DRAFT

TOWN OF NEW LEBANON

DRINKING WATER SOURCE PROTECTION PROGRAM (DWSP2) PLAN

Technical Assistance Provided By:

New York Rural Water Association (NYRWA)

October 2022

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List of Acronyms

CWS	Community Water System
DWSP2	Drinking Water Source Protection Program
FHA	Federal Housing Administration
GPM	Gallons per minute
IWS	Individual Water Supply
MCL	Maximum Contaminant Level
NTNCWS	Non-Transient, Non-Community Water System
NYRWA	New York Rural Water Association
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
SWAP	Source Water Assessment Program
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

1.0 SUMMARY

The following is a plan to protect the drinking water resources of the Town of New Lebanon, including privately-owned public water systems, commercial establishments, and individual (residential) water supply wells. Such a plan is referred to as a Drinking Water Source Protection Program (DWSP2) Plan. In June 2017, the Town Board of the Town of New Lebanon passed a resolution that approved the development and implementation of such a source water protection plan. It also authorized a stakeholder group to work with New York Rural Water Association (NYRWA) on this plan.

Approximately 10 percent of the Town's population is supplied with drinking water from community water systems. These residents reside largely at mobile home parks. The remainder of the Town's population is supplied by individual (residential) water supply (IWS) wells. An overview of the privately-owned public water systems and IWS wells is contained in Section 3.1. Based upon the compiled data, 86% of water wells drilled in New Lebanon since 2000 have been completed in bedrock. Wells completed in bedrock are considerably deeper than those completed in unconsolidated deposits (sand and gravel deposits). Data on the water quantity and quality from bedrock and unconsolidated deposits is detailed in Section 3.2. This section includes several maps portraying the occurrence of the various bedrock formations, unconsolidated aquifers, and well data in New Lebanon.

Drinking water source protection areas were mapped around public water systems to help protect them from potential sources of contamination (Section 3.3). Although it is not feasible to map protection areas around all individual water supply (IWS) wells, recommended separation distances for drinking water wells from potential sources of contamination are presented. An inventory of potential contaminant sources was conducted by NYRWA to identify land uses that, if improperly managed, may impact the quality of drinking water sources (Section 3.4). Nearly all potential sources of contamination are located within the Wyomanock and Kinderhook Valleys along the NY Route 22/US Route 20 corridor. Results of water supply sampling near three identified potential contaminant sources is detailed in Section 3.4.1. This includes testing of IWS wells downgradient from the former Bouchard Landfill and Ceramaseal (CeramTec) facility on US Route 20, as well as the former New Lebanon Landfill off Old Post Road.

Four protection methods have been proposed to help mitigate potential impacts to groundwater resources that serve as drinking water sources in New Lebanon. As described in Section 4, these are: public education, continued monitoring and reporting, designation of critical environmental areas for sensitive groundwater resources, and development of a climate vulnerability assessment and hazard mitigation plan. An implementation timeline for these strategies was developed to allow the Town to organize protection efforts, develop reasonable expectations, and encourage completion of the work.

2.0 INTRODUCTION

2.1 Background and Purpose

Source water includes surface water or groundwater used for drinking purposes. A source water protection plan identifies source water protection areas and potential sources of contamination, defines priorities, identifies protection strategies, defines implementation tasks and milestones, sets a timetable for achieving the plan goals, and outlines a process for periodically evaluating progress towards these goals.

Recently, New York State has prioritized updating assessments that were developed in the early 2000's as part of the Source Water Assessment Program (SWAP). These assessments delineated source water assessment areas, generated potential contaminant inventories, and developed susceptibility analyses for public water systems. In addition, New York State is now focused upon creating and implementing updated source water protection plans. This initiative has led to the development of the Drinking Water Source Protection Program (DWSP2). This program has issued a draft framework to help New York State communities build a tailored source water protection plan, known by the state as a DWSP2 Plan. This framework can be downloaded from: https://www.dec.ny.gov/docs/water_pdf/dwsp2draftframework.pdf.

New York Rural Water Association (NYRWA), as a technical assistance provider, has pledged to follow the phases and components of the DWSP2 Plan Framework to the greatest extent practicable when working with a community on the development of a source water protection plan. This DWSP2 Plan for the Town of New Lebanon, developed with the assistance of NYRWA, is consistent overall with the DWSP2 Plan Framework. This DWSP2 Plan aims to protect the drinking water sources located in New Lebanon for the residents and businesses of the Town. This includes several privately-owned public water systems as well as individual (residential) water supply (IWS) wells.

The United States Environmental Protection Agency (USEPA) defines a public water system as providing water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serves an average of at least 25 people for at least 60 days a year. Note that the New York State Department of Health (NYSDOH) has a broader definition of a public water system that includes any system with at least 5 service connections. A community water system (CWS) is a public water system that serves the same people year-round. In contrast, a non-community water system is a public water system that does not serve the same people year-round. There are 2 types of non-community water systems. A non-transient, non-community water system (NTNCWS) regularly supplies water to at least 25 of the same people at least 6 months per year. A transient, non-community water system does not regularly serve the same people. Public water systems with sources in New Lebanon are indicated in Table 1. Maps showing the location of public water systems supplying water for residents and businesses across New Lebanon are shown in Figures 1 and 2. All public water systems in New Lebanon are supplied by groundwater.

Approximately 200 Town residents (this count does not include boarding students at the Darrow School) are supplied with drinking water from community water systems. This represents about

10 percent of the Town's population. The remaining Town population are thus supplied by individual (residential) water supply (IWS) wells.

Public Water System Name	Type	Population Served
ADAMS CROSSING MOBILE HOME PARK	Community water system	70
DARROW SCHOOL	Community water system	150
DARROW SCHOOL NORTH FAMILY WELL	Community water system	150
SHAKER MEADOWS MOBILE HOME PARK	Community water system	24
SHERMAN TRAILER PARK	Community water system	20
SKI LODGE TRAILER PARK	Community water system	24
TAZMUTT, INC. (SHAKER FLATS MHP)	Community water system	69
NEW LEBANON ELEMENTARY SCHOOL	Non-Transient non-community system	350
NEW LEBANON HIGH SCHOOL	Non-Transient non-community system	375
ABODE OF THE MESSAGE	Transient non-community system	40
BLUEBERRY HILL MARKET CAFE	Transient non-community system	36
CHINA CITY (SHAKER MILL PROPERTY II LLC)	Transient non-community system	25
GALLUP INN	Transient non-community system	75
JIMMY DS PIZZA ROYALE & REST.	Transient non-community system	106
LEBANON VALLEY CONCESSIONAIRES	Transient non-community system	250
MARIOS RESTAURANT	Transient non-community system	81
MAVERICKS (VALLEY PLAZA)	Transient non-community system	25
MOUNTAIN ROAD CAMP	Transient non-community system	150
SMITTYS PUB	Transient non-community system	25
STEWARTS SHOP #168 NEW LEBANON	Transient non-community system	31
THE INN @ SHAKER MILL FARM	Transient non-community system	25
THE KSHACK	Transient non-community system	30

Note: System Population Data from NYSDOH and USEPA

Table 1. Public Water Systems in New Lebanon

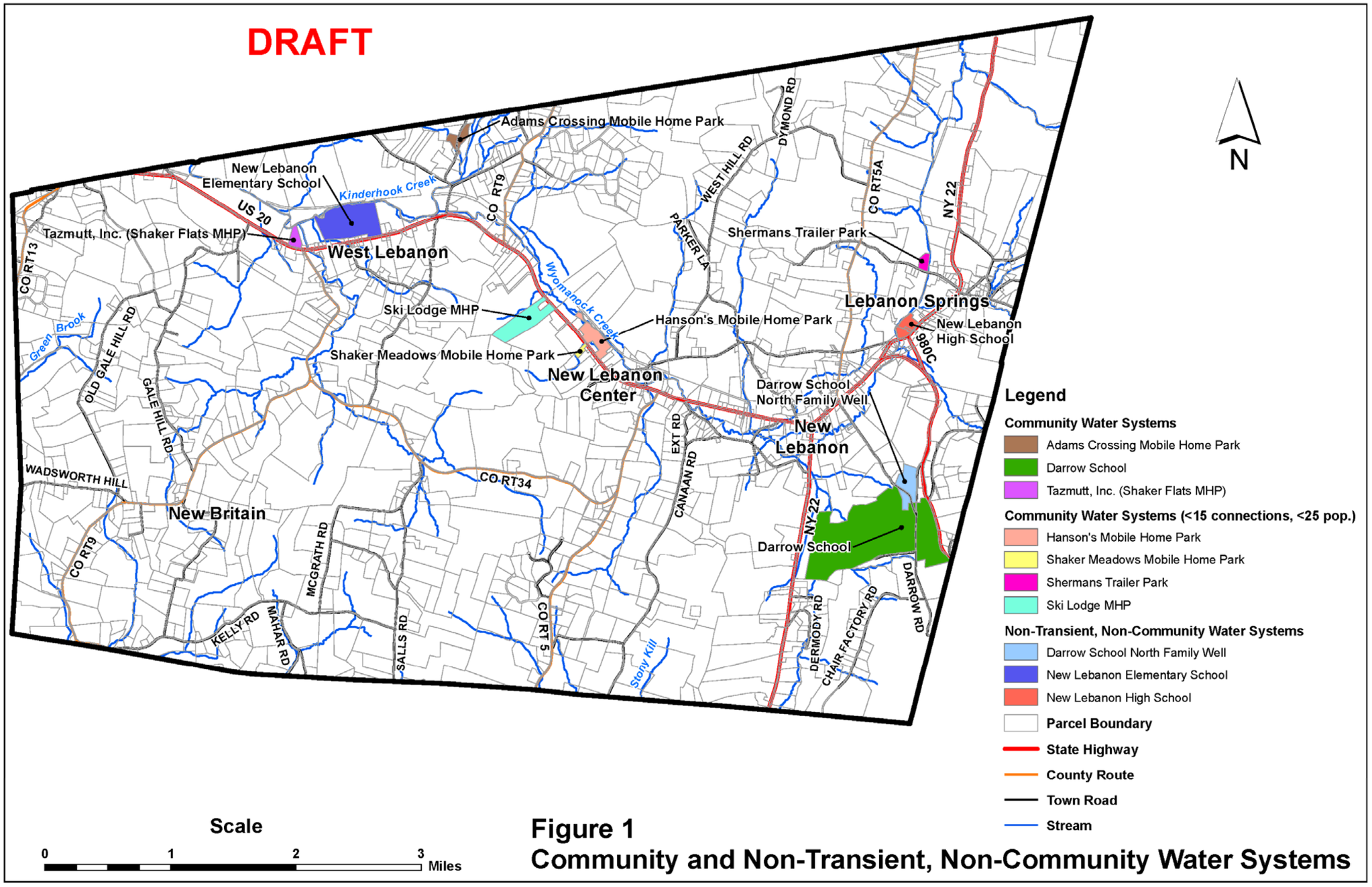


Figure 1
Community and Non-Transient, Non-Community Water Systems

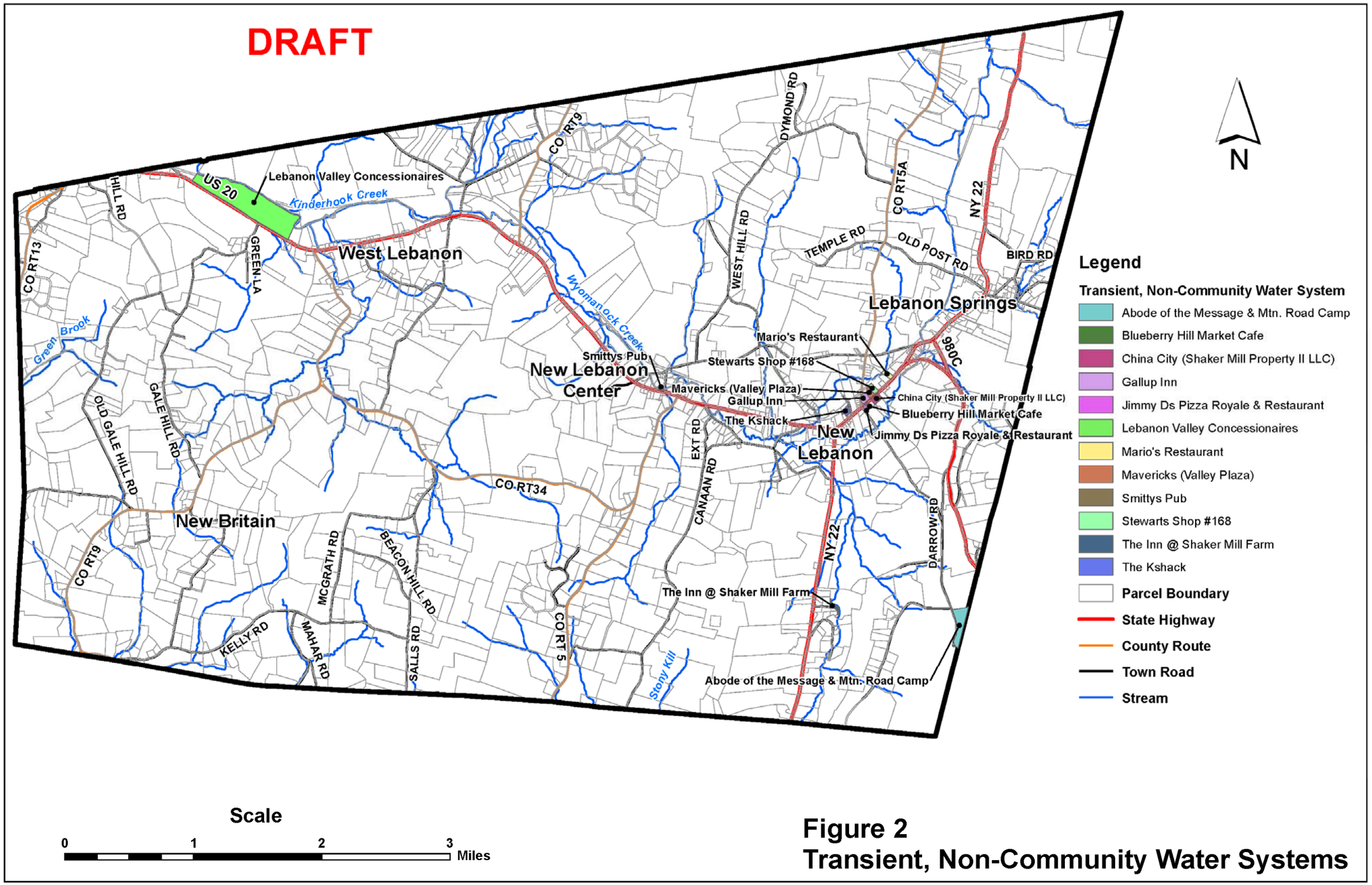


Figure 2
Transient, Non-Community Water Systems

2.2 Planning Team (Stakeholder Group)

In June 2017, the Town Board of New Lebanon passed a resolution to develop and implement a source water protection plan. Subsequently a planning team (stakeholder group) was authorized to include Conservation Advisory Council (CAC) members, a Zoning Board of Appeals Member, a Town Board Member & Zoning Re-Write Committee Member, and the New Lebanon representative to the Columbia County Environmental Management Council. These individuals have met with NYRWA and provided community-specific guidance on the source water planning process.

2.3 Goals and Vision

From the 2017 Town Board resolution, the goals of the source water protection plan in New Lebanon have been to (1) identify water supply resources and potential threats and (2) recommend and implement protection strategies to protect the identified water resources. From the Town Board resolution, the vision of the source water protection plan is to *"seek to further develop its water resources planning and management strategies in order to protect drinking water resources"*.

3.0 DRINKING WATER SOURCE ASSESSMENTS

A drinking water source assessment includes: an overview of the privately-owned public water systems and IWS wells; a description of the varied hydrogeologic settings and sensitivity of well supplies in New Lebanon; delineation of drinking water source protection areas; and an inventory of potential contaminant sources that might lead to the release of contaminants within the delineated areas.

3.1 An Overview of Drinking Water Systems

3.1.1 Privately-Owned Community Water Systems

There are 5 mobile home parks and 2 residential institutions that have their own source of water and operate as community water systems in New Lebanon (see Figure 1 and Table 1). All these systems rely upon wells for their source of supply. There are 2 non-transient, non-community water systems. NYRWA has compiled data on the supply wells for these types of systems from the Columbia County Department of Health and other sources such as the United States Geological Survey (USGS) and the NYSDEC. Table 2 is the resulting data compilation. Data on these wells, particularly those that are older, is frequently incomplete. Water quality is summarized in Table 2 as well. Nitrate levels are low, with no levels above the level that result in accelerated sampling (5 mg/L). Recent sampling for emerging contaminants (PFOA, PFOS, and 1,4-Dioxane) at the community water systems that serve 25 or more people as well as at the non-transient, non-community water systems revealed levels below detectable limits except at the New Lebanon High School. Here, levels of PFOA/PFOS have been in the range of 4.4 to 11 ng/L (the Maximum Contaminant Level, MCL, is 10 ng/L for each).

System	Well	Depth	Casing	Aquifer	Yield	Water Quality
ADAMS CROSSING MOBILE HOME PARK	#1	116		Walloomsac Formation (?)	20	Nitrate - <0.01
ADAMS CROSSING MOBILE HOME PARK	#2			Walloomsac Formation (?)	12	Nitrate - <0.01
DARROW SCHOOL	#1	132		Austerlitz/Nassau Phylite	15	Nitrate - 1.4; Cl = 198; TDS = 688; Hardness = 211
DARROW SCHOOL	#2	338		Austerlitz/Nassau Phylite	10	
DARROW SCHOOL	#3	205	39	Austerlitz/Nassau Phylite	21	Nitrate - 2.2; Cl = 232; TDS = 711; Hardness = 409
DARROW SCHOOL NORTH FAMILY WELL	#1	285		Austerlitz/Nassau Phylite	15	Nitate - 0.4
HANSON'S MOBILE HOME PARK	#1	98	98	Unconsolidated (?)	60	
SHAKER MEADOWS MOBILE HOME PARK	#1					
SHERMANS TRAILER PARK	#1					Nitrate - 0.13 to 0.15
SKI LODGE MHP	#1	62		Unconsolidated (?)		Nitrate - 0.2
TAZMUTT, INC.	#1	79	73	Walloomsac Formation (?)	20	Nitrate - 0.15
NEW LEBANON ELEMENTARY SCHOOL	#1	68				Nitrate - 0.2
NEW LEBANON HIGH SCHOOL	#1	80	65	Stockbridge Formation		Nitrate - 2 to 2.7

Table 2. Public Water Supply System Well Data

3.1.2 Individual Water Supply (IWS) Wells

As indicated above, most households in New Lebanon rely upon individual private water supply wells. These wells range widely in age and construction. In a 2017 survey that NYRWA conducted of homeowners with IWS wells in New Lebanon, 71 percent indicated that their well was drilled prior the year 2000. Fifteen percent of respondents did not know when their well was drilled.

Since 2000, water well contractors must notify NYSDEC prior to commencement of drilling a water well and file a Water Well Completion Report with NYSDEC upon completion of a water well. A copy of this report must also be provided to the owner of the water well. In addition, there are now minimum standards for the construction, renovation, development, and abandonment of drinking water wells.

Although NYSDEC water well completion reports are required to be submitted, water quality testing of IWS wells is not mandated by state or local regulations. From the water well survey, 79 percent of respondents indicated water quality issues. Hardness, iron, and sediment were among the numerous issues (see Figure 3 below). Fifteen percent of residents indicated that their well had tested positive for coliform bacteria.

The NYSDOH Bureau of Water Supply Protection sampled 21 IWS wells in April 2021 for various constituents including coliform bacteria, color, turbidity, odor, pH, conductivity, hardness, nitrate, iron, manganese, chloride, sulfate, sodium, fluoride, arsenic, and lead (known collectively as the routine physical and chemical group). Sixteen of the 21 wells (76 percent) had water which would be classified as hard (a level of hardness above 60 mg/L). Of these, 43 percent have water characterized as moderately to very hard which would typically necessitate a softener to control scale deposition. From the well survey, only 29 percent of residents utilize a softener.

Iron and manganese are also commonly found in New Lebanon well water. Some 29 percent of wells tested had iron above the maximum contaminant level of 0.3 mg/L and 14 percent had manganese above the maximum contaminant level of 0.3 mg/L. Three of the wells tested positive for total coliform bacteria. Of these, only 1 tested positive for E. coli bacteria. Further discussion of the results of the NYSDOH well sampling is contained in **Section 2.2 Hydrogeologic Setting** below.

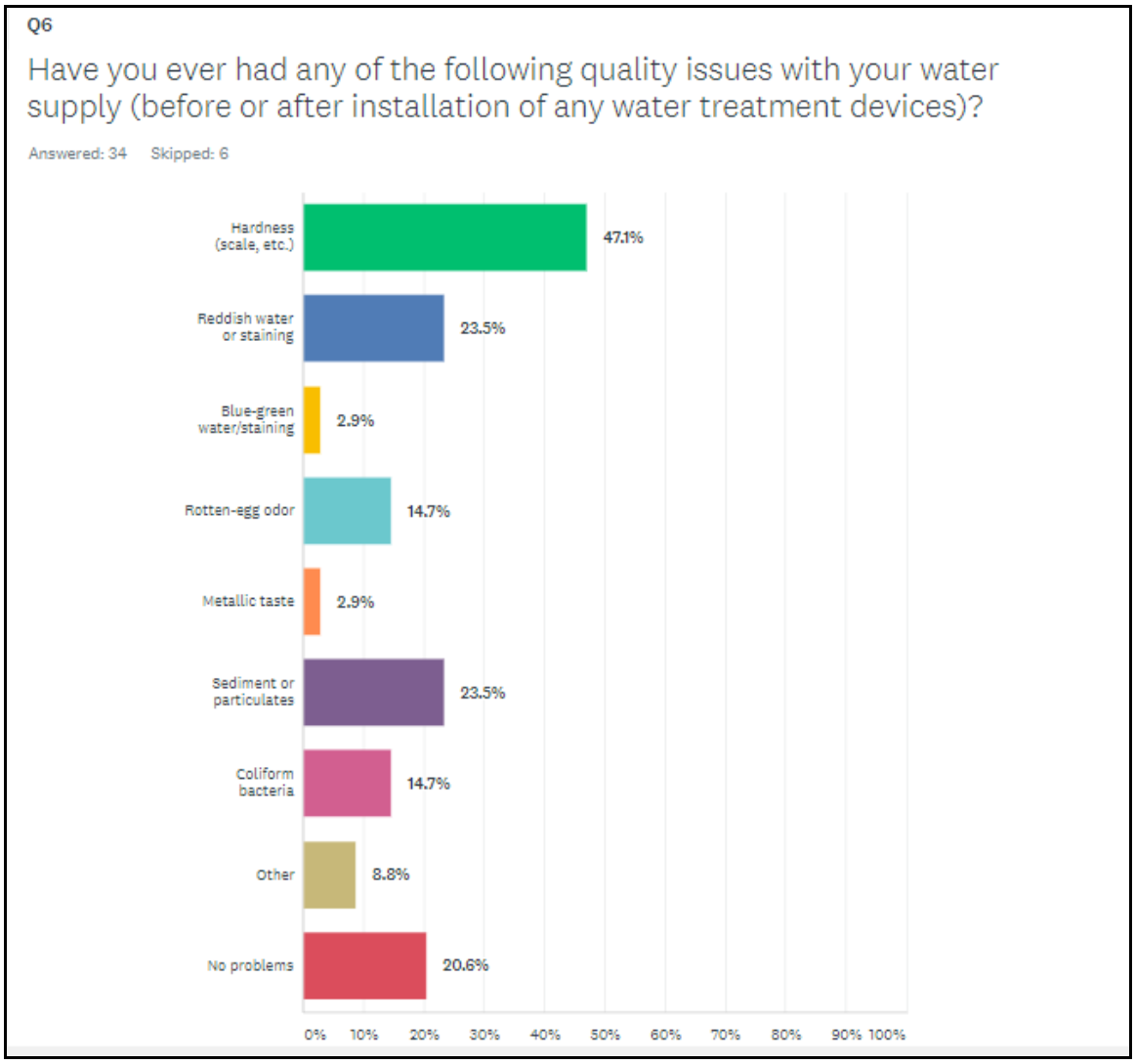


Figure 3. Self-Reported Drinking Water Quality Issues

NYRWA obtained the Water Well Completion Reports for wells drilled in New Lebanon as well as the corresponding data in Geographic Information (GIS) format. Other sources of well data included LaFleur and DeSimone (1991) and the United States Geological Survey (USGS). Based upon the compiled data, 86% of water wells drilled in New Lebanon since 2000 have been completed in bedrock. Bedrock wells in New Lebanon have a median depth of 325 feet and a median yield of 5 gallons per minute (gpm). Note that the median value is the one lying at the midpoint of the observed values (one-half fall above it and one-half fall below it).

Nearly one-third (32%) of bedrock wells have yields less than the 5 gpm required by the Federal Housing Administration (FHA) for new construction home loans. Fifteen percent of bedrock wells yield less than the 3 gpm required by FHA for new home loans. A discussion of bedrock water well characteristics based upon the bedrock formation is contained in Section 2.2.3 below.

In contrast, the median depth of wells completed in unconsolidated deposits (the material above bedrock) is 55 feet and the median yield is 20 gpm. No wells finished in unconsolidated deposits yield less than 5 gpm. More information on unconsolidated aquifers is discussed in Section 3.2.2 below.

3.2 Hydrogeologic Setting

3.2.1 Topography and Drainage

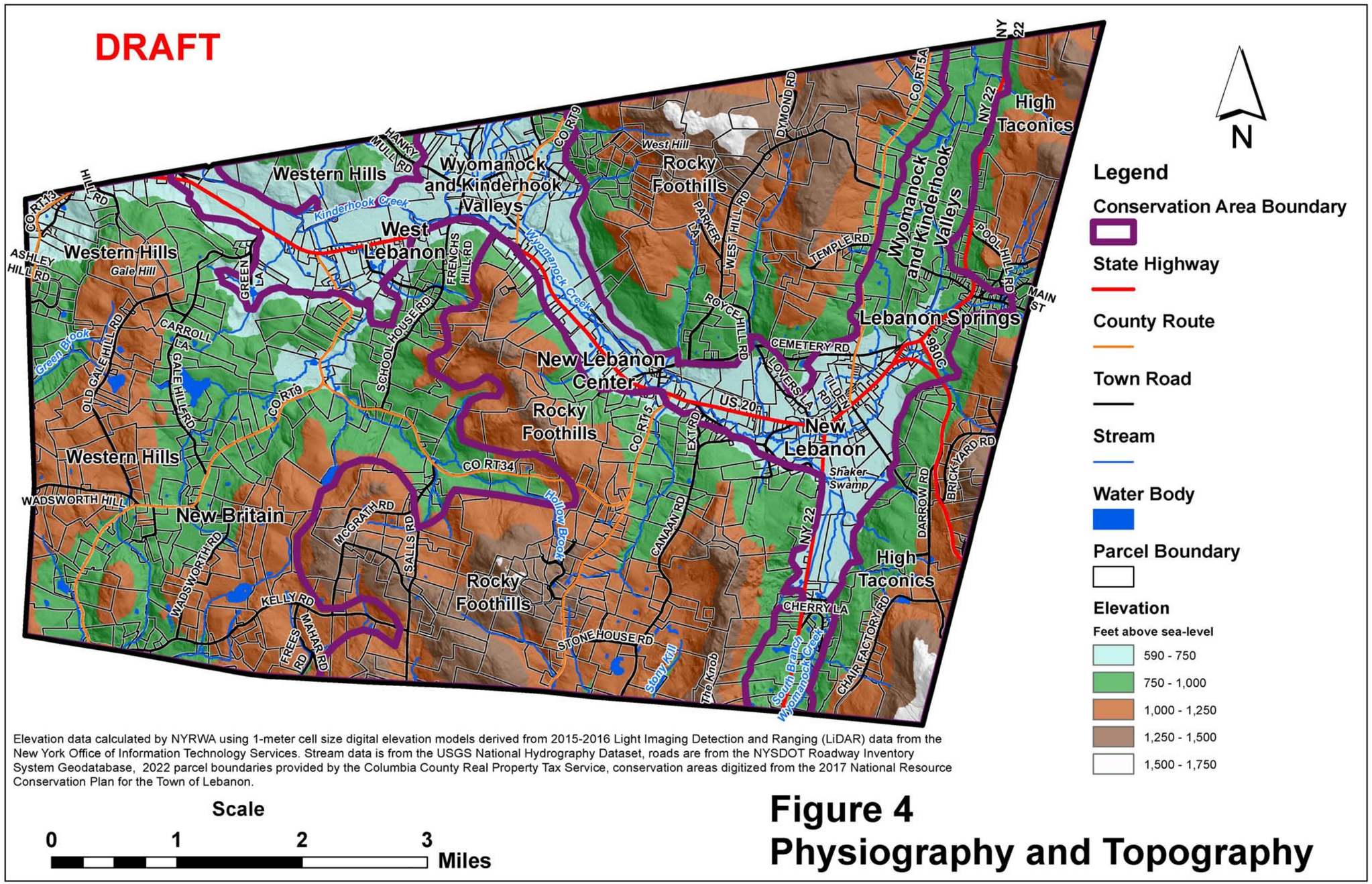
New Lebanon lies almost entirely within the Taconic section of the New England physiographic province (Fenneman and Johnson, 1946). The western most portion of New Lebanon (west of Old Gale Hill Road) is situated within the Hudson Valley section of the Valley and Ridge physiographic province. Note that the Natural Resource Conservation Plan for the Town of New Lebanon (2017) divided New Lebanon into 4 conservation areas based on topography, geology, and natural resource features. These are the High Taconics, the Wyomanock and Kinderhook Valleys, the Rocky Foothills, and the Western Hills (see Figure 4).

Elevations in New Lebanon range from lows of 590 to 850 feet in the Wyomanock and Kinderhook Valleys to summit elevations of 1,500 to 1,700 feet above sea-level in the Rocky Foothills and High Taconics (Figure 4). Slopes range widely across New Lebanon, averaging 25 percent (Figure 5). Overall, just over one-quarter of the land area of New Lebanon has slopes less than 15 percent. Note that slopes of greater than 15 percent are not considered acceptable for septic systems (NYSDOH – Appendix 75A). The lowest slopes are generally found in the Wyomanock and Kinderhook Valleys and in some upland valley areas. Steepest slopes are found in the upland areas of Town (High Taconics, the Rocky Foothills, and the Western Hills) (see Figure 5).

All land areas of New Lebanon drain to Kinderhook Creek and its tributaries. Approximately one-half of the Town drains to Wyomanock Creek, including the South Branch Wyomanock Creek (Figure 6). Other areas drain directly to Kinderhook Creek or to other tributaries such as the Black River, Green Brook, Hollow Brook, Stony Kill, and Tackawasick Creek (Figure 6). In terms of the lengths of stream and rivers in New Lebanon, the Wyomanock Creek totals 8.9 miles, Hollow Brook 4.7 miles, Kinderhook Creek 3.5 miles, South Branch Wyomanock Creek 2.4 miles, Green Brook 1.2 miles, and the Stony Kill 0.6 miles.

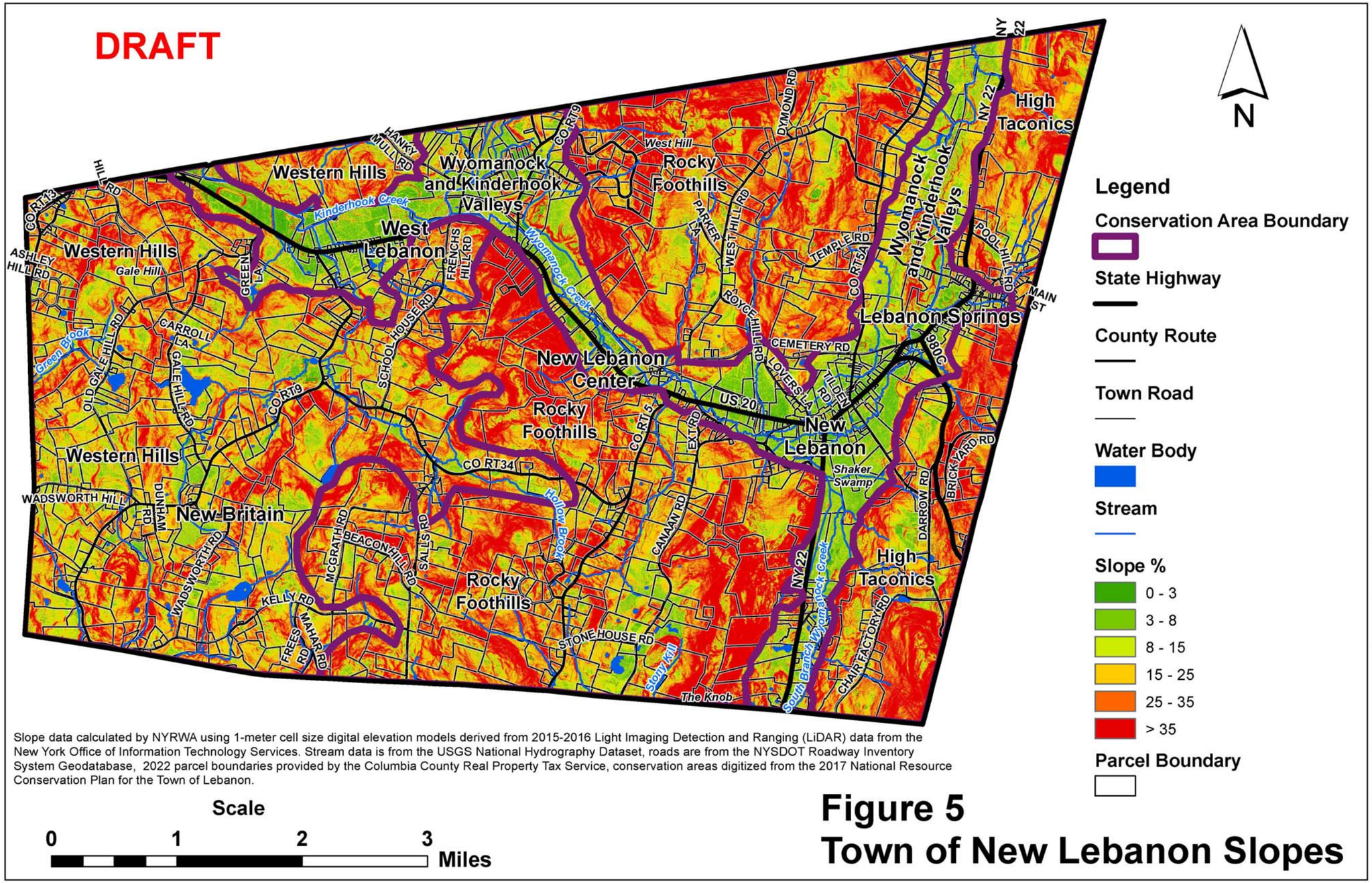
3.2.2 Unconsolidated Aquifers

Steven Winkley, P.G. of NYRWA mapped the unconsolidated (sand and gravel) aquifers of New Lebanon at a 1:24,000-scale (see Figure 7). Aquifer boundaries were digitally mapped using the following: the interpretation of topographic expression from 1-meter cell size digital elevation models derived from 2015-2016 Light Imaging Detection and Ranging (LiDAR) data, field observations, subsurface data from water wells and test borings, and georeferencing and review of unpublished mapping by LaFleur and DeSimone (1991) in a report entitled Water Resources of New Lebanon, NY.



Elevation data calculated by NYRWA using 1-meter cell size digital elevation models derived from 2015-2016 Light Imaging Detection and Ranging (LiDAR) data from the New York Office of Information Technology Services. Stream data is from the USGS National Hydrography Dataset, roads are from the NYSDOT Roadway Inventory System Geodatabase, 2022 parcel boundaries provided by the Columbia County Real Property Tax Service, conservation areas digitized from the 2017 National Resource Conservation Plan for the Town of Lebanon.

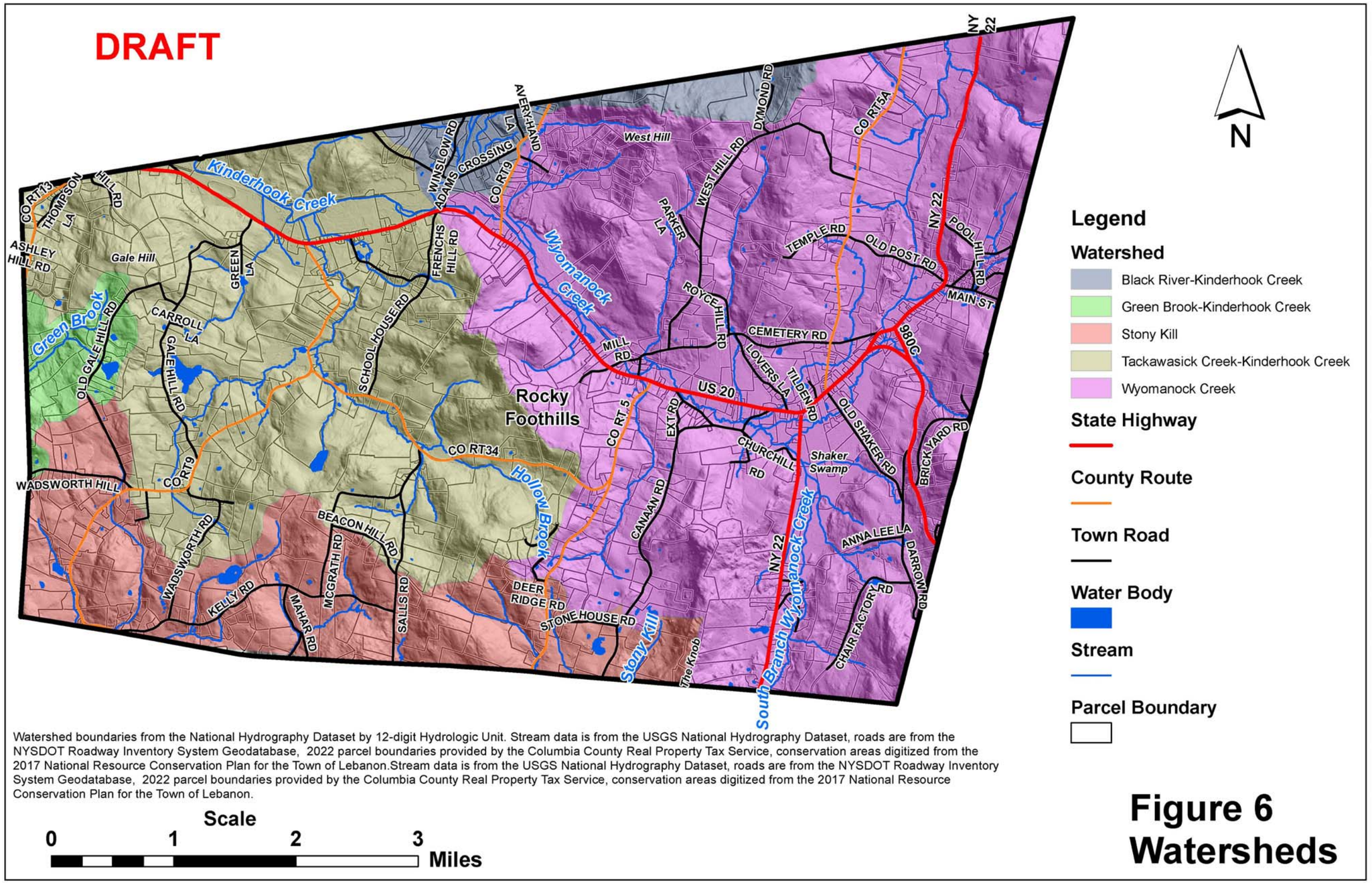
Figure 4
Physiography and Topography



Slope data calculated by NYRWA using 1-meter cell size digital elevation models derived from 2015-2016 Light Imaging Detection and Ranging (LiDAR) data from the New York Office of Information Technology Services. Stream data is from the USGS National Hydrography Dataset, roads are from the NYSDOT Roadway Inventory System Geodatabase, 2022 parcel boundaries provided by the Columbia County Real Property Tax Service, conservation areas digitized from the 2017 National Resource Conservation Plan for the Town of Lebanon.

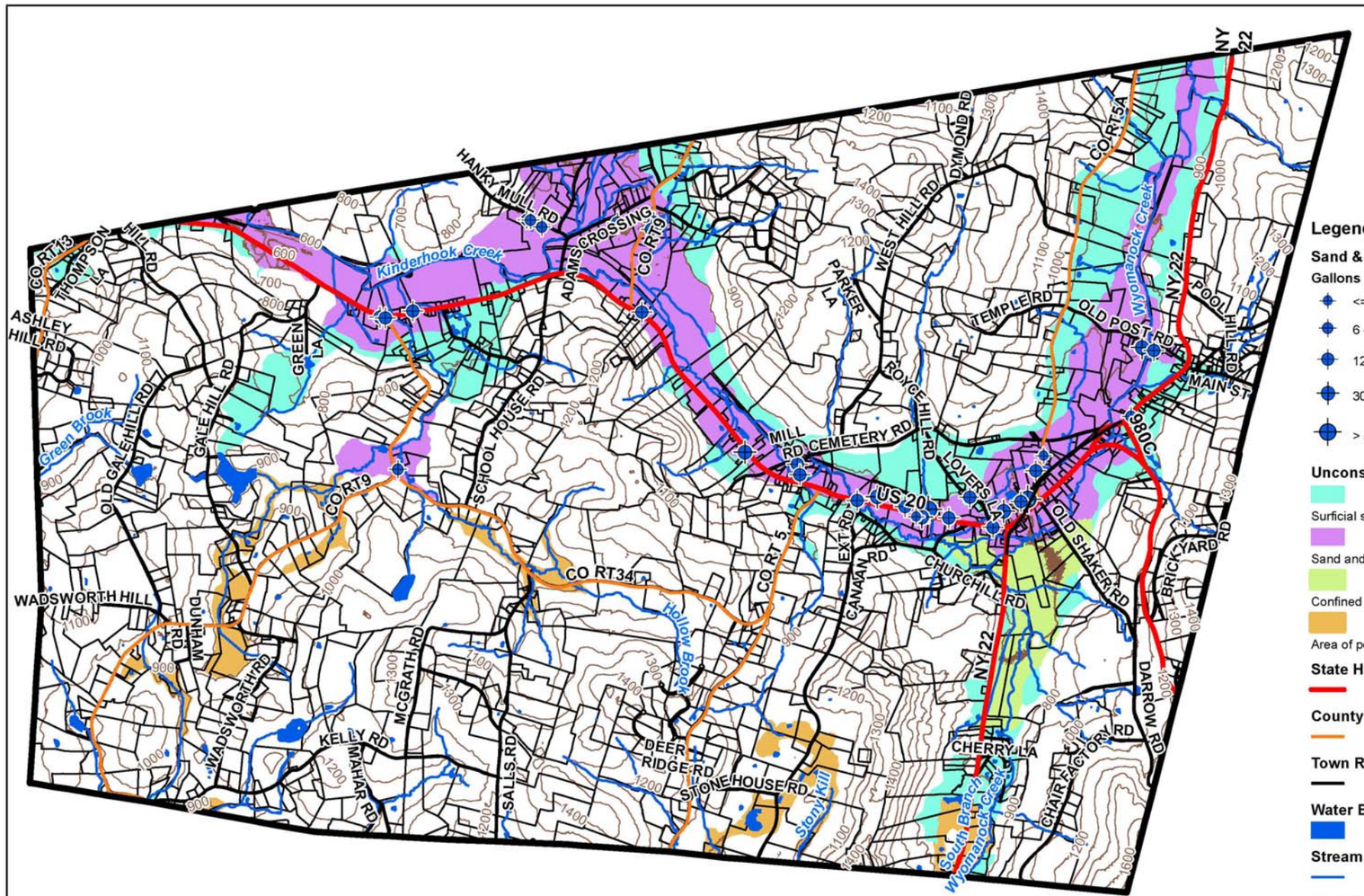
Scale
0 1 2 3 Miles

Figure 5
Town of New Lebanon Slopes



Watershed boundaries from the National Hydrography Dataset by 12-digit Hydrologic Unit. Stream data is from the USGS National Hydrography Dataset, roads are from the NYSDOT Roadway Inventory System Geodatabase, 2022 parcel boundaries provided by the Columbia County Real Property Tax Service, conservation areas digitized from the 2017 National Resource Conservation Plan for the Town of Lebanon.Stream data is from the USGS National Hydrography Dataset, roads are from the NYSDOT Roadway Inventory System Geodatabase, 2022 parcel boundaries provided by the Columbia County Real Property Tax Service, conservation areas digitized from the 2017 National Resource Conservation Plan for the Town of Lebanon.

Figure 6 Watersheds



About This Map:

This map shows the occurrence of unconsolidated (sand and gravel) aquifers. These aquifers typically produce higher water well yields than bedrock sources.

How This Map Was Made:

Sand and gravel aquifer boundaries were mapped by Steven Winkley, P.G. of the NY Rural Water Association using detailed surficial geologic mapping and interpretation of subsurface data from water wells and monitoring wells.

GIS base map datasets used by NYRWA include the USGS National Hydrography Dataset, the NYSDOT Roadway Inventory System Geodatabase, New York Office of Information Technology Services Classified LiDAR Tiles, and tax parcel boundaries provided by the Columbia County Real Property Tax Service.

Well data was compiled and plotted by Steven Winkley, P.G. of the NY Rural Water Association using data from the NYSDEC Water Well Contractors Program, the USGS Site Inventory System, and a study by LaFleur & DeSimone (1991).

Scale

0 1 2 3 Miles

Figure 7
Unconsolidated Aquifers

Four classifications of unconsolidated aquifers were mapped by NYRWA (Figure 7). The first are areas where sand and gravel found at or near the land surface has either a limited saturated thickness and/or a silty texture. Such sand and gravel aquifers often occur along the edges of the Wyomanock and Kinderhook Valleys in geological features known as alluvial fans or kame terraces. Less than 10 percent of sand and gravel wells occur in this type of aquifer, with well depths ranging from 35 to 45 feet and yields from 5 to 15 gpm. In many instances there is insufficient saturated thickness to produce a usable well in such areas. However, these areas provide recharge to the underlying bedrock aquifer and provide groundwater to help sustain streams and wetlands.

The second mapped classification of sand and gravel aquifers in New Lebanon are areas where sand and gravel deposits are found at or near the land surface and there could also be an underlying deeper, confined aquifer. This lower aquifer, ranging in depth from 40 to 145 feet, is confined by glacial lake silt and clay that was deposited across the Wyomanock and Kinderhook Valleys as well as a few upland valleys such as that of Hollow Brook. Some of these confined wells naturally flow due to artesian pressure. Reported well yields in the confined aquifers range from 5 to 50 gpm, with a median yield of 20 gpm. Most of these wells produce from open-ended casing. Significantly higher yields are possible in wells constructed with a developed screen. The deepest portion of the confined aquifer is found near the confluence of the Kinderhook and Wyomanock Creeks. Here a significant delta was built into the glacial lake that occupied the valley.

The surficial sand and gravel aquifer deposits across the Kinderhook and Wyomanock Creek Valleys can produce reported well yields of 25 to 125 gpm in wells ranging from 6 to 38 feet depth. Some residences along Shaker Road and West Street near New Lebanon hamlet have driven or dug wells that are believed to be completed in the upper (surficial) sand and gravel aquifer. Due to the shallow nature of these productive valley-bottom deposits, such wells are more vulnerable to flooding and surface forms of contamination (septic systems, road runoff, spills, etc.).

The 2 other aquifer classifications are: confined aquifers where confined sand and gravel may be found beneath finer sediments and areas of potential sand and gravel for which no well data exists to indicate saturated thickness. The confined aquifer areas are where extensive fine-grained wetland deposits exist at the land surface found in the South Branch Wyomanock Creek valley. This includes Shaker Swamp. Unfortunately, no data exists on the extent of confined sand and gravel in these areas. Areas mapped as potential sand and gravel for which no well data exists are largely upland tributary valleys with surficial deposits of alluvium (modern stream deposits). No well data exists in these areas either. Alluvium can produce usable quantities of water to wells, but such deposits are susceptible to contamination due to their shallow nature and position in flood prone areas.

The NYSDOH Bureau of Water Supply Protection sampled 6 wells likely to be completed in unconsolidated deposits. The median level of conductivity, a measure of the dissolved solids in the water, was relatively low in these wells: 88.4 µmhos/cm. Water in these wells was also soft, at a median of 32 mg/L. Water from unconsolidated aquifers is high in iron though, at a median concentration of 0.37 mg/L, above the maximum

contaminant level of 0.3 mg/L. Four of the 6 wells had iron levels above 0.3 mg/L. Two of the 3 wells that tested positive for total coliform bacteria are completed within unconsolidated aquifers.

3.2.3 Bedrock

The High Taconics, Rocky Foothills, and Western Hills upland regions in New Lebanon (Figure 4) are covered by a varying thickness of an unsorted mixture of clay, silt, sand, gravel, cobbles, and boulders known as glacial till. In some places in these regions of Town, bedrock outcrops at the land surface. Based upon water well data, the median depth to bedrock across these three uplands region in New Lebanon is 26 feet. Virtually all wells (99%) in the upland regions of New Lebanon are completed in bedrock. In the Wyomanock and Kinderhook Valleys, nearly two-thirds (65%) of wells are also completed in bedrock. In the valleys, the depth to bedrock is greater at a median depth of 68 feet. Most bedrock wells across the Wyomanock and Kinderhook Valleys are confined by glaciolacustrine silt and clay and/or glacial till.

There are 4 bedrock formations occurring throughout New Lebanon that are sources of drinking water (see Figure 8). The distribution of bedrock formations in New Lebanon was compiled by Steven Winkley of NYRWA using GIS. Several different published and unpublished mapping sources were digitized and utilized in this effort.

New Lebanon's bedrock geology is the result of ancient geologic history that occurred between 550 and 460 million years ago. Initially, the area was covered by a shallow sea and marine sediments were deposited on the floor of this ocean. Eventually, these deposits were consolidated into limestone and dolostone. In many areas, the limestone and dolostone were exposed to heat and/or pressure and were metamorphosed to a more crystalline rock known as marble. Collectively these are called carbonate rocks since they are composed chiefly of the mineral calcium carbonate. Such rocks can be dissolved by soil water and groundwater to form karst features such as sinkholes, caves, etc. The rock formation that resulted from the sediments of this period is known as the Stockbridge Formation. In New Lebanon it is found chiefly beneath portions of the valleys occupied by the Stony Kill and Wyomanock Creek (Figure 8). However, it also occurs at or near the land surface in some upland areas near the High Taconics and the Rocky Foothills (near the feature known as the Knob). The famous New Lebanon Warm Spring, the only warm spring in New York State, is situated off Spring Hill Road in Lebanon Springs at the base of the High Taconics. This unique spring issues from the Stockbridge Formation (Dunn Geosciences Co., 1981) and Hobba et. al (1979) near where the less permeable Austerlitz Formation has been thrust against the carbonate rock.

Following a period of erosion, the New Lebanon area became part of a deep ocean trench analogous to those found in today's Pacific Ocean. A thick layer of silty mud was deposited in this deep trench on top of the carbonate rocks. These sediments eventually consolidated to form shale rock and were later metamorphosed in places into slate and a higher-grade rock known as phyllite. Collectively, the gray to black shale, slate, and phyllite are referred to as the Walloomsac Formation. It is the most common bedrock formation in New Lebanon (Figure 8). The cause of the heat and pressure that caused

metamorphism of the Walloomsac Formation and the Stockbridge Formation was related to a mountain building event that began to occur some 450 million years ago. At this time, the area that is today New Lebanon was at the intersection of 2 crustal plates. As these 2 plates collided, the Taconic Range was thrust upwards. As this occurred, older rocks were pushed large distances westward over the younger Walloomsac Formation and the Stockbridge Formation. The rocks that were thrusted make up slices of rock known as allochton material. The underlying rocks that originated in place are part of autochton material. In New Lebanon, a common rock of allochton material is composed of the greenish Austerlitz Phyllite and the Nassau Formation (see Figure 8). The Austerlitz and Nassau Formation have been mapped together on Figure 8. The other chief rock type found in the allochton material in New Lebanon is the Rensselaer Graywacke. This bedrock formation is composed chiefly of impure sandstone with minor amounts of shale. The boundaries between allochton and autochton rocks are marked by low angled thrust faults.

The characteristics of water wells completed in bedrock vary based upon the formation and the localized distribution of fractures. Table 3 is a summary of well characteristics based upon the geologic formation. In general, the Stockbridge Formation produces the highest yields in New Lebanon, due to fractures and other openings that have been enlarged. The lowest yields are found in the Walloomsac Formation (Table 3).

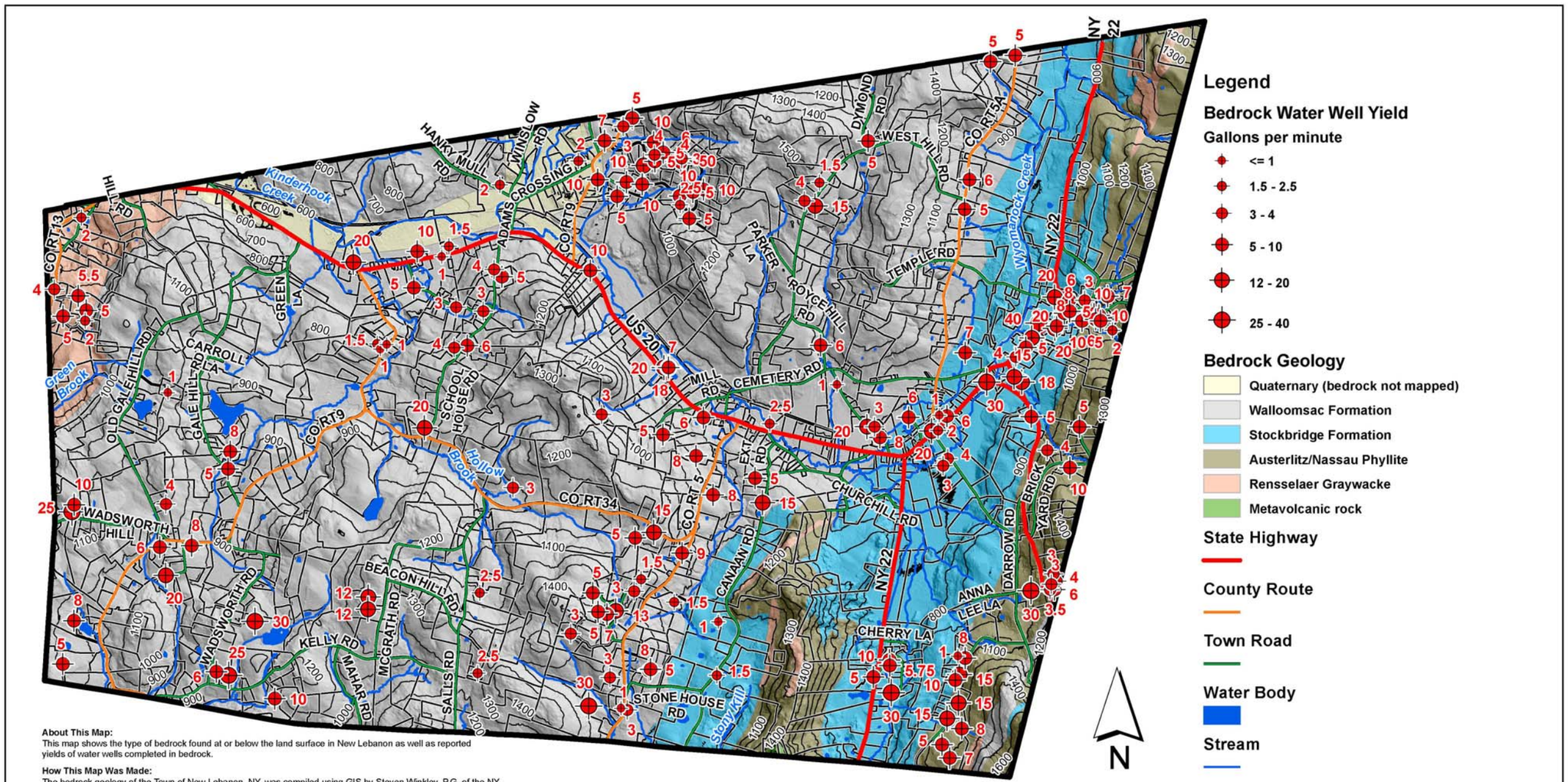
In terms of water quality, NYSDOH Bureau of Water Supply Protection sampling of water wells indicates that water from the Stockbridge Formation is quite hard (Table 4), as typically is the case with carbonate rock. Water in the Walloomsac Formation is softer but has more issues with iron and manganese (Table 4). Unfortunately, the NYSDOH sampling event was able to sample only 1 well in the Austerlitz/Nassau Formation. The water from this well was the most mineralized in New Lebanon and the arsenic level in this well exceeded the MCL (Table 4).

3.3 Drinking Water Source Protection Areas

Drinking water source protection areas are established to protect against different classes or types of contaminants. For wells serving public water systems, there are various protection areas that can be identified. These include: (1) the ownership and control area (required); (2) the critical area; and (3) the source water area. The required ownership and control area is mandated under the New York State Sanitary Code such that the owner of the public water system possesses one hundred feet ownership around the well and controls land activities within 200 feet of the well. The critical area is an area surrounding the supply well(s) where it takes less time to reach the drinking water source. Ideally this is based upon a certain time-of-travel to the well. Finally, the source water area is beyond the critical area and includes an area that still contributes water to the well(s) either at a longer time-of-travel or indirectly such as through surface water runoff for eventual groundwater recharge.

3.3.1 Privately-Owned Water Systems

Due to a lack of positional accuracy and the desire to maintain security, the ownership and control area has not been mapped for the various privately-owned public water



About This Map:
This map shows the type of bedrock found at or below the land surface in New Lebanon as well as reported yields of water wells completed in bedrock.

How This Map Was Made:
The bedrock geology of the Town of New Lebanon, NY, was compiled using GIS by Steven Winkley, P.G. of the NY Rural Water Association. A number of published and unpublished mapping sources listed below were digitized and utilized in this effort.

Fisher, D.W., 2006, The Rise and Fall of the Taconic Mountains – A Geological History of Eastern New York: Black Dome Press Corp., 184 p.

Fisher, D.W., Isachsen, Y.W., and L.V. Rickard, 1970, Geologic Map of New York, Hudson-Mohawk Sheet: New York State Museum and Science Service, Map and Chart Series No. 15.

Fisher, D.W., 196(?), Draft Geologic Map of the Canaan Quadrangle, N.Y.-MASS., 1:24,000 Series: New York State Geological Survey, Open File number 1gG1701.

Fisher, D.W., 196(?), Draft Geologic Map of the East Canaan Quadrangle, N.Y.-MASS., 1:24,000 Series: New York State Geological Survey, Open File number 1gG1707.

Radcliffe, N.M., 1978, Reconnaissance Bedrock Geologic Map of the Pittsfield West Quadrangle and part of the Canaan Quadrangle, Berkshire County, Massachusetts and Columbia County, New York: U.S. Geological Survey, Miscellaneous Field Studies Map MF-980.

Zen, E-an, Goldsmith, R., Ratcliffe, N.M., Robinson, P., and R.S. Stanley, 1983, Bedrock Geologic Map of Massachusetts: U.S. Geological Survey.

Well data was compiled and plotted by Steven Winkley, P.G. of the NY Rural Water Association using data from the NYSDEC Water Well Contractors Program, the USGS Site Inventory System, and a study by LaFleur & DeSimone (1991).

Figure 8
Bedrock Geology & Well Yields

Formation	# of Wells		Well Depth Range	Median Well Depth	Casing Depth Range	Median Casing Depth	Yield Range	Median Yield	% of Wells <5 gpm	% of Wells <3 gpm
		Units	Feet	Feet	Feet	Feet	Gpm	Gpm		
Austerlitz/Nassau Phyllite	22		144 - 600	311	20 - 164	58	2 - 30	6	28.5%	4.7%
Rensselaer Graywacke	7		330 - 465	360	60 - 100	83	2 - 5.5	4.5	50.0%	33.3%
Stockbridge Formation	41		32 - 722	221	20 - 258	80	1 - 40	6	25.8%	12.9%
Walloomsac Formation	114		79 - 820	353	20 - 300	40	1 - 50	5	33.7%	16.8%

Table 3. Bedrock Well Characteristics by Formation

Formation	# of Wells		Conductivity Range	Hardness Range	Iron Range	Manganese Range	Iron + Manganese Range	Arsenic Range
		Units	µmhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L
		MCL		120	0.3	0.3	0.5	0.01
Austerlitz/Nassau Phyllite	1		546	260	1.69	0.12	1.81	0.014
Stockbridge Formation	4		338 - 543	156 - 267	<0.01 - 0.16	<0.01 - 0.02	<0.01 - 0.18	<0.0005 - 0.0014
Walloomsac Formation	10		42 - 481	100 - 159	<0.01 - 0.77	0.01 - 2.54	0.01 - 2.6	<0.0005 - 0.0043

Red denotes value above MCL

Table 4. Bedrock Well Water Quality by Formation

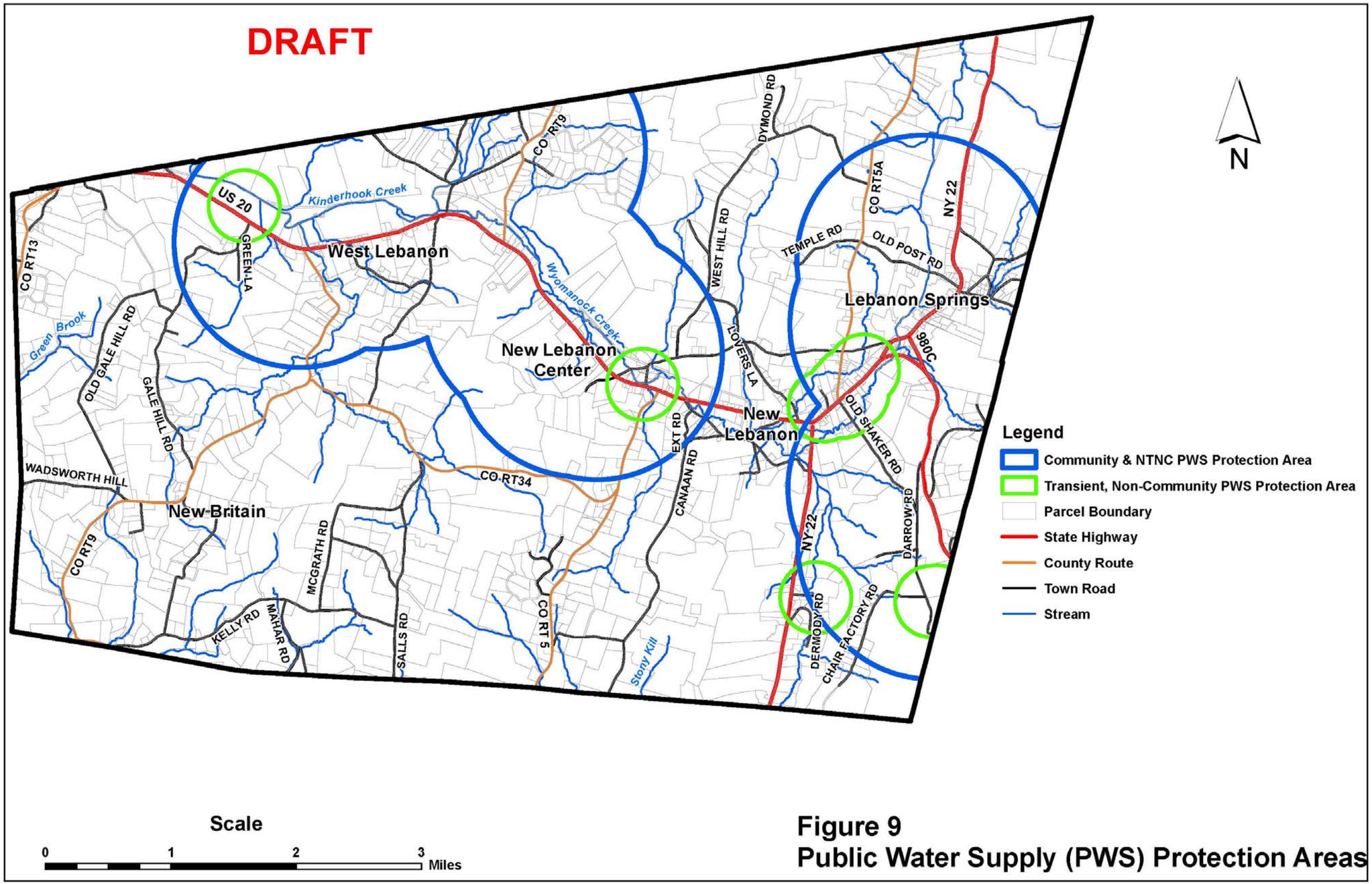


Figure 9
Public Water Supply (PWS) Protection Areas

systems in New Lebanon. Furthermore, in the absence of information on groundwater flow, pumping rates, well construction, etc., a precise contribution area cannot be delineated for these various privately-owned water system wells. Instead, a simplified drinking water source protection area of a fixed radius of up to 1 mile in all directions around the source was delineated (see Figure 9). A drinking water source protection area of 1,500 feet was drawn around each transient, non-community water system. These fixed radius distances are consistent with the SWAP.

3.3.2 IWS Wells

It is not possible to map protection areas around all individual water supply (IWS) wells. However, it is important to note that New York State regulations Part 5, Subpart 5-1 - Appendix 5B specifies separation distances of drinking water wells from potential sources of contamination. The specified separation distances in these regulations, shown in Table 3 below, should be exceeded by 50% whenever the source of water for the well is at a depth of less than 50 feet.

Contaminant Source	Distance (Feet)[1]
Chemical storage sites not protected from the elements (e.g., salt and sand/salt storage)[2]	300
Landfill waste disposal area, or hazardous or radiological waste disposal area[2]	300
Land surface application or subsurface injection of effluent or digested sludge from a Municipal or public wastewater treatment facility	200
Land surface application or subsurface injection of septage waste	200
Land surface spreading or subsurface injection of liquid or solid manure [3]	200
Storage Areas for Manure piles [4]	200
Barnyard, silo, barn gutters and animal pens [5, 6]	100
Cesspools (i.e. pits with no septic tank pretreatment)	200
Wastewater treatment absorption systems located in coarse gravel or in the Direct path of drainage to a well	200
Fertilizer and/or pesticide mixing and/or clean up areas	150
Seepage pit (following septic tank) [5]	150
Underground single walled chemical or petroleum storage vessels	150
Absorption field or bed [5]	100
Contained chemical storage sites protected from the elements (e.g. salt and sand/salt storage within covered structures) [7]	100
Septic system components (non-watertight) [5]	100
Intermittent sand filter without a watertight liner [5]	100
Sanitary Privy pit [5]	100
Surface wastewater recharge absorption system constructed to discharge storm water from parking lots, roadways or driveways [5]	100
Cemeteries	100
Sanitary privy with a watertight vault	50
Septic tank, aerobic unit, watertight effluent line to distribution box	50
Sanitary sewer or combined sewer	50
Surface water recharge absorption system with no automotive-related Wastes (e.g., clear-water basin, clear-water dry well)	50
Stream, lake, watercourse, drainage ditch, or wetland	25
All known sources of contamination otherwise not shown above	100

Table 5. Required Minimum Separation Distance to Protect Water Wells

3.4 Potential Contaminant Source Inventory

The next portion of the drinking water source assessments in New Lebanon consists of an inventory of potential contaminant sources. The DWSP2 Plan Framework completed by New York State to assist with development of a protection plan contains a list of potential sources of contamination that may impact the quality of drinking water sources, if improperly managed.

3.4.1 Privately-Owned Community Water Systems and IWS Wells

NYRWA has plotted several potential sources of contamination across the Town of New Lebanon on Figures 10-12. Many of these are government-regulated such as wastewater discharges, mines, petroleum bulk storage facilities, etc. (see Figure 10). There also have been several spills that have been identified as impacting groundwater resources in New Lebanon. These are identified on Figure 11. Such spills have been remediated and are categorized now as being closed by the NYSDEC. Most of these spills were due to equipment failures such as with tanks.

On Figure 12 are some potential sources of contamination that are higher risk land uses identified chiefly from real property type classification codes. These include auto body, tire shops, other related auto sales, auto dealers, motor vehicle service, highway garages, a former landfill, cemeteries, etc. Table 6 below is a summary inventory table of the most common identified regulated potential contaminant sources and higher risk land uses.

Note that nearly all potential sources of contamination are located within the Wyomanock and Kinderhook Valleys along the NY Route 22/US Route 20 corridor.

Potential Contaminant Sources Inventory Table		
Potential Source	**Contaminants of Concern**	**Relevant Information**
Petroleum Bulk Storage Facilities	Leaks of petroleum or other substances from tanks or spills during delivery or handling.	Information on bulk storage facilities and reported spills can be found at: https://www.dec.ny.gov/chemical/8437.html
Wastewater Discharges (SPDES Permits)	Nutrients, bacteria, viruses.	Regulated by NYSDEC. All active smaller discharges to groundwater are covered under general permits.
Sand and Gravel Pits	Accidental leaks of petroleum or clandestine dumping.	Regulated by NYSDEC. Information on mines can be found at: https://www.dec.ny.gov/cfmx/extapps/MinedLand/search/mines/
Vehicle Maintenance Shops	Solid and hazardous wastes that are handled and generated.	Depending upon the type and amount of wastes, hazardous waste regulations are likely required to be followed. More information can be found at: https://www.dec.ny.gov/docs/permits_ej_operations_pdf/vehiclemaint.pdf
Cemeteries	Research indicates levels of bacteria, metals (e.g. arsenic), and nutrients have been found to be elevated in groundwater near cemeteries.	One of the most recent studies in the United States can be downloaded at: https://doi.org/10.3133/sir20185120

Table 6. Potential Contaminant Sources Inventory Table

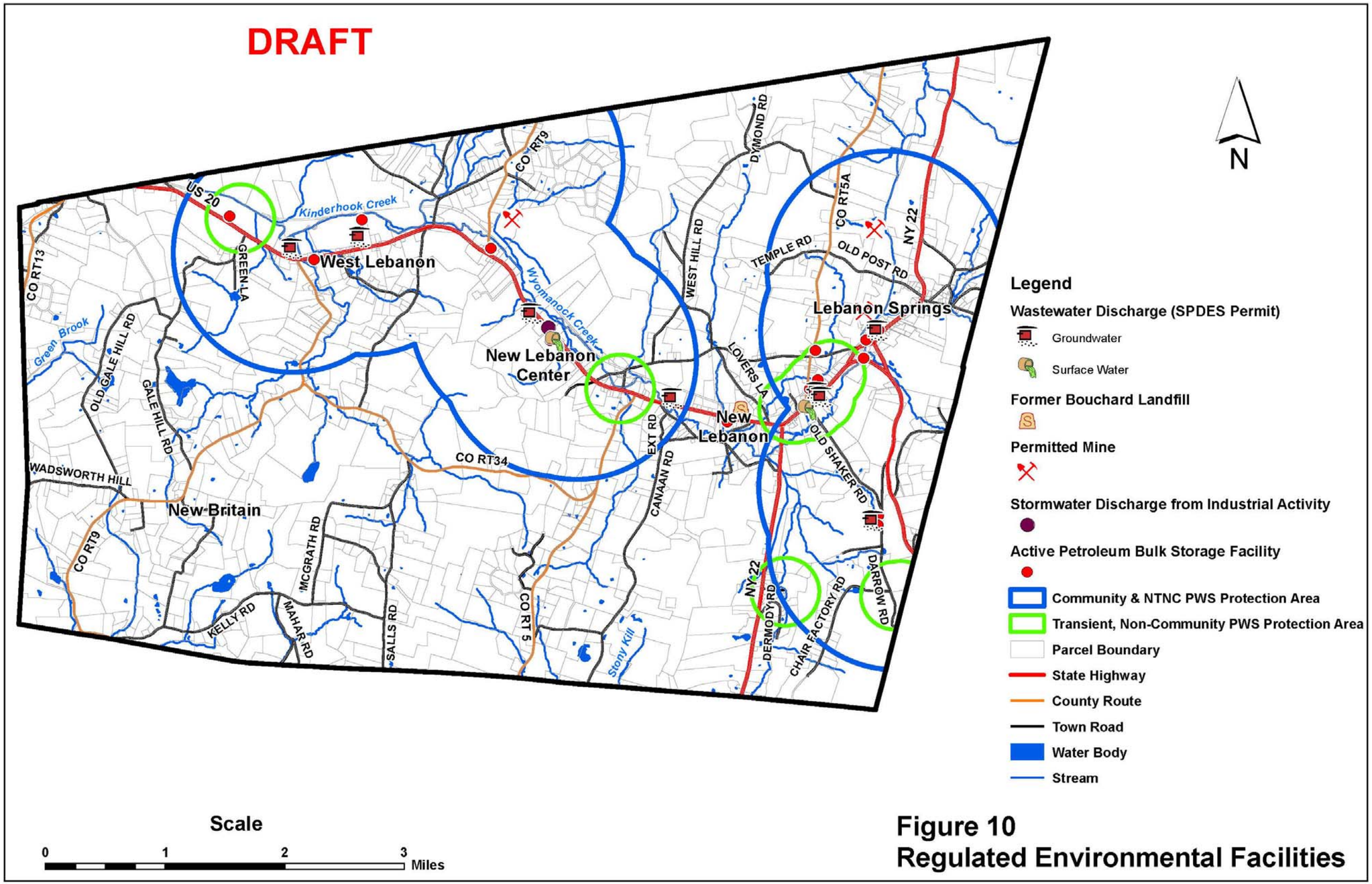


Figure 10
Regulated Environmental Facilities

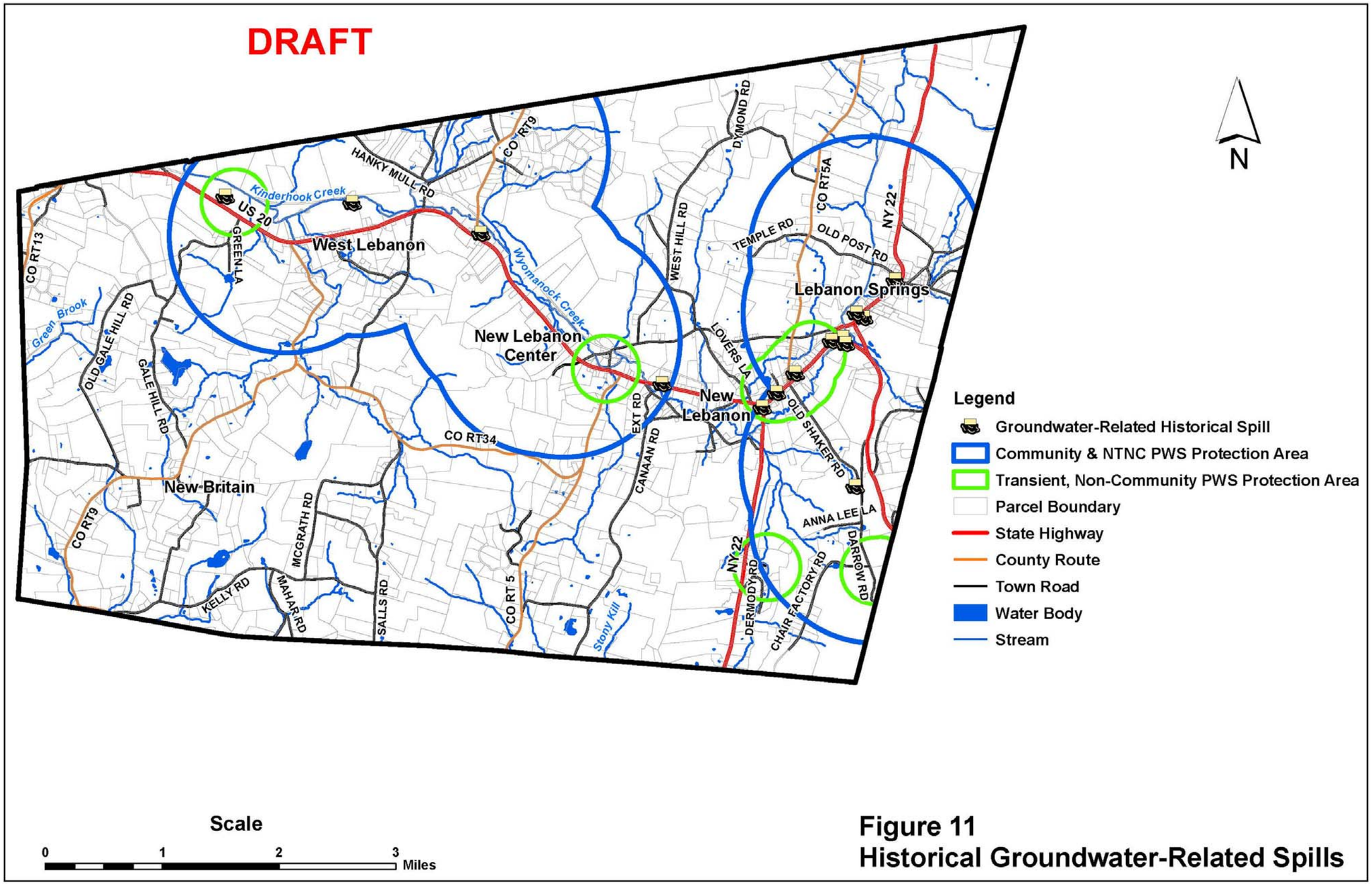


Figure 11
Historical Groundwater-Related Spills

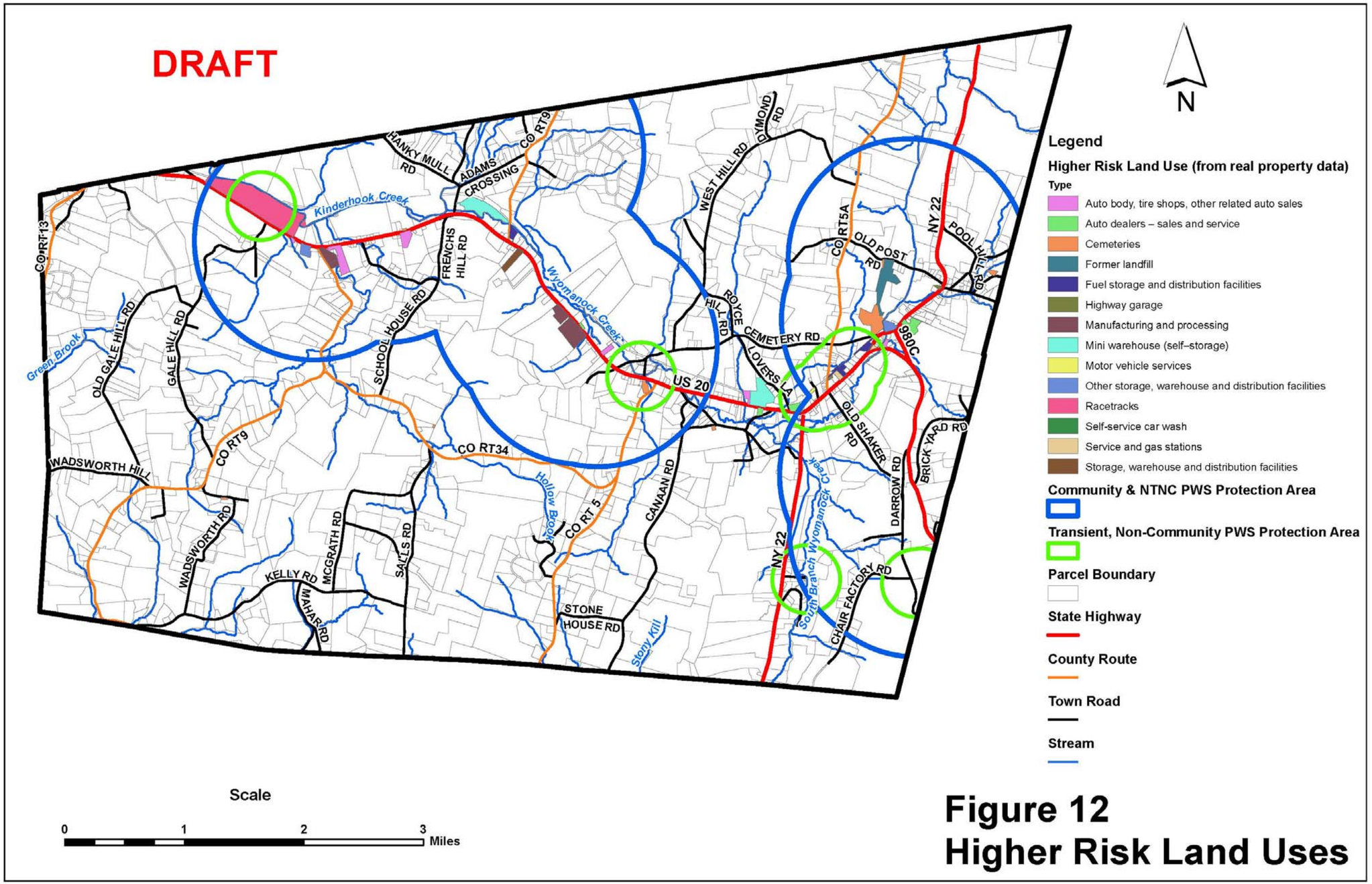


Figure 12
Higher Risk Land Uses

The NYSDOH Bureau of Water Supply Protection tested water from IWS wells downgradient from the former Bouchard Landfill (Figure 10) and the former Ceramaseal, Inc., (CeramTec) facility on US Route 20 for other parameters in addition to the routine physical and chemical group parameters that all the IWS wells across New Lebanon were tested for. Three wells downgradient from CeramTec were sampled for metals and volatile organic compounds (VOCs). Two wells downgradient from the former Bouchard Landfill were analyzed for VOCs. No levels of VOCs were detected. The concentration of metals in the three wells were either below detection limits or considerably below MCLs.

As part of its Inactive Landfill Initiative (ILI) Program, NYSDEC had monitoring wells at the former New Lebanon Landfill off Old Post Road (Figure 12) sampled. Elevated levels of per- and polyfluoroalkyl substances (PFAS) were found in some monitoring wells located immediately downgradient from the former municipal landfill (up to 160 ng/L PFOA). As a result, the NYSDEC and NYSDOH did a coordinated sampling of IWS wells situated downgradient from the former New Lebanon Landfill (Figure 12) on Old Post Road in 2020. No levels of PFAS were detected. Following the detection of elevated levels of PFOS (11 ng/L) at the New Lebanon High School (see page 8), another round of IWS well sampling covering 11 wells was conducted earlier this year. These wells were situated on Old Post Road, County Route 5A, or NY Route 22 in Lebanon Springs. Again, no wells had detectable levels of PFAS. No other indicators of landfill leachate were evidently detected either.

4.0 PROTECTION AND IMPLEMENTATION STRATEGIES

New Lebanon is entirely dependent upon groundwater for drinking water, both for individual water supplies and at privately-owned public water systems. Protection of the local groundwater resources from potential sources of contamination is especially important. Also critical is ensuring the future sustainability of local well supplies. Potential climate change impacts could affect both the quality and quantity of drinking water wells. It is important to note that some well supplies in New Lebanon are more sensitive to contamination or depletion impacts than others. The most susceptible wells are those that are shallow, lack a confining layer, and/or are situated in areas prone to flooding or other potential contaminant sources.

4.1 Identify Protection Methods

Source water protection methods are a set of approaches a municipality can take to protect drinking water source protection areas. These methods are not specific to a potential contaminant source and can be utilized through regulatory and/or non-regulatory means.

4.1.1 Public Education

The aim of public education is to increase the awareness of local landowners, residents, and officials of the importance of protecting drinking water resources.

Some public education has already been implemented. An online well survey was created and eventually completed in 2017-2018 by forty individuals in Town. One of the primary objectives of this survey was to get residents to think about their individual water supply source. Some of the results from this survey have been referenced in this DWSP2 Plan.

Future public education may include informing residents and officials about the results of this plan (i.e., a presentation to the Town Board and a separate public meeting), including information on groundwater resource occurrence, quality, and susceptibility. Some of this is to be done utilizing the ArcGIS Story Map Series app template. This will result in a series of online maps and informative graphics that are accessible through tabs.

4.1.2 Continued Monitoring and Reporting

The purpose of monitoring and reporting is to get a better understanding of water quality in Town, identify where contamination from emerging contaminants such as PFAS may exist, and determine where to focus additional protection strategies. Monitoring and reporting are a continuation of work that already has been partially implemented. This involved the acquisition and review of monitoring information from regulated public water systems and the sampling of IWS wells.

Future monitoring and reporting will involve the regular acquisition and review of information from regulated public water systems. This data, accessible from the Columbia County Department of Health, is to be obtained every 1-2 years and tracked in a spreadsheet.

Second, future monitoring and reporting will involve the testing of additional IWS wells for the routine physical and chemical group parameters that NYSDOH established and for PFAS. This testing would be made possible from an ARPA (American Rescue Plan Act) grant. Additional routine physical and chemical group water quality testing is necessary. Unfortunately, some of the bedrock formations in New Lebanon were insufficiently sampled in the 2021 round of sampling. For example, only one well completed in the Austerlitz/Nassau formation was sampled and it had elevated arsenic. This potential issue needs further investigation. In addition, no wells were sampled from the Rensselaer Graywacke in the northwest portion of the Town.

Secondly, it has been pointed out that some shallow wells tapping the unconfined unconsolidated aquifer in the Wyomanock Creek valley near the hamlet of New Lebanon have issues with bacteria, etc. This includes some businesses and residences along Shaker Rd and West St. A water well survey/inventory and routine physical and chemical group water testing here would address this issue.

PFAS testing of IWS wells has revealed no detectable levels southwest and southeast of the former New Lebanon Landfill off Old Post Road. However, there

has been an interest expressed to investigate PFAS in other areas of New Lebanon. Table 7 can be used to identify priority areas for PFAS sampling in New Lebanon. Based upon the potential contaminant source inventory (Figures 10-12), areas of highest risk of PFAS would be along NY Route 22/US Route 20 corridor in the Wyomanock and Kinderhook Valleys. Most susceptible wells in this valley setting would be those under fifty feet in depth.

The cost for the routine physical and chemical group with lead has been quoted for $265.00 by a local New York State certified laboratory (the same one utilized by NYSDOH). The quoted cost for doing an EPA Method 533 for 25 PFAS compounds is $800 per sample (including field blank testing). Well owners within the targeted areas discussed above could be solicited for the free testing. For the Town to obtain the results of the testing, a reimbursement program is recommended.

4.1.3 Critical Environmental Areas

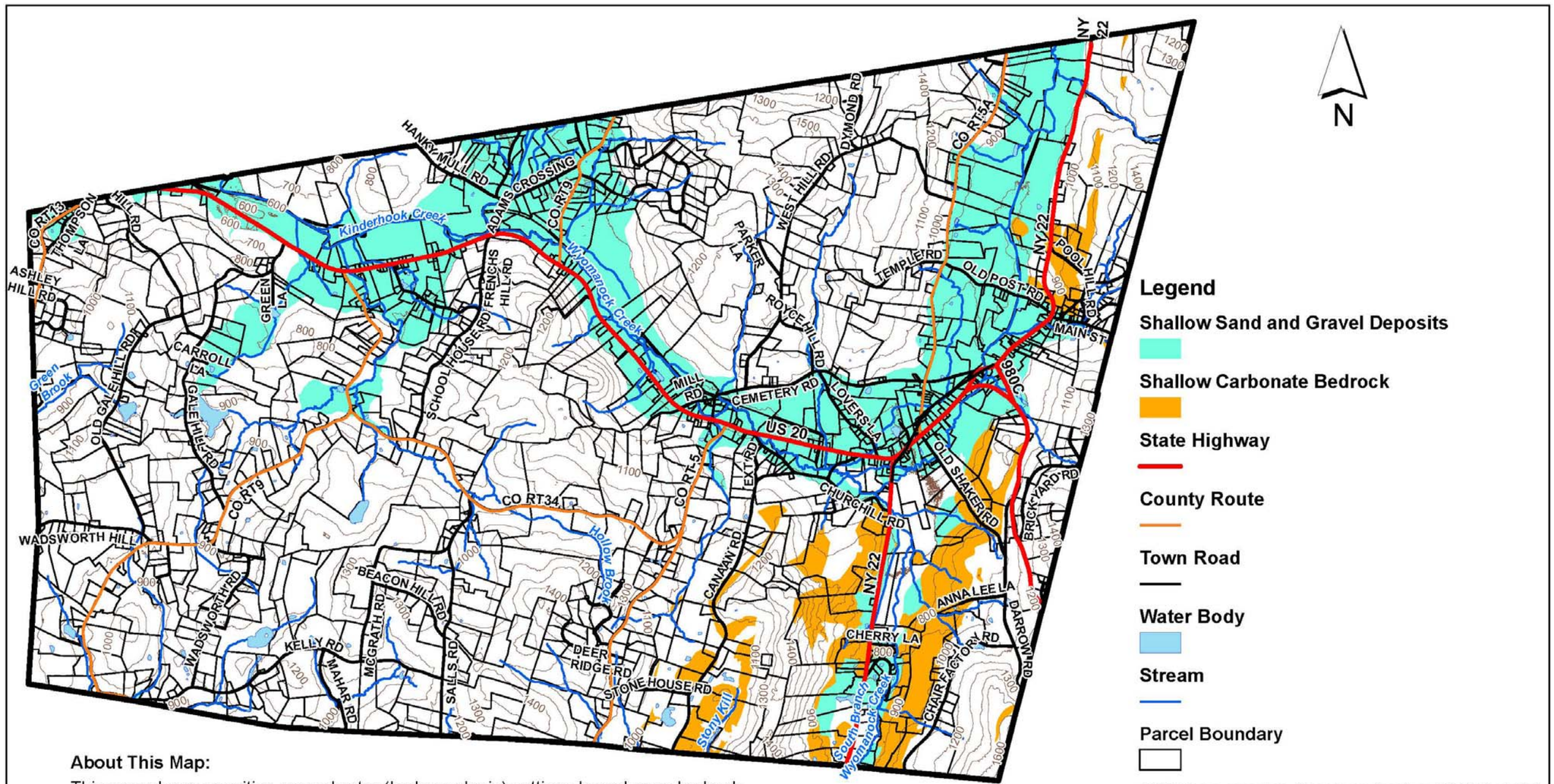
A tool to protect drinking water in New Lebanon is the designation of particularly sensitive groundwater resource areas as Critical Environmental Areas (CEAs). Local governments may designate a CEA under 6 NYCRR 617.14(g) of State Environmental Quality Review (SEQR) regulations. A CEA is an area with exceptional character with respect to one or more of the following:

1. a benefit or threat to human health;
2. a natural setting such as fish and wildlife habitat, forest and vegetation, open space, and areas of important aesthetic or scenic quality;
3. agricultural, social, cultural, historic, archeological, recreational, or educational values; or
4. an inherent ecological, geological, or hydrological sensitivity that may be adversely affected by any change.

Protecting drinking water resources meets criterion one and four above.

CEA designation is meant to raise awareness about the notable features contained within the CEA to landowners, developers, and government agencies. When approving, funding, or directly undertaking an action that may affect the environment under SEQR, an agency of government at the state, county and local level within New York must specifically consider how the proposed action might affect the qualities of the designated area. CEA designation ensures that any potentially harmful impacts to the exceptional or unique features of the CEA are evaluated.

Particularly sensitive groundwater resource areas in New Lebanon that may be adversely impacted by land use changes and could be considered for CEA designation include: a) where carbonate (karst) bedrock is at or near the land surface; and b) where sand and gravel is found at or near the land surface. Figure



About This Map:

This map shows sensitive groundwater (hydrogeologic) settings based upon bedrock, surficial geology, and aquifer mapping completed by Steven Winkley, P.G. of NY Rural Water Association.

Scale

0 1 2 3 Miles

Figure 13
Sensitive Hydrogeologic Settings

13 is a map of these sensitive hydrogeological areas. New Lebanon has designated two CEAs within its boundaries. On May 10, 2022, the Town of New Lebanon passed a resolution designating the contribution area for the Warm Spring as a CEA. On June 14, 2022, the Town approved a second CEA for cool ravines, a regionally rare habitat where steep, rocky ravine walls flank a stream.

4.1.4 Development of a Climate Vulnerability Assessment and Hazard Mitigation Plan

The Town of New Lebanon is working with Cornell Cooperative Extension Service in Columbia County on developing a climate vulnerability assessment. This involves identifying, analyzing, and prioritizing the effects of climate hazards and risks, like flooding, drought, etc. The potential impacts of identified climate hazards to drinking water is one of the steps identified by the Climate Smart Communities (CSC) program. Note that a vulnerability assessment that addressed seasonal drought was prepared by Anthonisen (2020).

Following completion of a climate vulnerability assessment, the Town plans to develop a climate adaptation plan and/or a climate-resilient hazard mitigation plan. The climate adaption plan would address vulnerabilities identified in the climate vulnerability assessment and outline a vision and set of strategies to improve the Town's resilience to climate change. A climate-resilient hazard mitigation plan would define the strategies to be taken to reduce potential exposure and losses identified in the vulnerability assessment. Drinking water impacts from flooding, drought, etc. would be included in the adaptation/mitigation plan. For example, it has been proposed that a water resources contingency plan be developed to ensure the availability of water for drinking, agriculture and use by the Lebanon Valley Protective Association (LVPA) (Hughes & Ahktar, 2021).

4.2 An Implementation Strategy Timeline Table

An implementation timeline allows the Town to organize protection efforts, develop reasonable expectations and encourage completion of the work. The following table (Table 8) is to be used to organize a timeline of protection and implementation efforts.

Identify Protection and Management Methods & Develop an Implementation Strategy Timeline			
Protection Method and/or Management Method	**Goal**	**Project Leader and Partnerships Needed**	**Implementation Timing**
Public Education	Increase the awareness of local landowners, residents, and officials of the importance of protecting and preserving drinking water resources.	Conservation Advisory Council (CAC) NYRWA	Beginning in 2017-2018, effort is on-going
Monitoring and Reporting	Better understand the drinking water quality in Town, identify if contamination from PFAS exists, and determine where to focus additional protection strategies.	Conservation Advisory Council (CAC) NYRWA Town Board	Continuation of work started in 2021. Testing would likely commence in late-2022 and continue to spring 2023
Designation of Critical Environmental Area (CEA) for Groundwater Protection	Protect sensitive groundwater resource areas that could be adversely impacted by land use changes.	Conservation Advisory Council (CAC) NYRWA Town Board	2023
Development of a Climate Vulnerability Assessment and Adaptation/Mitigation Plan	Define the strategies to be taken to reduce impacts on drinking water from flooding, drought, etc.	New Lebanon Climate Smart Communities Task Force NYRWA	2023

Table 8. Implementation Strategy Timeline

5.0 PLAN PROGRESSION AND MAINTENANCE

A Plan Management Team is to implement this plan. Such a team is specifically noted in the New York State draft framework for development of a DWSP2 Plan and will be the CAC. Individuals on the Plan Management Team will keep others updated on the implementation of the protection/management strategies identified in this DWSP2 Plan through progress reports. NYRWA will be available to assist the Town of New Lebanon through the review and DWSP2 Plan implementation process. New York State recommends that a progress report be produced and shared with the Planning Team and other interested agencies/individuals no less than once a year.

Members of the Planning Team, also known as the Stakeholder Group (see Section 1.2), have reviewed this plan, and provided input. Since this plan has not been funded by New York State, it is optional that the draft plan be shared with the NYSDOH and NYSDEC. However, some state grant programs are now offering additional points (i.e., Water Quality Improvement Project Program) for State accepted DWSP2 Plans, and the Climate Smart Communities (CSC) program gives 6-10 points for an accepted source water protection plan.

In the future, New York State recommends that the DWSP2 Plan be reviewed at the same frequency that the municipality has set for updating its adopted comprehensive plan. The plan

should also be amended due to any substantial changes in land use, water quality trends, etc. To remain effective and relevant, the DWSP2 Plan should reflect such changes.

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