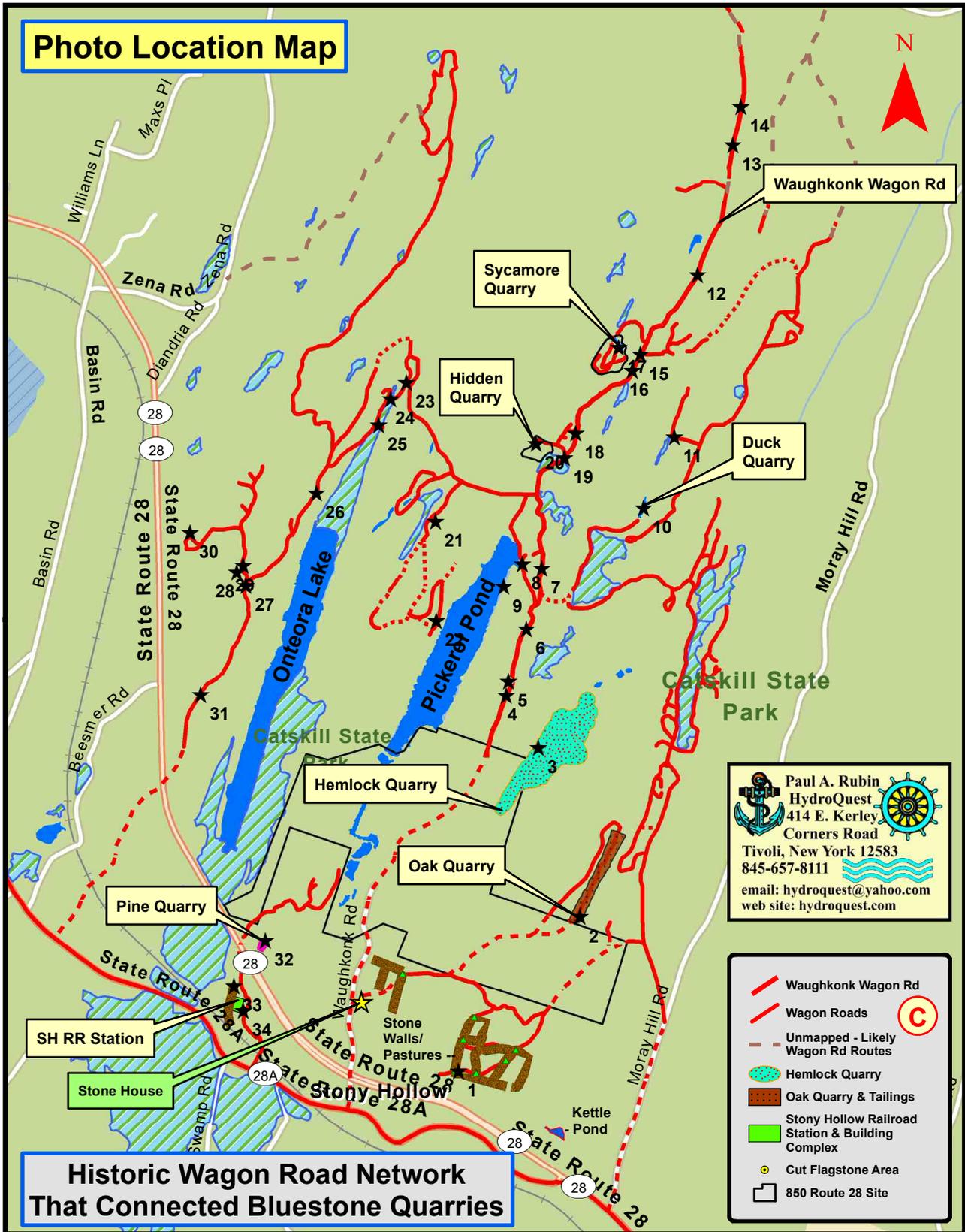




Map Date: Nov. 20, 2020 Feet

0 750 1,500 3,000 4,500 6,000 **Figure 2**

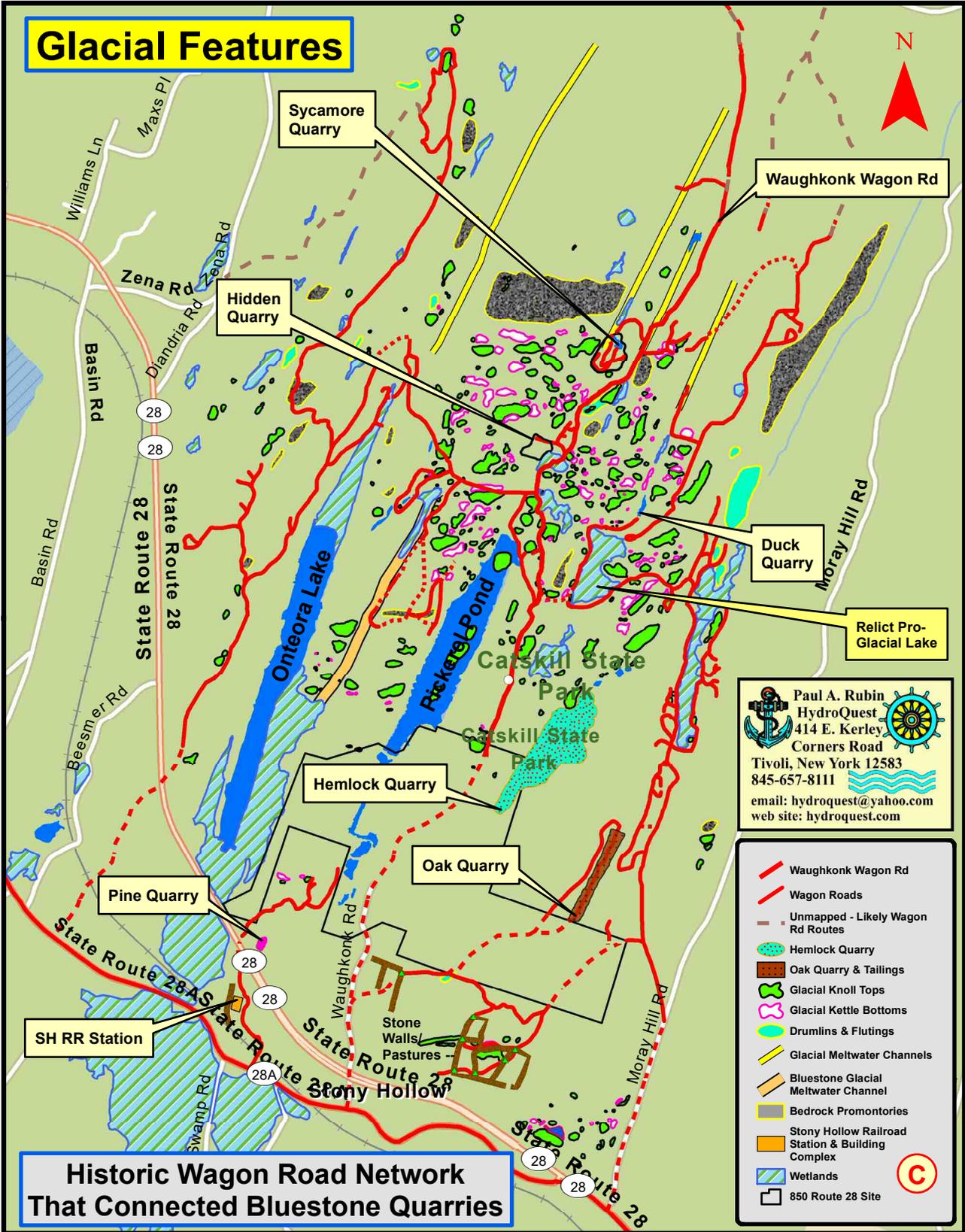
# Photo Location Map



## Historic Wagon Road Network That Connected Bluestone Quarries

**Figure 3**

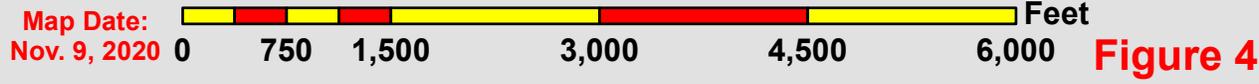
# Glacial Features




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-  Waughkonk Wagon Rd
-  Wagon Roads
-  Unmapped - Likely Wagon Rd Routes
-  Hemlock Quarry
-  Oak Quarry & Tailings
-  Glacial Knoll Tops
-  Glacial Kettle Bottoms
-  Drumlins & Flutings
-  Glacial Meltwater Channels
-  Bluestone Glacial Meltwater Channel
-  Bedrock Promontories
-  Stony Hollow Railroad Station & Building Complex
-  Wetlands
-  850 Route 28 Site

## Historic Wagon Road Network That Connected Bluestone Quarries





Location 1. Photo 1. Stone wall around pasture.



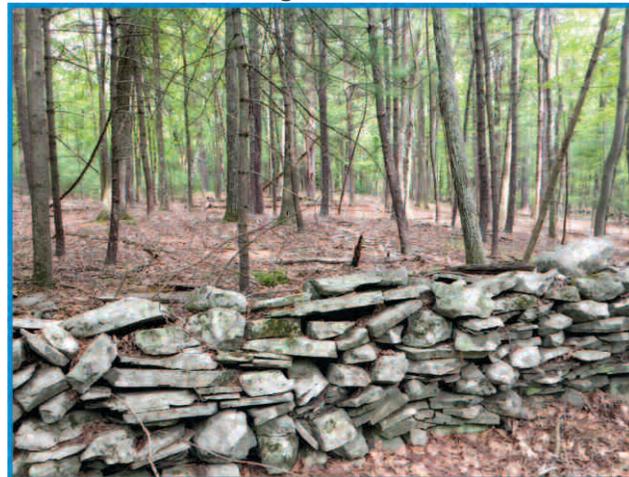
Location 1. Photo 2. Wagon road entryway into relict pasture.



Loc. 1. Photo 3. Small stones draped over stone wall from field clearing.



Loc. 1. Photo 4. Pasture wall and 7.5-inch high field notebook.



Location 1. Photo 5. Pasture wall and relict pasture.



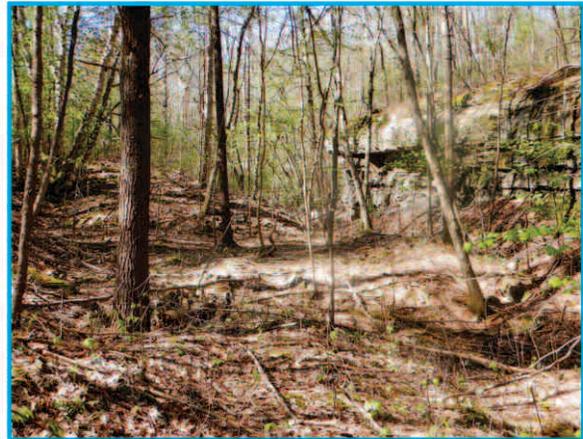
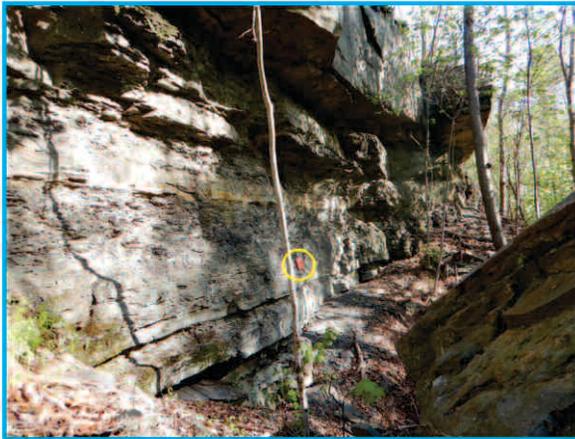
Loc. 2. Photo 6. Oak Quarry. Shale top beds over thick-bedded bluestone.



**Loc. 2. Photo 7. Oak Quarry: Shale "top" rock overlying partially exposed thick bedded bluestone.**



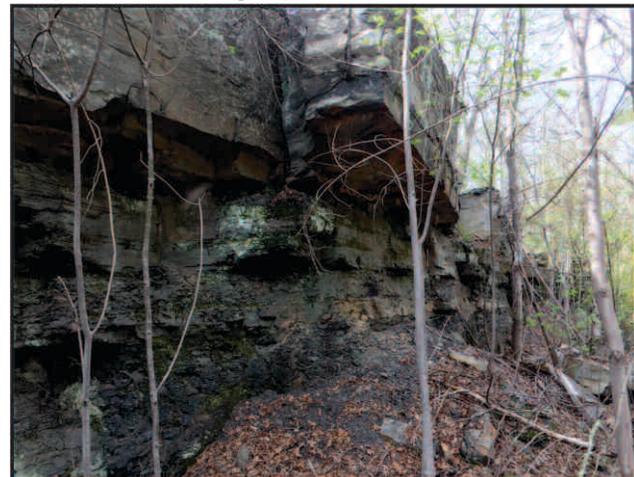
**Loc. 3. Photo 8. Hemlock Quarry: Thick bedded sandstone overlying fissile shale beds.**



**Location 3. Photo set 9. Hemlock Quarry: Thick bedded sandstone top beds overlying shale beds with thin interbedded sandstone beds. Rubble pile to left in right photo.**



**Location 3. Photo 10. Hemlock Quarry: Note massive fallen top sandstone block to left.**



**Loc. 3. Photo 11. Hemlock Quarry: Workers removed basal shaly beds to exploit overlying bluestone.**



**Location 3. Photo set 12. Cartway extending outward from Hemlock Quarry used to dump quarry rubble. Massive rubble piles are associated with quarries. Some extend directly into wetlands.**



**Location 4. Photo 13. Wagon ruts in bedrock along Waughkonk Wagon Road near old foundation.**



**Location 4. Photo 14. Stone wall alongside Waughkonk Wagon Road.**



**Loc. 5. Photo 15. Beekman foundation: possible old stagecoach stop along Waughkonk Wagon Rd.**



**Loc. 6. Photo 16. Wagon worn ruts in bedrock along Waughkonk Wagon Road.**



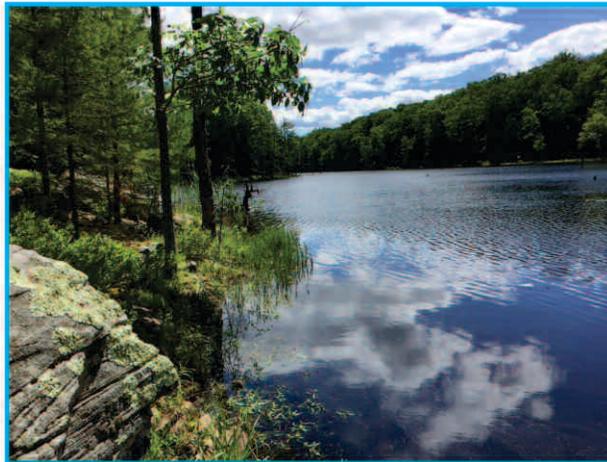
Location 7. Photo 17. Waughkonk Wagon Road.



Location 8 area. Northern Pickerel Pond.



Location 8. Photo set 18. Left: North end of Pickerel Pond. Right: Trace of old wagon road alongside Pickerel Pond.



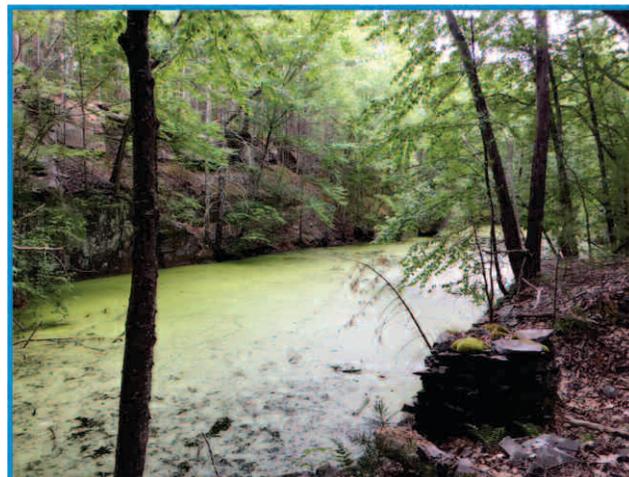
Location 9. Photo set 19. Northern end of Pickerel Pond. Left: Pondsideside boulder. Right: Boulder cluster that is part of a prominent glacial push moraine near a relict wagon road.



Location 10. Photo 20. Duck Quarry: Note sandstone beds proximal to ground surface.



Location 10. Photo 21. Duck Quarry: Its flooded nature attracts ducks and other wildlife.



Loc. 10. Photo 22. Duck Quarry: During operation, this pit quarry required dewatering efforts.



Loc. 11. Photo 23. Short wagon road spur from several small nearby cliff quarries.



Location 12. Photo 24. Relict Waughkonk Wagon Road winding through Bluestone Wild Forest.



Loc. 13. Photo 25. Parallel wagon ruts grooved bedrock to 1.2 feet in depth.



Loc. 14. Photo 26. Northern Waughkonk Wagon Road worn down to underlying bedrock.



Loc. 15. Photo 27. Waughkonk Wagon Road.



Location 16. Photo 28. Waughkonk Wagon Road.

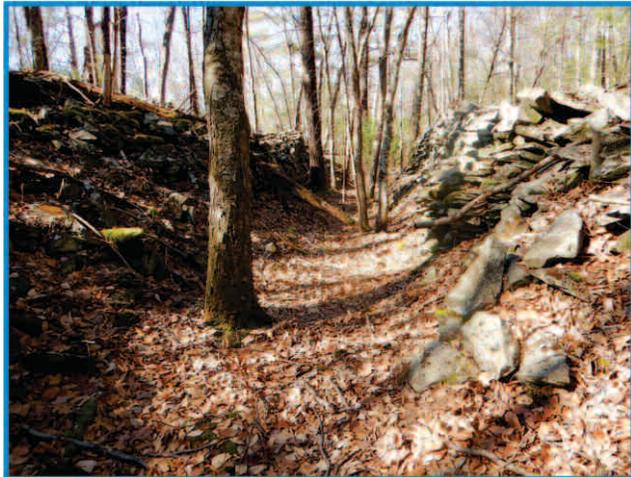


Loc. 17. Photo 29. Sycamore Quarry: This pit quarry required dewatering during operation.

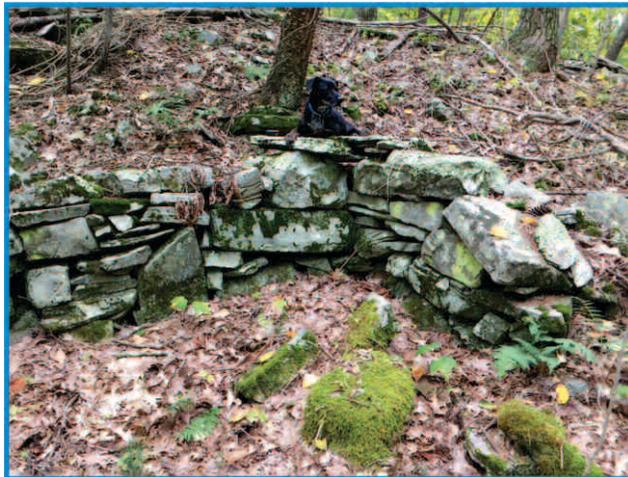


Location 17. Photo set 30. Sycamore Quarry: Massive piles of sandstone rubble abut this and nearby trench quarries.





Loc. 17. Photo 31. Sycamore Quarry: Wagon route between rubble piles and constructed stone wall.



Loc. 18. Photo 32. Relict foundation some 300 feet north of location 18 quarries.



Loc. 18. Photo 33. Quarry and nearby rubble pile. Waughkonk Wagon Road on photo left.



Loc. 18. Photo 34. Shale top rock was removed to access underlying bluestone.



Loc. 19. Photo 35. Waughkonk Wagon Road winding through Bluestone Wild Forest.



Loc. 20. Photo 36. Hidden Quarry: Main quarry area. Smaller secondary quarries are nearby.



Loc. 20. Photo 37. Hidden Quarry: Note thick bedding and wide vertical joint spacing.



Loc. 20. Photo 38. Hidden Quarry: Thick-bedded blocks suggest massive slabs came from this quarry.



Loc. 21. Photo 39. Large boulders excavated from glacial knolls were exploited for bluestone.



Loc. 22. Photo 40. Cliff quarry face and boulders dropped from stagnant melting glacier ice.



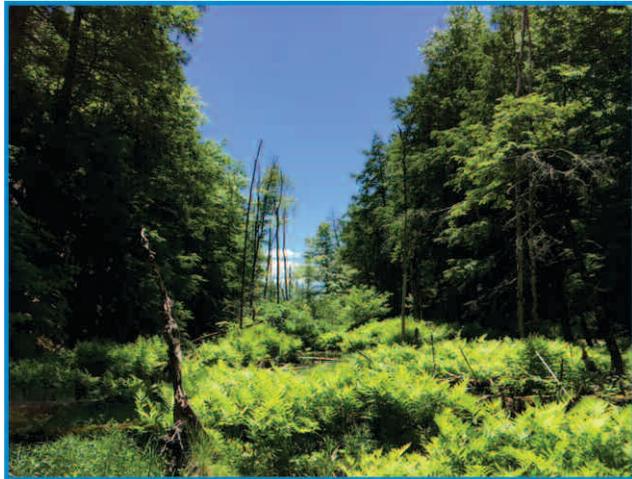
Loc. 22. Photo 41. Cliff quarry with worked faces. Sandstone present at ground surface.



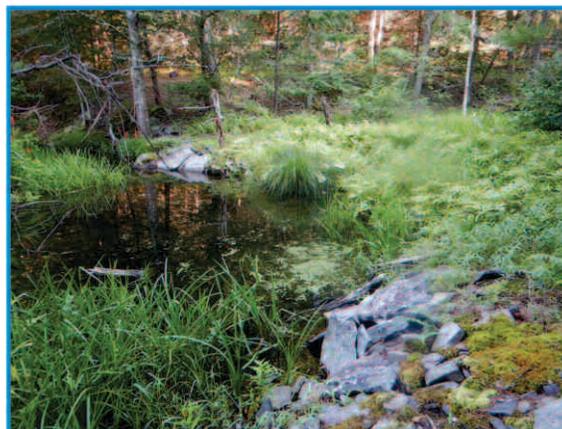
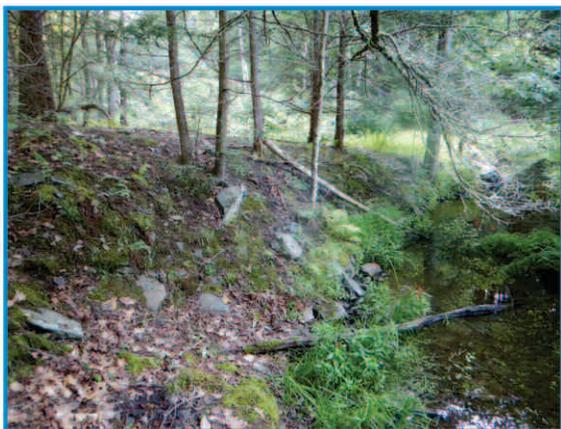
Loc. 23. Photo 42. Cliff quarry along forest trail. Sandstone present at ground surface.



Loc. 23. Photo 43. Wagon road beneath bluestone cliff engineered from quarry rubble.



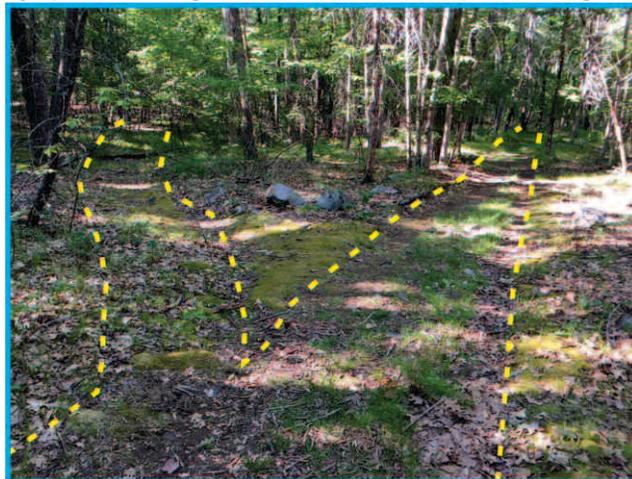
Loc. 24. Photo 44. Northern wetland end of Onteora Lake where a wagon road probably crossed to Loc. 23.



Loc. 25. Photo set 45. Near northern end of Onteora Lake where a well-engineered ramp leads nowhere. Left: Western end connects to wagon road and nearby quarries. Right: Low wetland ramp crossing.



Loc. 26. Photo 46. Wagon road north-northwest of Onteora Lake traverses between sentinel boulders.



Loc. 27. Photo 47. Wagon road spur to Location 30 quarry. Junction angle denotes wagon flow direction.



Location 28. Photo 48. Bluestone cliff quarry.



Location 30. Photo 50. Wagon road ramps uphill alongside a cliff.



Location 29. Photo 49. Wagon road ramps uphill alongside a cliff to access quarry area at Location 30.



Location 31. Photo 51. Bluestone pavement with glacial striations and ruts worn by wagon wheels.



Location 32. Photo 52. Pine Quarry: An excellent example of a broad trench quarry.



Loc. 32. Photo 53. Pine Quarry: Worked bluestone faces exposed during quarry operations.



Loc. 33. Photo 54. Stone wall and flat foreground at long abandoned Stony Hollow Railroad Station.



Loc. 34. Photo 55. Worked and flawed bluestone slabs discarded prior to loading at Railroad Station.



Loc. 34. Photo 56. Worked bluestone slab at abandoned Stony Hollow Railroad Station.



Loc. 34. Photo 57. Large foundation hole at abandoned Stony Hollow Railroad Station.



Loc. 34. Photo 58. Stone wall remnant at abandoned Stony Hollow Railroad Station.



**Historic Wagon Roads in Bluestone Wild Forest:** Historic bluestone quarries in Bluestone Wild Forest, dating back to about 190 years, were integrated via a tributary wagon road network. Until recently, 19<sup>th</sup> century bluestone quarries were viewed in isolation within the forest. However, all quarries were connected along a road network on which heavily laden horse drawn wagons transported stone to docks in Wilbur. The attached GIS map depicts reconstruction of this relict wagon road network, over 18 miles to date. Reconnaissance, field mapping, and topographic analysis were used to identify roads and numerous quarries. Metal rimmed wagon wheels wore grooves in roads still visible today, some deeply cut into bedrock (to 1.2 feet). At least three of these old wagon roads project into the proposed 850 Route 28 development property. Many of these old wagon roads have become trails used today.



*Deep wagon wheel ruts in bedrock.*

**Quarry Types:** Geologic assessment of quarries in Bluestone Wild Forest reveals four distinct types ranging from most to least productive. Foremost are long cliff quarries ranging from those with sandstone from the ground surface downward to those with a thick crumbly shale overburden “top” requiring removal prior to reaching marketable underlying sandstone beds. Two of the very best examples of no overburden vs. shale overburden are found in the Hemlock (left photo below) and Oak (middle photo) cliff quarries, respectively. Sandstone was also exploited from open pit quarries, long and short trenches (right photo), and from boulders either excavated from within glacial deposits or found loose on the ground surface. Numerous small excavations might be termed “wildcat quarries” as they were exploratory in nature and are generally located close to wagon roads. Most expansive quarries are preferentially oriented along prominent fracture directions.

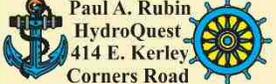


**Wagon Road Engineering:** Quarry workers went to great effort to engineer roadbeds suitable for heavy wagon traffic. A discerning eye will notice short and long road sections filled, graded, or entirely constructed with quarry rubble (to 250<sup>+</sup> feet), ramps crossing low wetlands and grading to quarry exposures (right), notched hillslopes, and loops constructed to connect quarries and direct wagon flow.



*Laid stone pillar alongside a water-filled pit quarry*

**Relict Artifacts:** Artifacts found within this historic quarry district include wagon roads, quarries, vast rubble piles, building foundations, laid stone pillars, cut dimension stones, wagon wheel parts, and a 46-inch long, flat-bladed, pry bar used to split bluestone along bedding plane partings (see header above). In addition, this road network linked stone wall enclosed pastures, an 1800s bluestone house, and an historic railway station. Clearly, wagon roads and quarries extend throughout the proposed development site and beyond, requiring broad oversight by a quarry master or lessee.



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