BUILD-OUT ANALYSIS

MOULTONBOROUGH BAY & WINTER HARBOR WATERSHEDS

FOR THE LAKE WINNIPESAUKEE ASSOCIATION

April 2020

Prepared By:

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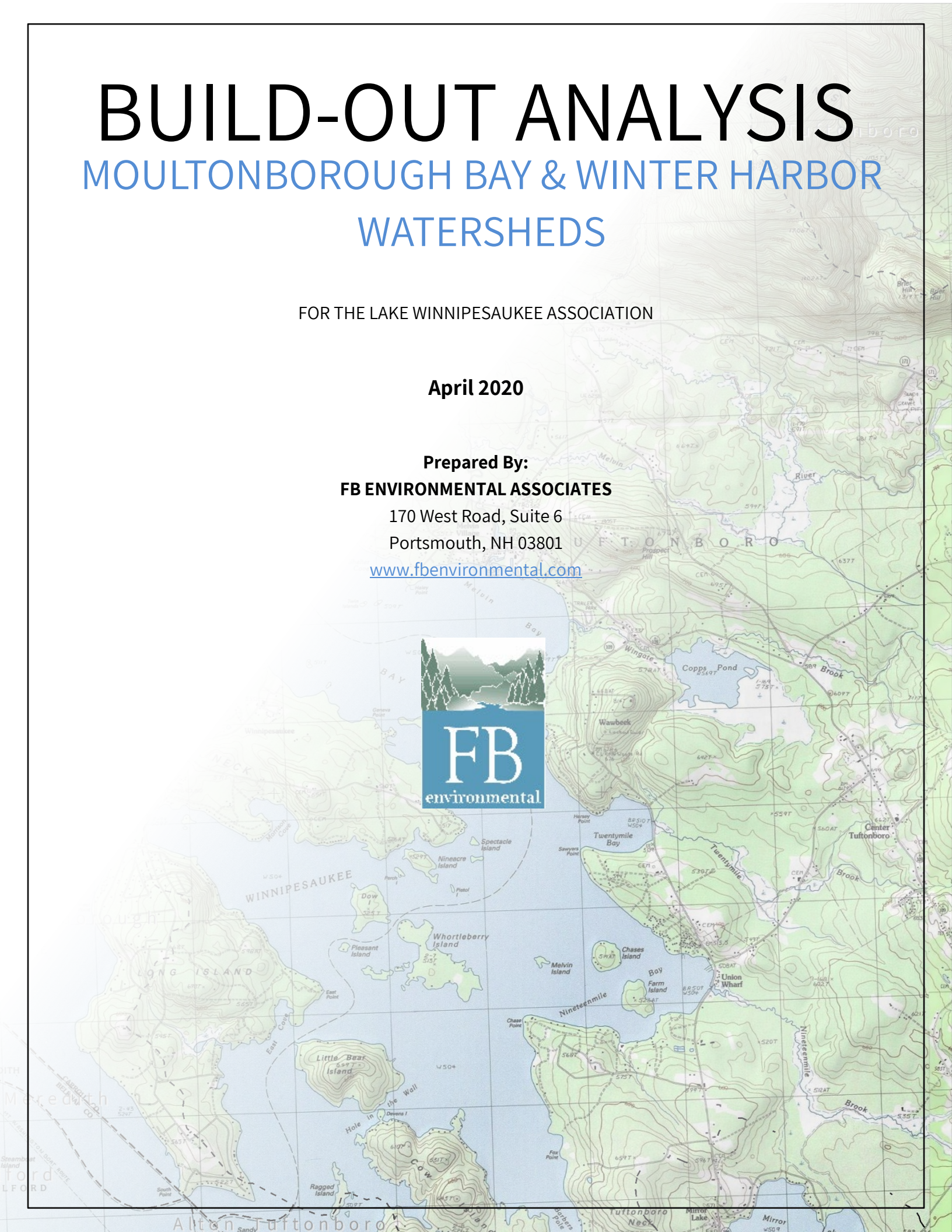

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EXECUTIVE SUMMARY

Concerned with protecting the water quality and ecological integrity of the Moultonborough Bay and Winter Harbor watersheds, the Lake Winnipesaukee Association (LWA) hired FB Environmental Associates (FBE) to perform a build-out analysis of the area as part of the Moultonborough Bay and Winter Harbor Watershed Management Plan Development Project. "Full Build-out" is a theoretical condition which represents the period when all available land suitable for residential, commercial, and industrial uses has been developed to the maximum conditions permitted by local ordinances. A build-out analysis identifies areas with development potential and projects future development based on a set of conditions (e.g., zoning regulations, environmental constraints) and assumptions (e.g., population growth rate). **The results of the build-out analysis can be used as a planning tool to help guide future development activities in a given study area, as well as target specific areas for conservation.** Note that the analyses presented herein provides a full build-out scenario based on Moultonborough, Tuftonboro, and Wolfeboro's current zoning standards which are subject to amendment. Therefore, the results presented herein should be viewed as estimates only[1].

The Moultonborough Bay and Winter Harbor watersheds consist of approximately 5,262 parcels, ranging in size from less than one acre to 830 acres. **The build-out analysis shows that, under current zoning regulations, 56% (16,770 acres) of the Moultonborough Bay and Winter Harbor watersheds is buildable.** The Tuftonboro Low Density Residential zone has the greatest amount of land available for development at 6,817 acres. FBE identified 2,910 existing buildings within the watershed area, and the build-out analysis projected that an additional 6,385 buildings could be constructed in the future, resulting in a total of 9,295 buildings.

Three iterations of the TimeScope Analysis (a tool facilitating analysis of change over time) were run using compound annual growth rates for 20-, 30- and 40-year periods from 1990-2010 (1.41%), 1980-2010 (1.69%), and 1970-2010 (2.23%), respectively. Full build-out is projected to occur in 2102 at the 20-year growth rate, 2089 at the 30-year growth rate, and 2072 for the 40-year growth rate. **This analysis shows that if growth rates, zoning, and other development constraints remain constant, the Moultonborough Bay and Winter Harbor watersheds will attain full build-out by the late 21st century to early-22nd century.**

Buzzell Cove, Moultonborough Bay, New Hampshire. Photo credit: https://lakesregionhome.com/

[1] The town of Ossipee, NH has 32 acres within the Moultonborough Bay and Winter Harbor Watersheds (0.11% of the watershed area) and has not been included in the summary tables.

1. INTRODUCTION

The Lake Winnipesaukee Association (LWA) is developing a Management Plan for the Moultonborough Bay and Winter Harbor Watersheds with assistance from FB Environmental Associates (FBE), funded by the New Hampshire Department of Environmental Services (NHDES). FBE is conducting a Lake Loading Response Model to estimate phosphorus loading for the lake watersheds. As part of this exercise, FBE performed a build-out analysis for the Moultonborough Bay and Winter Harbor watersheds (herein also referred to as "study area"), which provides a powerful educational and planning tool that can be used to inform future planning efforts in the watershed (Figure 1).

A build-out analysis is a computer model of community growth and development that can be used to investigate how much land is available for development, how a community might change in appearance and function over time, and what the potential impacts from future development may be. Performing a build-out analysis shows a locality what land is available for development, how much development can occur, and at what densities. The results of the analysis provide estimates of the numbers of potential lots and new building units the study area may see developed at some point in the future. "Full build-out" refers to the hypothetical time and circumstances in the future whereby no more building construction may occur, or the point at which lots have been subdivided to the minimum size allowed and there is no more "developable" land.

Lake Winnipesaukee, Moultonborough, New Hampshire. Photo credit: FBE

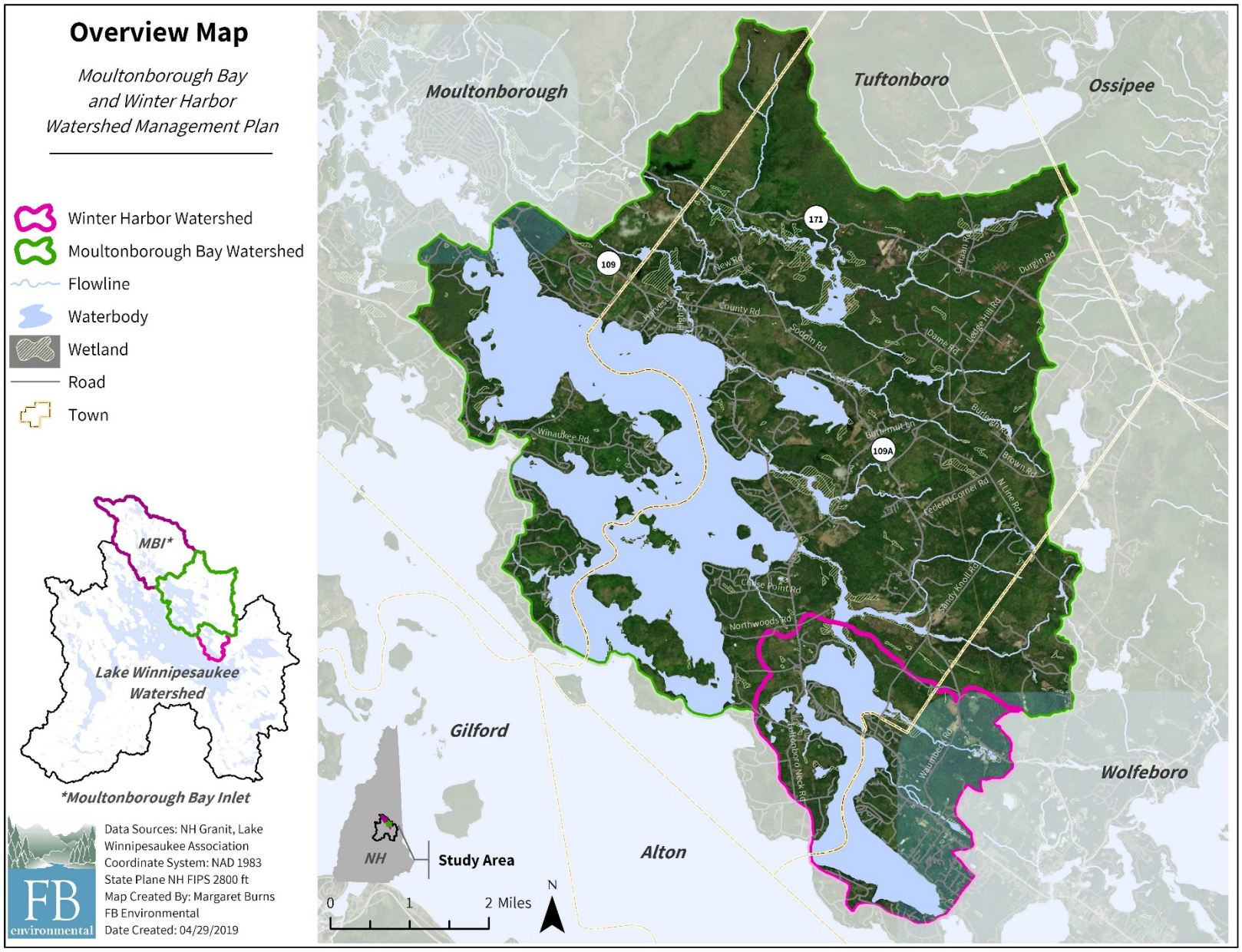

FIGURE 1. The Moultonborough Bay and Winter Harbor watersheds, in the Towns of Moultonborough, Tuftonboro, and Wolfeboro, New Hampshire.

2. METHODS

2.1 COMMUNITY VIZ SOFTWARE

FBE conducted the build-out analysis using ESRI ArcMap v. 10.6.1 geographic information system (GIS) software in conjunction with CommunityViz v.5.2. CommunityViz is a GIS-based, decision-support tool designed to help planners and resource managers visualize, analyze, and communicate important land use decisions. FBE utilized the software's 'Build-out Wizard' to calculate the development capacity of the study area (numerically and spatially), as well as the 'Time Scope Analysis' tool to project and visualize how future development might occur over time.

FBE performed the build-out analysis according to the following general steps:

1. Collect data on existing conditions in the study area: existing buildings, zoning, and growth rates.
2. Collect and/or create relevant GIS data (e.g., development constraints layers such as wetlands and conserved lands).
3. Analyze build-out potential using CommunityViz's Build-Out Wizard tool.
4. Determine potential dates at which full build-out is reached using CommunityViz's TimeScope Analysis tool.

2.2 DISCLAIMER AND DATA LIMITATIONS

Much of the data used in the analysis are publicly available datasets obtained from New Hampshire's Statewide Geographic Information System Clearinghouse (NH GRANIT) online data catalog. Many of these data layers were created from remotely-sensed data (e.g., aerial photography, digital orthophotos, and satellite images) and large, landscape-level mapping projects (e.g., soil units). Due to their inherent levels of accuracy, the data layers were originally intended to be viewed at certain scales (generally 1:24,000 or 1:25,000). NH GRANIT maintains a continuing program to identify and correct errors in these data but make no claims as to the validity or reliability or to any of the implied uses of these datasets. As a result, the data presented herein should be used for planning purposes only. If greater data precision is required, this report should be supplemented with field surveys or other on-the-ground methods of data collection. There may also be minor data discrepancies between datasets used in this analysis due to the variety of source materials and mapping standards used by the original creators of the datasets. The reader is encouraged to refer to the original referenced sources if specific data inconsistencies need to be resolved.

2.3 EXISTING BUILDINGS

FBE used 2016 ESRI World Imagery to create a GIS layer of existing buildings within the study area. Examination of aerial imagery resulted in the creation of a shapefile with 2,910 points representing principal structures (secondary structures were not included) (Figure 2). In areas where it was difficult to discern the presence of a dwelling (typically due to shadows or the presence of trees), ESRI World Imagery was cross-checked using recent Google Earth Imagery.

2.4 ZONING

Crucial to a build-out analysis is the process of modeling zoning requirements to create spatial datasets of development restrictions (Table 1). Moultonborough has one zone within the study area, while Tuftonboro and Wolfeboro have nine and seven zones, respectively. FBE received a Moultonborough zoning map file developed by CAI Technologies from the Town. A Wolfeboro zoning map file was received from the Town as a draft version (Wolfeboro's zoning regulations are currently being updated). For the Town of Tuftonboro, FBE created a zoning

layer by georeferencing[2] a map (PDF version, obtained via email from the Town) with a layer of the Town's parcels. FBE obtained digital tax parcel information for the entire study area from NH GRANIT. Information regarding minimum lot sizes and building setbacks was obtained from each Town's zoning ordinance.

TABLE 1. Base zoning standards used in the build-out for the Towns of Moultonborough, Tuftonboro, and Wolfeboro, NH.

Zone	Front Setback (ft)	Side/Rear Setback (ft)	Minimum Lot Size (sq. ft)	Minimum Lot Size (acres)
Moultonborough				
Residential/Agricultural	50	50	40,000	0.91
Tuftonboro				
Low Density Residential	30	25	87,120	2
Medium Density Residential	30	25	43,560	1
Islands' Conservation	50	20	43,560	1
Lakefront Residential	50	20	43,560	1
Open Space/Forestry	50	40	174,240	4
Neighborhood Business	50	20	43,560	1
Manufactured Housing/Low Density Residential	30	25	87,120	2
Manufactured Housing/Medium Density Residential	30	25	43,560	1
Manufactured Housing/Open Space/Forestry	50	40	174,240	4
Wolfeboro				
Residential	30	25	43,560	1
Rural Residential/Manufactured Housing	30	25	130,680	3
Rural Residential	30	25	130,680	3
Shorefront Residential	30	25	43,560	1
General Residential	30	25	87,200	2
Residential/Agricultural	30	25	217,800	5
Municipal Watershed	30	10	217,800	5

2.5 POPULATION GROWTH RATES

According to the US Census Bureau, Moultonborough, Tuftonboro, and Wolfeboro have experienced steady population growth since the middle part of the 20th century (Table 2), increasing from a combined total of 5,256 people in 1970 to 12,700 people in 2010.

TABLE 2. US Census Bureau population and growth rates for Moultonborough, Tuftonboro, and Wolfeboro, 1970-2010. Data from www.census.gov.

Town	Population					20 yr. Avg. Annual Growth Rate 1990-2010	30 yr. Avg. Annual Growth Rate 1980-2010	40 yr. Avg. Annual Growth Rate 1970-2010
	1970	1980	1990	2000	2010			
Moultonborough	1,310	2,206	2,956	4,484	4,044	1.58%	2.04%	2.86%
Tuftonboro	910	1,500	1,842	2,148	2,387	1.30%	1.56%	2.44%
Wolfeboro	3,036	3,968	4,807	6,083	6,269	1.34%	1.54%	1.83%
Combined	**5,256**	**7,674**	**9,605**	**12,715**	**12,700**	**1.41%**	**1.69%**	**2.23%**

[2] Georeferencing is aligning geographic data to a known coordinate system so it can be viewed, queried, and analyzed with other geographic data. Georeferencing may involve shifting, rotating, scaling, skewing, and in some cases warping, rubber sheeting, or orthorectifying the data.

2.6 DEVELOPMENT CONSTRAINTS

To determine where development may occur within the study area, the build-out analysis first subtracts land unavailable for development due to physical constraints, including environmental restrictions (e.g., wetlands, conserved lands, hydric soils), zoning restrictions (e.g., shoreland zoning, street Right-of-Ways (ROWs), and building setbacks), and practical design considerations (e.g., lot layout inefficiencies). Existing buildings also reduce the capacity for new development (Figure 2, p.7).

FBE created the development constraints dataset by obtaining hydric soils and steep slopes data the SSURGO Database, Conserved Lands data from NH GRANIT, waterbody, watercourse data from the National Hydrography dataset, and wetlands data and National Wetlands Inventory. Specific development constraints are as follows:

- **Building setbacks** were estimated based on the average front and rear setbacks specified by the zoning ordinances (Table 1). Setbacks are measured from building center points in CommunityViz. To account for this, building footprints need to be estimated to avoid building overlap. FBE estimated the dimensions of the minimum building footprint to be 35 feet x 35 feet. This number was added to the average front/rear setback for each zone to estimate the "Minimum Separation Distance" used in CommunityViz.
- **Minimum lot size requirements** used were based on requirements for each zone (Table 1). Future lots were made the smallest size allowable for the zoning district, and unit types (e.g., residential house, commercial building) were not specified.
- **Conserved Land** parcels were treated as unbuildable.
- **Hydric soils** and **steep slopes** (25% and greater) were treated as unbuildable.
- **Waterbodies** and **watercourses** buffered to 75 feet were treated as unbuildable.
- **Wetland areas** were treated as unbuildable.

The above list does not represent the full range of possible restrictions or resources that may be found in the field. For example, rare and/or state-listed species may be present but no data regarding their specific location(s) are available. Small, unmapped wetlands and watercourses may also be present that would further restrict development.

Building density is difficult to predict with precision in the build-out analysis because the exact siting of construction and development occurs in a somewhat unpredictable fashion. A wide range of factors can decrease the allowed density: stormwater drainage facilities, parcel contiguity, ROWs, setbacks, road frontage, conservation restrictions, etc. A standard approach to account for these density losses is to use an "efficiency factor," a simple multiplier that adjusts the "lot efficiency," the amount of land on a parcel that is available for construction after addressing all constraints. Efficiency factors are useful for areas where the Code or Comprehensive Plan allows for development densities that might not be practically achieved. Efficiency factors are entered as a percentage, where 100% means complete efficiency (no density lost) and 0% means no buildings are estimated for a zone. FBE used an efficiency factor of 66% for all zones based on prior experience.

2.7 TIMESCOPE ANALYSIS

The TimeScope Analysis is a computer model of community growth that simulates change over time in a study area. In this analysis, each projected building within the study area is assigned a future build date based on the population growth rate for the study area. FBE used compound annual growth rates representing 20-, 30-, and 40-year periods, from 1990-2010 (1.41%), 1980-2010 (1.69%), and 1970-2010 (2.23%), respectively, to run three iterations of the TimeScope analysis for the study area. The projections also provide a date of when full build-out is attained based on each population growth rate.

This tool provides an analysis of how the number of buildings within the Towns of Moultonborough, Tuftonboro, and Wolfeboro may increase in tandem with projected population increases, but it does not take into account

zoning amendments or other factors affecting development that may occur in the future. These unforeseen or unpredictable factors may lead to increases or decreases in population and development. It is also important to note that the growth rates used in the TimeScope Analysis are based on town-wide census statistics. Using census data to project population increase and/or development has the inherent limitation of extrapolating future growth based on past conditions. As such, the TimeScope Analysis might over- or underestimate the time required for the study area to reach full build-out. Numerous social and economic factors influence population change and development rates, including policies adopted by federal, state, and local governments. These relationships among the various factors may be complex and therefore difficult to model.

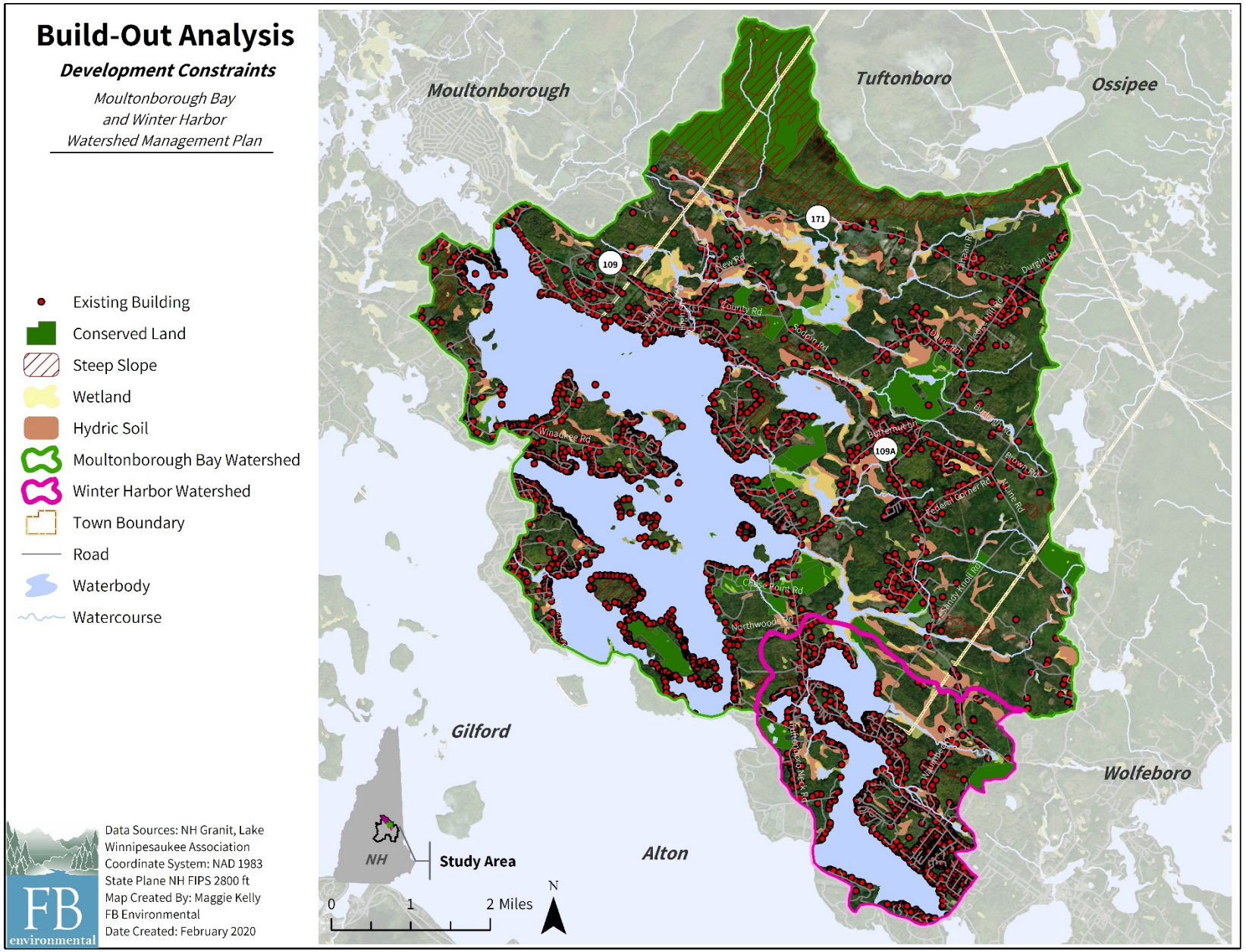

FIGURE 2. Development constraints (including existing buildings) in the Moultonborough Bay and Winter Harbor watersheds.

3. RESULTS

3.1 PARCELS AND ACREAGE

The Moultonborough Bay and Winter Harbor watersheds consist of approximately 5,262 parcels, ranging in size from less than one acre to 830 acres. Moultonborough, Tuftonboro, and Wolfeboro haves 4,690, 18,943, and 6,080 acres within the study area, respectively.

3.2 BUILDABLE AREA

The build-out analysis showed that 56% (16,770 acres) of the study area is buildable under current zoning regulations. The Tuftonboro Low Density Residential zone has the most acreage of land available for development, having 6,817 acres of its total 11,645 acres available. (Table 3, Figure 4). The Wolfeboro Rural Residential District has the highest percentage (72%) of buildable land within the study area.

TABLE 3. Amount of buildable land within the Moultonborough Bay and Winter Harbor watersheds.

Zone	Total Area (Acres)	Buildable Area (Acres)	Percent Buildable Area
Moultonborough			
Residential/Agricultural	4,690	2,406	51
Tuftonboro			
Low Density Residential	11,645	6,817	59
Medium Density Residential	1,963	1,294	66
Islands' Conservation	630	214	34
Lakefront Residential	867	293	34
Open Space/Forestry	2,891	1,227	42
Neighborhood Business	346	234	68
Manufactured Housing/Low Density Residential	487	235	48
Manufactured Housing/Medium Density Residential	51	8	16
Manufactured Housing/Open Space/Forestry	63	37	59
Wolfeboro			
Residential	1,435	813	57
Rural Residential*	3,717	2,663	72
Shorefront Residential	382	208	54
General Residential	452	318	70
Residential/Agricultural	71	3	4
Municipal Watershed	23	2	9
Total	**29,713**	**16,772**	**56**

**Wolfeboro Rural Residential Zone includes Manufactured Housing Overlay.*

Note: The portion of the watershed in the Town of Ossipee is not included in the summary tables. This portion is 32 acres and composes 0.11% of the watersheds.

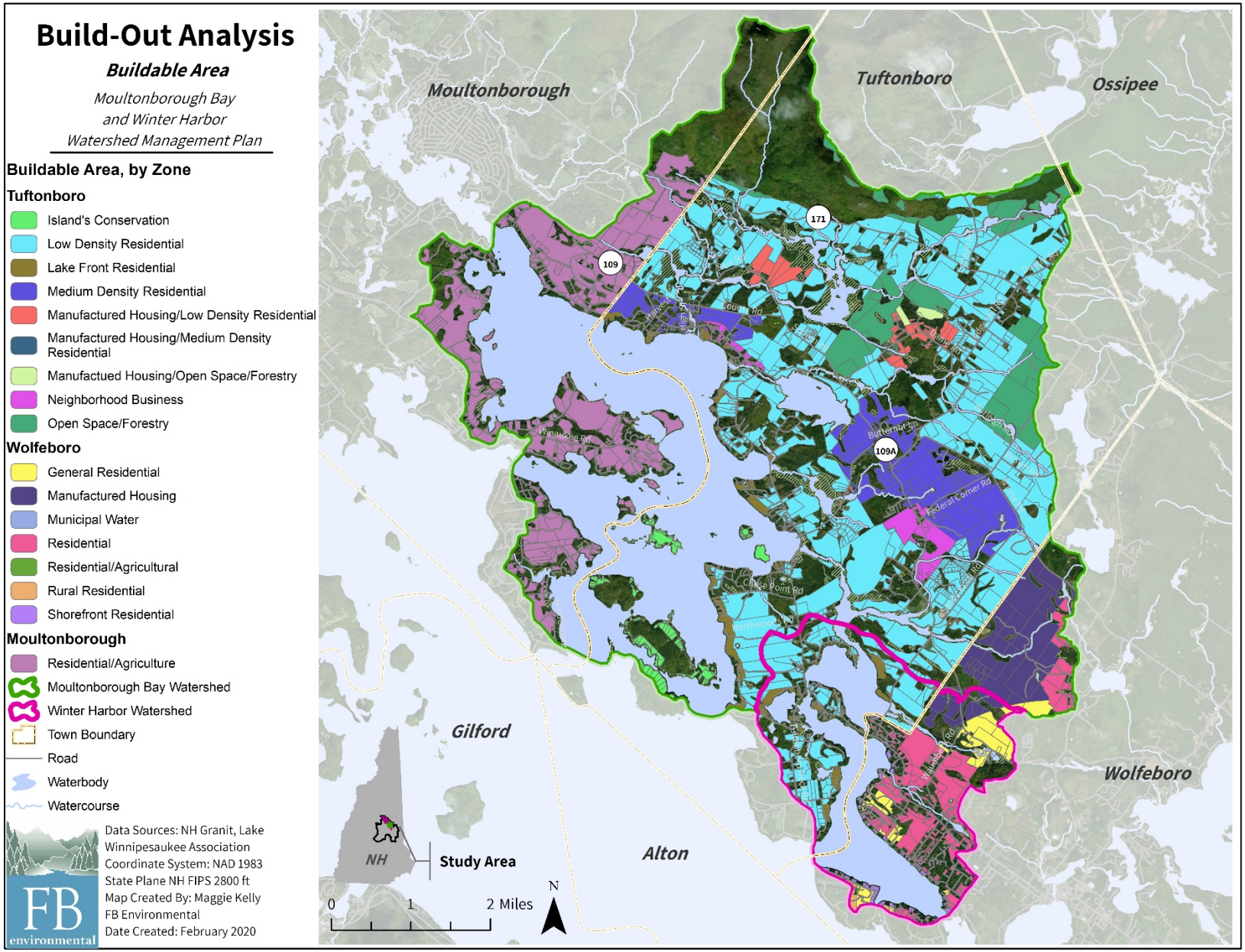

FIGURE 3. Buildable area in the Moultonborough Bay and Winter Harbor watersheds.

3.3 PROJECTED BUILDINGS

The existing buildings layer identified 2,910 principal buildings. Based on the current input parameters, the build-out analysis projected that an additional 6,385 buildings could be constructed in the future, resulting in a total of 9,295 buildings (Table 4, Figure 5). Tuftonboro's Low Density Residential zone has the largest number of projected buildings at 2,177 buildings. The Open Space/Forestry zone in Tuftonboro has the highest percent increase from existing buildings to projected buildings at 4,725%.

TABLE 4. Projected increase in buildings by zone within the Moultonborough Bay and Winter Harbor watersheds.

Zone	No. Existing Buildings	No. Projected Buildings	Total No. Buildings	Percent Increase
Moultonborough				
Residential/Agricultural	733	1,562	2,295	**213**
Tuftonboro				
Low Density Residential	557	2,177	2,734	**391**
Medium Density Residential	276	769	1,045	**279**
Islands Conservation	171	191	362	**112**
Lakefront Residential	429	224	653	**52**
Open Space/Forestry	4	189	193	**4,725**
Neighborhood Business	81	151	232	**186**
Manufactured Housing/Low Density Residential	44	81	125	**184**
Manufactured Housing/Medium Density Residential	8	16	24	**200**
Manufactured Housing/Open Space/Forestry	3	5	8	**167**
Wolfeboro				
Residential	326	574	900	**176**
Rural Residential*	127	230	357	**181**
Shorefront Residential	139	96	235	**69**
General Residential	12	120	132	**1,000**
Total	**2,910**	**6,385**	**9,295**	**219**

**Wolfeboro Rural Residential Zone includes Manufactured Housing Overlay.*

The Municipal Watershed and Residential Agricultural Zone have small buildable area and no projected buildings.

**The portion of the watershed in the Town of Ossipee is not included in the summary tables. This portion is 32 acres and composes 0.11% of the watershed.*

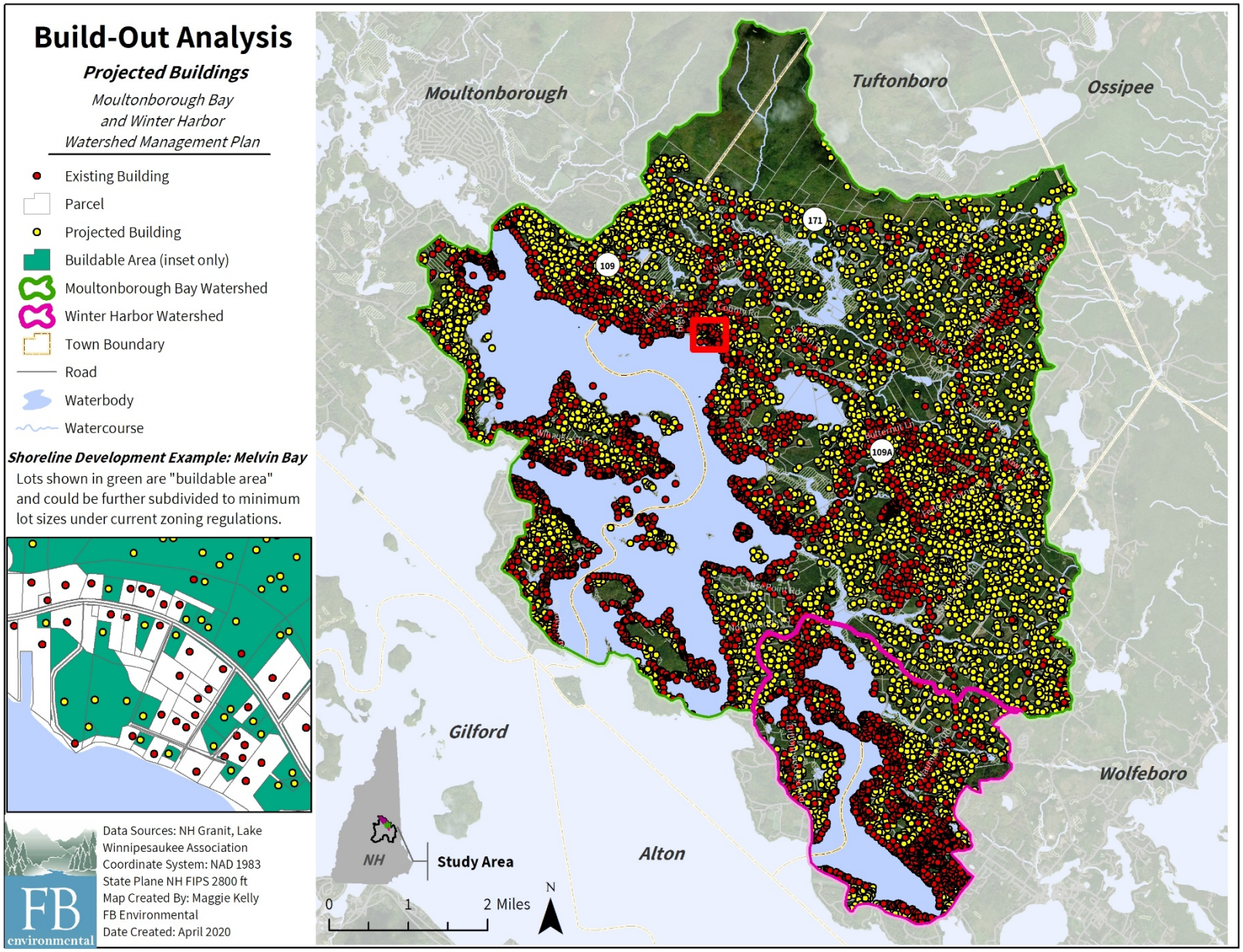

FIGURE 4. Projected buildings in the Moultonborough Bay and Winter Harbor watersheds.

3.4 TIMESCOPE ANALYSIS

Three iterations of the TimeScope Analysis were run using compound annual growth rates (CAGR) for 20-, 30- and 40-year periods from 1990-2010 (1.41%), 1980-2010 (1.69%), and 1970-2010 (2.23%), respectively (Table 2). Full build-out is projected to occur in 2102 at the 20-year growth rate, 2089 at the 30-year growth rate, and 2072 for the 40-year growth rate. This analysis shows that if growth rates, zoning, and other development constraints remain the same, the Moultonborough Bay and Winter Harbor watersheds will be fully built out by the late 21st century to early-22nd century.

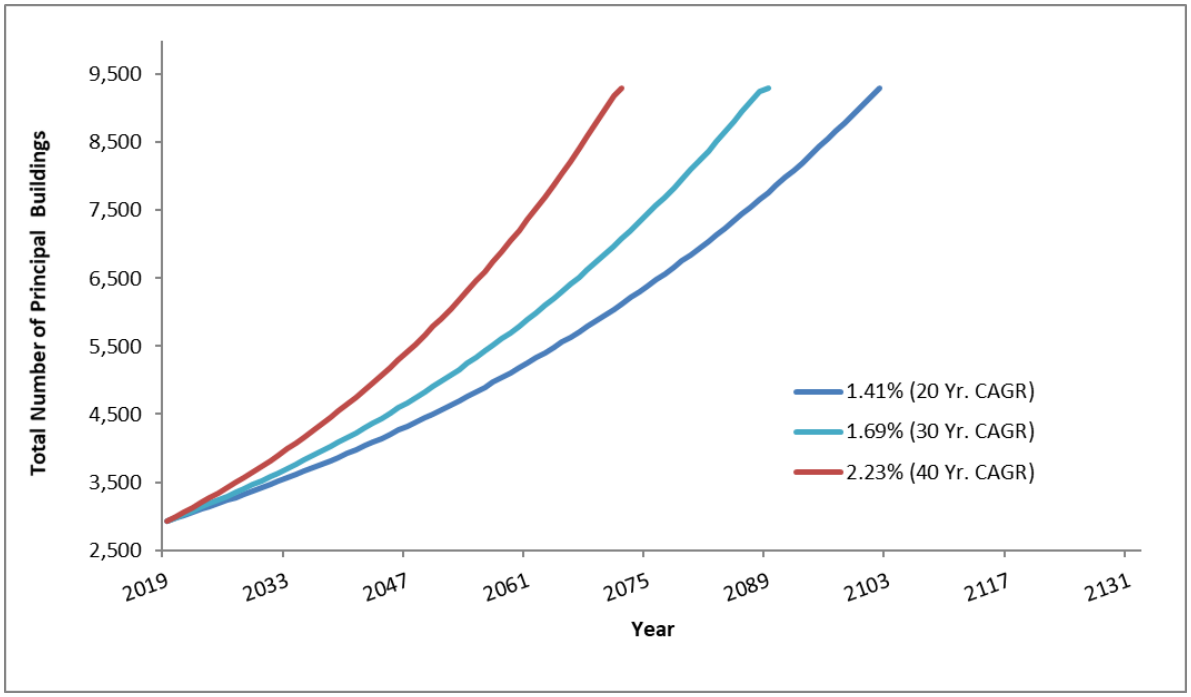

FIGURE 5. Full build-out projections of the Moultonborough Bay and Winter Harbor watersheds (based on compound annual growth rates reported in Table 2).

4. REFERENCES

Moultonborough (2019). Zoning Ordinance for Moultonborough, NH. Revised March 12, 2019.

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