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Stream Buffer Characterization Study

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A Final Report to

The New Hampshire Estuaries Project

Submitted by

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NewHampshire EstuariesProject

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Executive Summary

The Complex Systems Research Center at the University of New Hampshire conducted a characterization of 2nd order and higher streams within the Piscataqua/Coastal Basin of New Hampshire. GIS and remote sensing data archived in the NH GRANIT database were used to map a suite of anthropogenic factors, including land use, impervious surface coverage, and transportation infrastructure, within standard buffers around each stream segment. These factors were then analyzed to produce a categorical indicator representing the status of each stream.

The indicator categories, established with guidance from a project advisory committee, reflect the degree to which each buffer was impacted by human activity. Based on the percent of buffer land area mapped as developed (including gravel pits and quarries), transportation, or agricultural land (including old fields and other cleared land), the categories are as follows:

Category	Decision Rule
Intact	<10% impacted
Mostly Intact	10-25% impacted
Somewhat Modified	25-50% impacted
Altered	>50% impacted

Processing began using hydrography data to identify perennial streams/rivers of order 2 or higher. Each stream segment was buffered by 150' to support water quality analyses and by 300' to support wildlife habitat analyses, and the buffers were then combined with land use data derived from 1998 USGS Digital Orthophotoquads. Finally, the buffer/land use composites were categorized using the project decision rules listed above.

The resulting analysis showed that there were 25,279 acres within the 150-ft. stream buffers, representing 3.6% of the total mapped area of 759,673 acres. The percent of total land acreage in each category was as follows: Intact, 2.3%, Mostly Intact, 0.7%, Somewhat Modified, 0.4%, and Altered, 0.2%. Within the 300-ft. stream buffers, there were 52,037 acres (7.3% of the total mapped area). Here, 3.9% of the land acreage was categorized as Intact, with 1.6% Mostly Intact, 1.3% Somewhat Modified and 0.6% in the Altered category.

Existing impervious surface data was summarized at the town level, showing that the extent ranged from 4.4% of the land area in 1990 to 6.4% in 2000 to 7.5% in 2005. The percent of each 300-ft. buffer mapped as impervious in 2005 was also derived for map display purposes. Finally, conservation lands (level 1, 2, or 2A) were tallied, by town, for the entire study area. The total acreage of protected lands was 75,596 or 10.7% of the land within the project area.

Project results were presented on community-based, large format maps displaying the stream characterizations and the corresponding acreage tables. In addition, the data have been made available as digital data layers archived in the GRANIT database. These results deliver a valuable resource to the coastal management community by establishing a baseline for developing and prioritizing future stream level protection measures.

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Introduction

Protective corridors, or buffer zones, around streams, lakes, and other surface water features are an important planning tool in helping to protect stream water quality and aquatic habitat. Left in a vegetated state, buffers serve a number of important and well-documented services and functions, including filtering and removing pollutants from stream channels, controlling streambank erosion, providing wildlife habitat, providing water storage and floodplain protection measures, shading streams from excessive heat, and delivering recreational opportunities. And they provide these services in both urban and rural settings.

The NH Estuaries Project has launched an aggressive campaign to educate coastal watershed towns about the importance of buffers and the need to enhance local buffer protective measures. The outreach effort includes a presentation that assists communities in assessing buffer characteristics and buffer protections in their town. The stream buffer characterization project provides an important resource to the NHEP and coastal towns by assessing the degree of human impact on stream segments and their corresponding buffers. Further, it provides an opportunity for towns to measure and monitor changing buffer conditions in the future.

More generally, municipalities across the state are becoming increasingly familiar with geospatial tools and the kinds of analyses they can deliver. With this widespread acceptance has come a request from many constituencies for better data, more sophisticated analyses, and always, more map output.

Project Goals and Objectives

The primary goal of the Stream Buffer Characterization Study was to characterize 2nd order and higher streams within the Piscataqua/Coastal Basin of New Hampshire to reflect the degree to which each stream has been impacted by human activity. Human impact was assessed by relying on a suite of GIS and remote sensing data sets archived in the NH GRANIT database, including land use, transportation infrastructure, and impervious surface coverage.

Project tasks included:

1. With the assistance of a project advisory team, develop a set of project protocols to guide the mapping and analysis activities, including:

    - data pre-processing – extracting and coding the stream subset
    - establishing standard buffer widths for water quality and wildlife buffers
    - establishing decision rules to govern assignment of categorical rankings based on the land use data
    - incorporating impervious surface and conservation data layers;

2. Derive buffered data sets and apply decision rules to generate categorical rankings; and
3. Produce town-based maps presenting the streams symbolized by the categorical rankings and with associated data summaries by town.

By establishing the basic condition of coastal area stream buffers, the project directly addressed the following NHEP Action Plans:

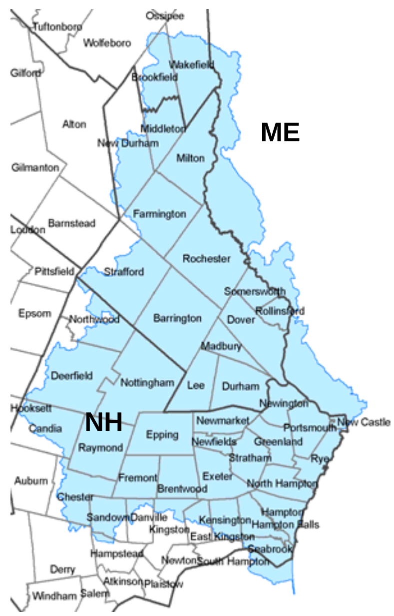
- LND-2: Implement steps to limit impervious surface cover and protect streams at the municipal level; and
- LND-14: Develop and implement an outreach program to encourage and assist communities in developing and adopting land use regulations to protect undisturbed shoreland areas.

Methods

a. Project Study Area

The project study area comprised the 48 towns that are wholly or partially within the Piscataqua/Coastal Basin of New Hampshire (see Figure 1). The analysis area extended across 759,673 acres in the coastal area of the state.

Figure 1. Project study area - Piscataqua/Coastal Basin in New Hampshire, HUC 01060003.



b. Data Sources

The stream characterization project relied on a number of data layers archived in the GRANIT database (www.granit.sr.unh.edu), as maintained by Complex Systems Research Center. The data sets utilized in the analysis included:

- Hydrography – based on New Hampshire National Hydrography Dataset (1:24,000). Also utilized 1:24,000 basic surface water layer for stream orders;
- Land Use – derived from 1998 Digital Orthophotoquads (1:12,000);
- Impervious Surfaces – derived from 1990, 2000, and 2005 Landsat Thematic Mapper Imagery using subpixel processing techniques; and
- Conservation Lands – based on April, 2006 update of Conservation/Public Lands data layer.

The 1998 land use data that formed the basis of the buffer characterization component was available for Rockingham County, Strafford County, and Brookfield/Wakefield in Carroll

County. Land use data development was required for small portions of the towns of Wolfeboro and Alton in order to provide full coverage of the project study area.

Additional data layers, including the 1998 Digital Orthophotoquads, town bounds, and road centerlines, were used in the map production phase of the project.

c. Project Protocols

A number of project protocols were developed to define the data preprocessing phase of the effort. These guidelines, described more fully below, defined the basic unit of analysis as 2^{nd} order and higher perennial streams based on "confluence to confluence" segments. The guidelines further described the assignment of unique codes to each stream segment. (While codes are associated with the NHNHD data, these codes are not unique confluence to confluence, and therefore could not be used for this project.) In addition to ID's, a variety of other stream data pre-preprocessing issues were incorporated in the protocols, e.g. treatment of islands, treatment of divergent paths, etc.

Protocols for the analysis phase of the project were also developed. These identified the size of the buffers to be generated, the classification of the land use within those buffers into qualitative categories, and the incorporation of conservation lands and impervious surface data in the analysis.

Generally, project protocols were initially drafted by GRANIT staff based on characteristics of the project data and access to GIS tools. A project advisory committee, with representatives from regional and state organizations (see Table 1), reviewed and revised the guidelines. The team provided valuable input both in finalizing the data protocols and in establishing map output parameters.

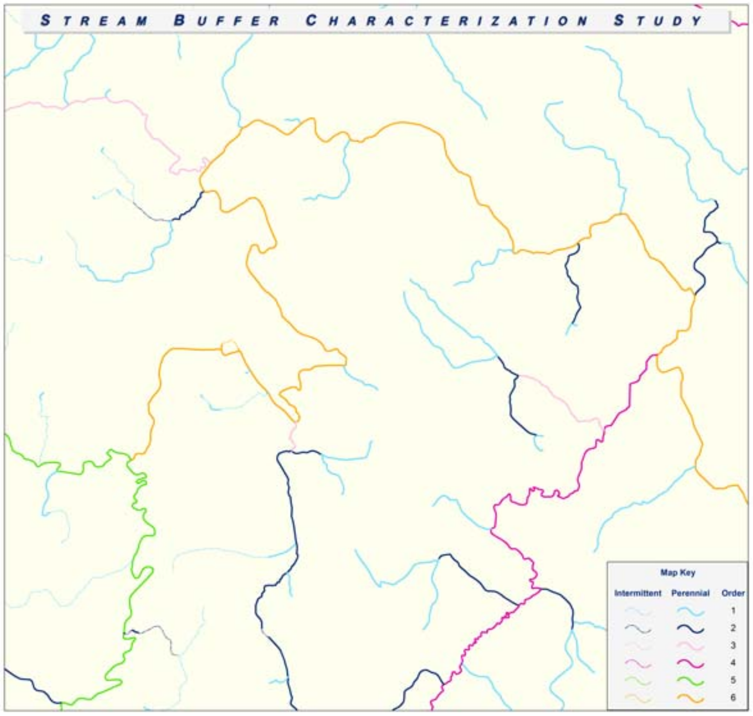
Table 1. Stream buffer characterization Project Advisory Committee.

Name	Affiliation
Jodi Castallo	NH Estuaries Project
Jennifer Hunter	NH Estuaries Project
David Wickliffe	Rockingham Planning Commission (formerly)
Dale Abbott	Strafford Regional Planning Commission
Jay Odell	The Nature Conservancy
Frank Mitchell	UNH Cooperative Extension
Alyson Eberhardt	UNH Jackson Lab

d. Data Processing and Analysis

The primary data set used in the analysis was the 1:24,000-scale New Hampshire National Hydrography Dataset (NHNHD). This data contains detailed information for individual stream reaches. However, in its native form, it lacks the stream order designations required to subset 2^{nd} order and higher streams. It was therefore necessary to move or "conflate" stream orders from a secondary surface water dataset to the NHNHD. This task was completed using ArcGIS tools to transfer data attributes based on network analysis and spatial locations (see Figure 2).

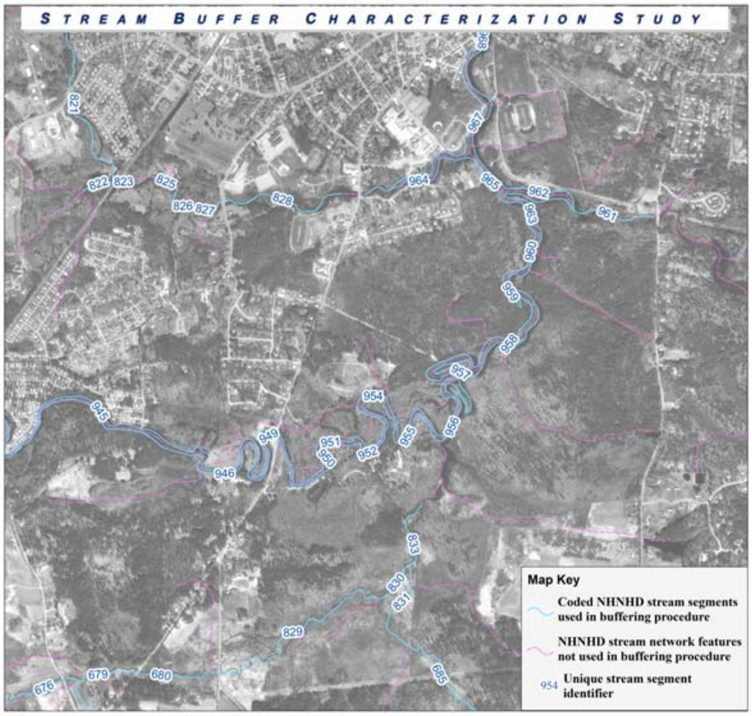
Figure 2. NHNHD data with stream orders conflated.



Once the stream order conflation was completed, the next step in the processing was to select perennial, 2nd order and higher streams and rivers from the parent data set. Initially, these features resided in both single line and double line feature classes, where the double line features were those streams wide enough to be represented as area features or polygons. The polygons were converted to linear features and incorporated into the single line feature class. The resulting dataset comprised the body of streams and rivers that would ultimately undergo the buffering procedure (henceforth referred to as the "focus dataset").

The next step involved coding each stream segment or "reach" to create unique identifiers that could be used to link the derived buffers with the original NHNHD data set. Each reach in the focus dataset was generated based on confluence to confluence stream segments (see Figure 3). Streams of any order, perennial or intermittent, that joined or entered other streams created the confluences. For reaches that originated from single line segments, coding was a simple matter of incrementing the id as other streams joined the subject arc, and assigning the NHNHD segment identifier to that reach. Figure 4 illustrates an example of this coding structure as we see intermittent/1st order streams creating a confluence that causes segment 470 to increment to segment 471.

Figure 3. Stream coding based on confluence to confluence segments.



The procedure for coding reaches generated from double line streams was not as straightforward. As shown in Figure 4, double bank streams are represented in the original NHNHD by a centerline or “artificial path”. In these cases, the arc in the focus dataset received its segment identifier from the NHNHD artificial path identifier. Because the NHNHD was created from data at various scales (e.g. 1:24,000 and 1:100,000), cases occurred where confluences as defined by this project did not match those of the NHNHD dataset. In those instances, the NHNHD identifier from the longest artificial path was transferred to the focus dataset. Again, confluences in the focus dataset were created by streams of any order, perennial or intermittent, entering or joining the segment at issue. Figure 4 also shows examples of confluences created in double line streams (see segments 1118 and 1119 separated by the confluence of segment 1117). It is important to note that the opposite bank was also split and coded to match the near bank (or bank where the entering stream creates the break).

Additional rules were applied to the focus dataset as coding of the stream segments progressed. Based on the project guidelines, islands less than 3 acres were not eligible for buffering and therefore were not coded (see Figure 4). Figure 5 provides examples of braided stream segments. As shown, these features did not create confluences, and therefore maintained the same id’s as adjoining features. Another issue addressed by the guidelines involved inlets. The rules stipulated that the banks of inlets greater than 250 ft. be treated as separate reaches (see Figure 6). Finally, the banks of double line streams, or rivers, greater than 1,000-ft. wide were coded as separate entities.

Figure 4. Stream coding – application of confluence and island rules.

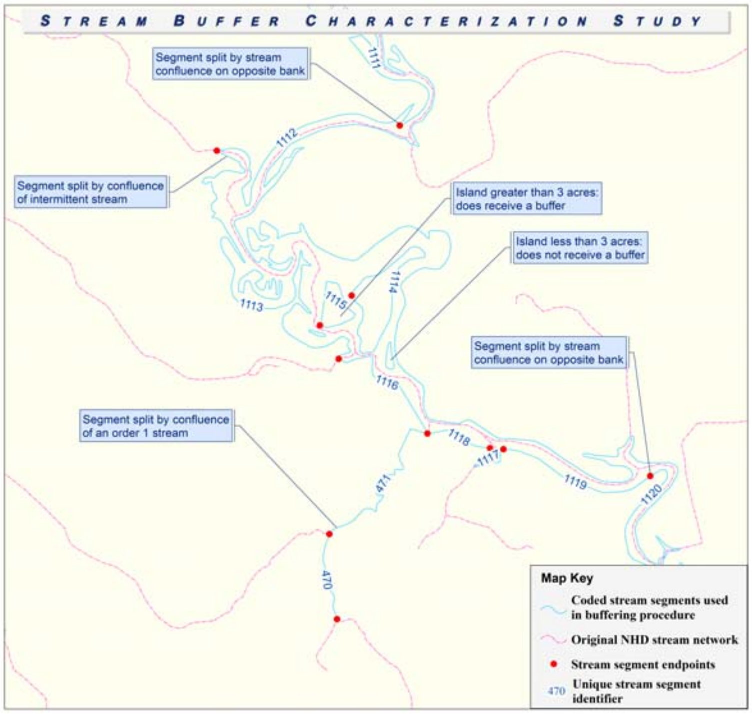


Figure 5. Stream coding – application of braided stream rules.

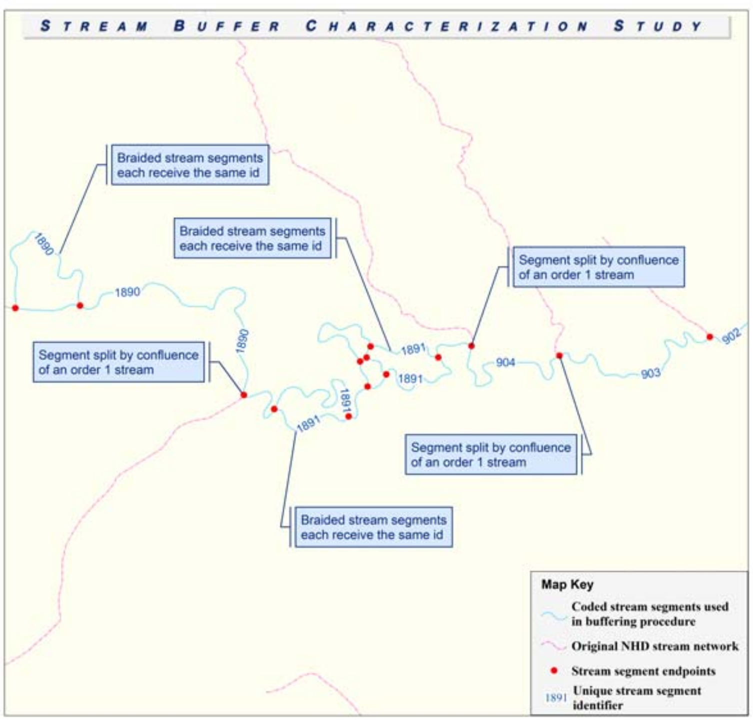
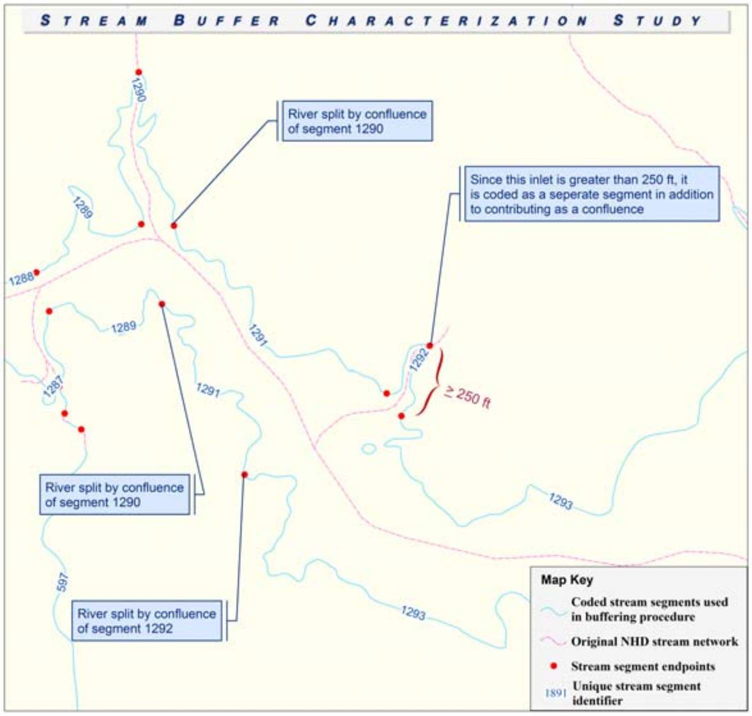


Figure 6. Stream coding – application of inlet rules.



The last aspect of the coding process required identifying which bank of double line streams was to be buffered. This identifier (LEFT or RIGHT) was used to force ArcGIS to buffer the upland side of each bank. (Because the focus dataset was derived from the NHNHD, stream banks were initially oriented such that the start of each arc was upstream from the end point and therefore, each LEFT/RIGHT identifier was oriented based on the downstream flow of the segment.)

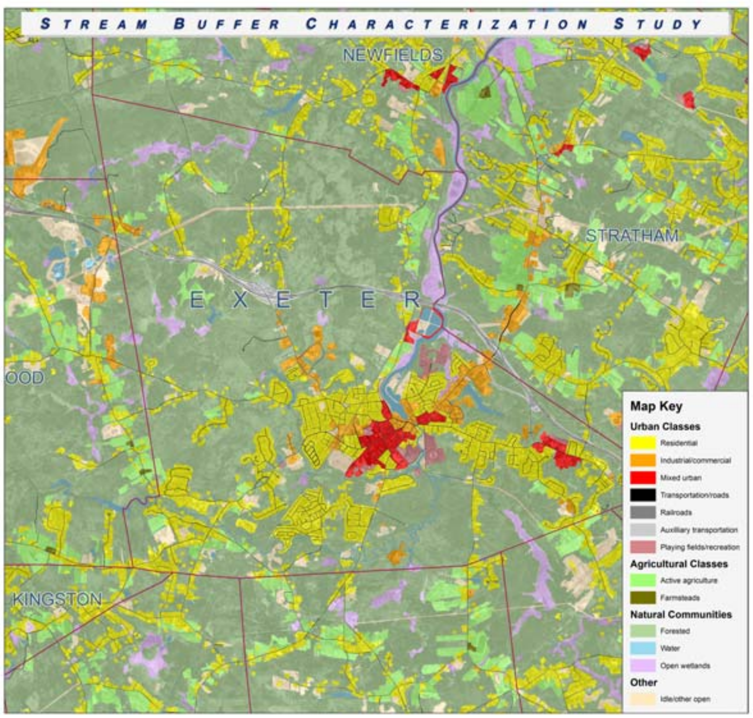
The buffering itself proceeded on an individual stream segment basis. Each segment of the focus dataset was buffered in both 150-ft. and 300-ft. increments. The 150-ft. buffer was selected to support water quality analyses, based on the NH Comprehensive Shoreland Protection Act, RSA 483-B. The 300-ft. buffer was chosen to support typical wildlife habitat analyses.

Results from the buffering iterations were combined into a final dataset, with the individual stream segment codes retained in the composite. Due to the complexity of the final dataset, the data was further processed to remove obvious errors/problem and to create a more meaningful and appropriate product. One of the common editing tasks eliminated buffers from the bank of a double line stream that extended to the upland of the opposite bank. These areas were deleted from the final dataset, as the opposite bank received its own buffer treatment. Regions of buffers that overlapped small islands (< 3 acres) were also eliminated, as were regions of buffers that extended into neighboring states.

As described above, stream reaches were identified, attributed, and buffered based on their extent from confluence to confluence. These procedures occasionally yielded very short stream segments and therefore relatively small buffers. It is also worth noting that because only 2nd order and higher perennial streams were analyzed, some discontinuities exist in the input data set and thus in the buffers.

The final buffer dataset, comprising both 150-ft. and 300-ft. buffers, was combined with the land use data layer (see Figure 7) so that the stream buffers could be characterized relative to their degree of disturbance or modification by human activities. This was accomplished by unioning the two datasets, thereby producing a single layer containing land use by stream buffer segment. At points of confluence and in other locations where buffers overlapped, the most impacted category was assigned to the overlap area.

Figure 7. Illustration of land use data set for area in vicinity of Exeter, NH.



Next, land use acreage within each stream buffer segment was summarized to capture the general condition of the buffer. A single category was then assigned to each buffer, reflecting the percent of land area mapped as either developed (including gravel pits, quarries, etc.), transportation, or agricultural land (including old fields and other cleared lands). Table 2 presents the decision rules used to determine the buffer categories.

Finally, the 300-ft. stream buffers were unioned with impervious surface data to determine the degree of imperviousness within each buffer. (This analysis was produced exclusively for the 300-ft. buffers due to the relative coarseness of the impervious surface dataset.) Two classes were used to characterize the imperviousness metric: less than 10-percent and greater than 10-percent.

Table 2. Decision rules used to categorize stream buffers.

Category	Decision Rule
Intact	<10% impacted
Mostly Intact	10-25% impacted
Somewhat Modified	25-50% impacted
Altered	>50% impacted

Figure 8 displays the 150-ft. and 300-ft. buffers overlain on the land use data for several stream reaches in the vicinity of Exeter, NH. Figure 9 presents the buffers categorized into the four "impact" categories for the same area. The image includes the impervious surface summary data for the 300-ft. buffers.

Figure 8. Land use within buffers for area in the vicinity of Exeter, NH.

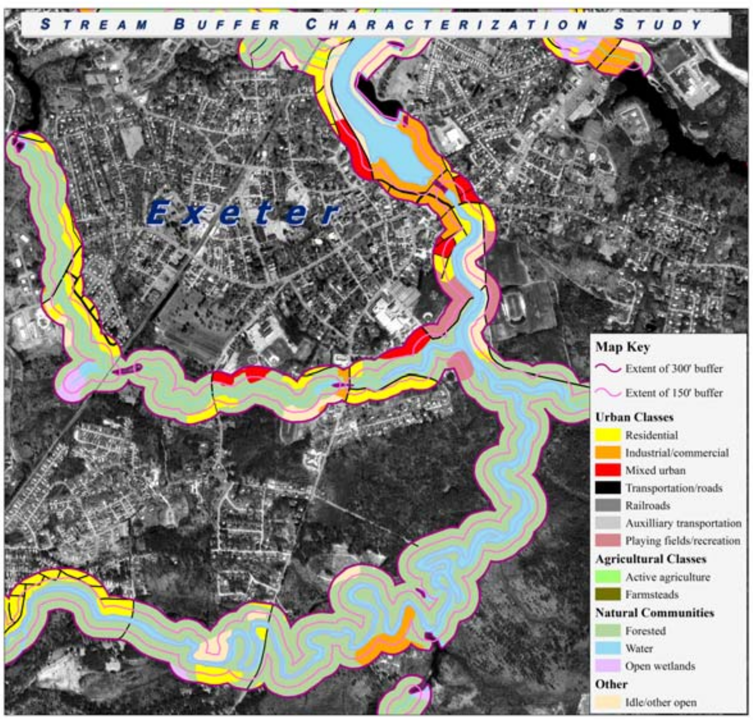
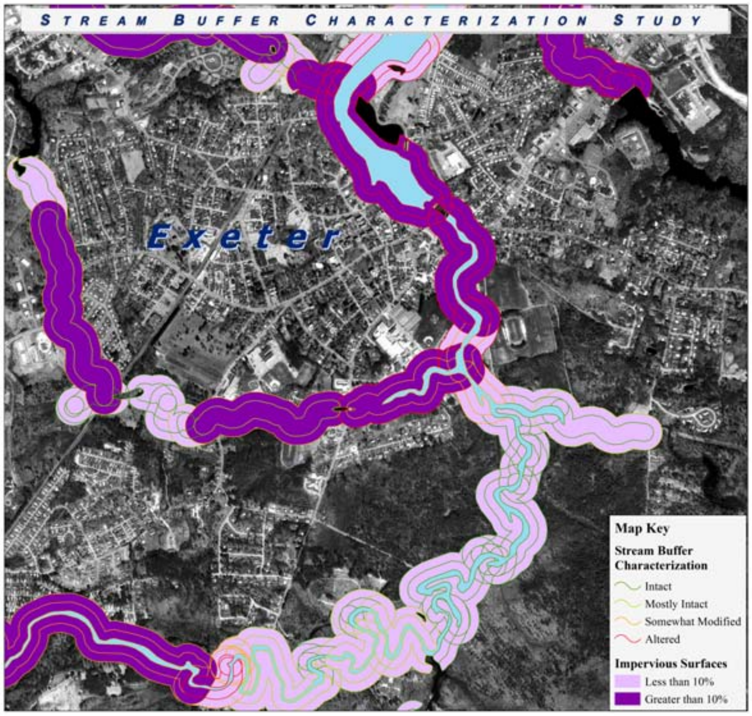


Figure 9. Final buffer categorization for area in the vicinity of Exeter, NH.



Results and Discussion

Tables 3 and 4 present town-level summaries based on the 150-ft. water quality stream buffers. They document the total acreage within each of the project stream buffer categories, as well as various percent derivatives. Note that 6 towns that are only partially in the Basin – Alton, Derry, Hampstead, Pittsfield, South Hampton, and Wolfeboro – have no streams extending into the study area. Total acreage figures are included for all towns in the tables, but because these 6 towns have no buffer acreage, they are excluded from consideration in the following discussion.

For the 150-ft. buffers, 2.3% of total town land acreage was classified as intact, while 0.2% was classified as altered. On an individual town basis, the percent of land acreage classified as intact extended from a high of 10.4% in the town of Seabrook, to a low of 0.3% in the town of Danville. At 0.4%, Newington also showed a very low percent of town land acreage within the intact buffer category. Examining land classified as highly impacted or altered, the town of New Castle had the highest percent of land acreage classified as altered buffers at 25.3%, while 17 communities had 0% of the land acreage mapped as altered buffers.

The tables also display the percent of total 150-ft. buffer acreage in the various impact categories. For the study area as a whole, over 63% of the buffer acreage was classified as intact, while only 5.2% was mapped as altered. Again on a town basis, the percent of buffer acreage classified as intact ranged from a high of 99.1% in Brookfield, to a low of 11.6% in New Castle. At the other end of the spectrum, data for a number of towns showed 0% of the buffer acreage classified as altered, while again New Castle had the highest percent of buffers in this category at 88.4%. Other locations with high percentages of buffer acreage mapped as altered included Portsmouth at 43.2% and Newington at 32.8%.

Tables 5 and 6 present the corresponding information for the 300-ft. wildlife habitat buffers. Based on these figures, we see that similar patterns prevail. For the study area as a whole, 3.9% of total town land acreage was mapped as intact, with 0.6% mapped as altered. Seabrook was again the town with the highest percent of land acreage classified as intact at 24.3%, with values ranging to a low of 0.6% in the town of Danville. Looking at buffers in an altered condition, New Castle again led the communities with 47.5% of the town acreage classified as altered buffers. The number of communities with 0% of the land acreage mapped as altered dropped to 7, but there were 7 more with only 0.1% of the acreage classified as such.

In reviewing the percent of total 300-ft. buffer acreage in the various categories, we see that over half of the buffer acreage in the study area (52.5%) was classified as intact, while 7.7% was mapped as altered. At the town level, once again New Castle had the lowest percent of buffer acreage considered intact at 10.7%, while 92.7% of the buffer acreage in Brookfield was mapped in that category. And finally, New Castle also had the highest percent of total buffer acreage classified as altered with 89.3%, while 5 communities remained at the 0% level.

As previously noted, the acreage of impervious surface by town for 1990, 2000, and 2005 was included in the reporting, as well as the acreage of conservation lands by town based on 2005 data. These results are displayed in Tables 7 and 8, respectively.

After completing the analysis phase of the project, a series of town-based maps (1:24,000-scale) was produced to illustrate the characterization results for each of the 42 NHEP towns that contained buffer segments. The maps displayed the 150-ft. and 300-ft. buffers and symbolized these based on the characterization categories described above. The 300-ft. buffers were also symbolized to show the two imperviousness classes. Furthermore, conservation lands (levels 1, 2, or 2A) were represented to show stream buffers occurring in protected areas. Figure 10 shows a scaled example of a town-based map for Durham, NH.

In addition to the project maps and data tables, a presentation suitable for delivery at local/regional conferences was developed. It will be initially delivered at the NHEP-sponsored State of the Estuaries Conference in fall, 2006, and will be available for subsequent use to those who request it.

Table 3. Town-level summary of 150-ft. stream buffers – acreage by category.

Town Name	Total Acres	Land Area		Surface Water Area		150' Buffer Area		Town Buffer Acreage Categorized as:			
		Acres	% of Town	Acres	% of Town	Acres	% of Town	Intact	Mostly Intact	Somewhat Modified	Altered
Alton	53230.5	40628.6	76.3	12601.9	23.7	0.0	0.0	0.0	0.0	0.0	0.0
Barrington	31117.2	29718.5	95.5	1398.7	4.5	1580.1	5.3	1242.7	244.4	82.3	10.8
Brentwood	10863.0	10740.6	98.9	122.4	1.1	481.4	4.5	240.8	222.5	4.2	14.0
Brookfield	14880.3	14592.9	98.1	287.4	1.9	323.0	2.2	320.2	2.8	0.0	0.0
Candia	19557.1	19340.2	98.9	216.9	1.1	488.5	2.5	408.1	36.6	43.9	0.0
Chester	16717.7	16617.6	99.4	100.1	0.6	579.2	3.5	401.0	144.5	33.7	0.0
Danville	7569.4	7438.9	98.3	130.5	1.7	50.7	0.7	22.3	28.3	0.0	0.0
Deerfield	33347.7	32583.6	97.7	764.1	2.3	1038.2	3.2	810.6	163.9	62.4	1.3
Derry	23225.6	22680.4	97.7	545.2	2.3	0.0	0.0	0.0	0.0	0.0	0.0
Dover	18592.1	17099.8	92.0	1492.3	8.0	1085.8	6.3	399.5	340.8	228.6	117.0
Durham	15852.2	14304.7	90.2	1547.5	9.8	689.7	4.8	167.9	247.8	210.5	63.4
East Kingston	6380.7	6317.9	99.0	62.8	1.0	208.8	3.3	143.3	42.5	23.0	0.0
Epping	16775.6	16469.8	98.2	305.8	1.8	1011.4	6.1	610.1	304.1	93.7	3.5
Exeter	12812.9	12552.9	98.0	260.0	2.0	931.1	7.4	466.9	230.8	154.4	79.1
Farmington	23639.9	23217.5	98.2	422.4	1.8	773.4	3.3	371.3	244.9	77.0	80.2
Fremont	11142.4	11034.6	99.0	107.8	1.0	564.6	5.1	242.2	191.8	112.6	18.0
Greenland	8523.8	6780.5	79.5	1743.3	20.5	329.1	4.9	145.4	148.9	11.8	23.1
Hampstead	9014.1	8543.4	94.8	470.7	5.2	0.0	0.0	0.0	0.0	0.0	0.0
Hampton	9072.7	8286.9	91.3	785.8	8.7	965.8	11.7	809.3	60.3	61.4	34.9
Hampton Falls	8078.0	7719.3	95.6	358.7	4.4	773.8	10.0	684.9	74.5	14.3	0.0
Kensington	7667.8	7635.4	99.6	32.4	0.4	370.4	4.9	246.2	57.2	55.3	11.7
Kingston	13450.2	12493.7	92.9	956.5	7.1	224.3	1.8	192.4	7.7	16.7	7.4
Lee	12927.2	12686.1	98.1	241.1	1.9	768.3	6.1	417.4	199.2	151.7	0.0
Madbury	7799.0	7399.5	94.9	399.5	5.1	387.0	5.2	237.7	143.9	2.1	3.4
Middleton	11842.9	11558.9	97.6	284.0	2.4	406.5	3.5	344.1	53.1	0.0	9.3
Milton	21935.8	21088.5	96.1	847.3	3.9	852.8	4.0	634.2	119.8	93.3	5.4
New Castle	1347.6	506.3	37.6	841.3	62.4	145.1	28.7	16.8	0.0	0.0	128.3
New Durham	28053.8	26344.9	93.9	1708.9	6.1	323.3	1.2	298.1	25.2	0.0	0.0
Newfields	4646.7	4540.8	97.7	105.9	2.3	293.3	6.5	198.1	63.7	19.9	11.6
Newington	7916.7	5216.4	65.9	2700.3	34.1	178.0	3.4	22.2	27.4	69.9	58.5
Newmarket	9080.3	8037.6	88.5	1042.7	11.5	457.9	5.7	223.6	96.0	85.8	52.4
North Hampton	8922.8	8862.0	99.3	60.8	0.7	490.2	5.5	345.2	115.4	10.2	19.4
Northwood	19356.9	17974.2	92.9	1382.7	7.1	284.7	1.6	259.5	22.9	0.0	2.4
Nottingham	30996.6	29881.6	96.4	1115.0	3.6	1408.7	4.7	1221.7	143.9	6.8	36.3
Pittsfield	15558.7	15189.6	97.6	369.1	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Portsmouth	10763.4	10002.0	92.9	761.4	7.1	430.6	4.3	176.2	17.5	50.7	186.2
Raymond	18943.5	18459.0	97.4	484.5	2.6	1092.3	5.9	484.3	424.7	165.9	17.4
Rochester	29080.6	28321.4	97.4	759.2	2.6	1568.9	5.5	513.2	520.9	381.8	153.0
Rollinsford	4842.8	4681.5	96.7	161.3	3.3	296.1	6.3	150.5	0.0	129.6	15.9
Rye	8405.8	7997.8	95.1	408.0	4.9	554.3	6.9	377.9	86.2	37.5	52.7

Table 3. Town-level summary of 150-ft. stream buffers – acreage by category (cont.)

Town Name	Total Acres	Land Area		Surface Water Area		150' Buffer Area		Town Buffer Acreage Categorized as:			
		Acres	% of Town	Acres	% of Town	Acres	% of Town	Intact	Mostly Intact	Somewhat Modified	Altered
Sandown	9231.8	8888.4	96.3	343.4	3.7	290.3	3.3	234.1	37.8	18.5	0.0
Seabrook	6161.3	5664.2	91.9	497.1	8.1	721.0	12.7	588.1	30.0	79.0	23.9
Somersworth	6398.3	6218.9	97.2	179.4	2.8	280.3	4.5	129.1	25.2	77.8	48.3
South Hampton	5146.6	5044.3	98.0	102.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Strafford	32778.8	31151.3	95.0	1627.5	5.0	690.7	2.2	657.3	13.5	11.0	8.9
Stratham	9901.6	9673.8	97.7	227.8	2.3	438.8	4.5	297.1	90.3	41.8	9.7
Wakefield	28717.1	25264.1	88.0	3453.0	12.0	451.0	1.8	310.1	49.7	80.7	10.4
Wolfeboro	37405.5	30693.0	82.1	6712.5	17.9	0.0	0.0	0.0	0.0	0.0	0.0
Total	**759673.0**	**708143.8**	**93.2**	**51529.2**	**6.8**	**25279.5**	**3.6**	**16061.7**	**5100.2**	**2799.8**	**1317.7**

Table 4. Town-level summary of 150-ft. stream buffers – percent by category.

Town Name	150' Buffer Area		Percent of Town Land Area Categorized as:				Percent of Buffer Acreage Categorized as:			
	Acres	% of Town	Intact	Mostly Intact	Somewhat Modified	Altered	Intact	Mostly Intact	Somewhat Modified	Altered
Alton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barrington	1580.1	5.3	4.2	0.8	0.3	0.0	78.6	15.5	5.2	0.7
Brentwood	481.4	4.5	2.2	2.1	0.0	0.1	50.0	46.2	0.9	2.9
Brookfield	323.0	2.2	2.2	0.0	0.0	0.0	99.1	0.9	0.0	0.0
Candia	488.5	2.5	2.1	0.2	0.2	0.0	83.5	7.5	9.0	0.0
Chester	579.2	3.5	2.4	0.9	0.2	0.0	69.2	24.9	5.8	0.0
Danville	50.7	0.7	0.3	0.4	0.0	0.0	44.1	55.9	0.0	0.0
Deerfield	1038.2	3.2	2.5	0.5	0.2	0.0	78.1	15.8	6.0	0.1
Derry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dover	1085.8	6.3	2.3	2.0	1.3	0.7	36.8	31.4	21.0	10.8
Durham	689.7	4.8	1.2	1.7	1.5	0.4	24.3	35.9	30.5	9.2
East Kingston	208.8	3.3	2.3	0.7	0.4	0.0	68.6	20.4	11.0	0.0
Epping	1011.4	6.1	3.7	1.8	0.6	0.0	60.3	30.1	9.3	0.3
Exeter	931.1	7.4	3.7	1.8	1.2	0.6	50.1	24.8	16.6	8.5
Farmington	773.4	3.3	1.6	1.1	0.3	0.3	48.0	31.7	10.0	10.4
Fremont	564.6	5.1	2.2	1.7	1.0	0.2	42.9	34.0	19.9	3.2
Greenland	329.1	4.9	2.1	2.2	0.2	0.3	44.2	45.2	3.6	7.0
Hampstead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hampton	965.8	11.7	9.8	0.7	0.7	0.4	83.8	6.2	6.4	3.6
Hampton Falls	773.8	10.0	8.9	1.0	0.2	0.0	88.5	9.6	1.9	0.0
Kensington	370.4	4.9	3.2	0.7	0.7	0.2	66.5	15.5	14.9	3.2
Kingston	224.3	1.8	1.5	0.1	0.1	0.1	85.8	3.4	7.5	3.3
Lee	768.3	6.1	3.3	1.6	1.2	0.0	54.3	25.9	19.7	0.0
Madbury	387.0	5.2	3.2	1.9	0.0	0.0	61.4	37.2	0.5	0.9
Middleton	406.5	3.5	3.0	0.5	0.0	0.1	84.6	13.1	0.0	2.3
Milton	852.8	4.0	3.0	0.6	0.4	0.0	74.4	14.0	10.9	0.6
New Castle	145.1	28.7	3.3	0.0	0.0	25.3	11.6	0.0	0.0	88.4
New Durham	323.3	1.2	1.1	0.1	0.0	0.0	92.2	7.8	0.0	0.0
Newfields	293.3	6.5	4.4	1.4	0.4	0.3	67.5	21.7	6.8	3.9
Newington	178.0	3.4	0.4	0.5	1.3	1.1	12.5	15.4	39.3	32.8
Newmarket	457.9	5.7	2.8	1.2	1.1	0.7	48.8	21.0	18.7	11.5
North Hampton	490.2	5.5	3.9	1.3	0.1	0.2	70.4	23.5	2.1	4.0
Northwood	284.7	1.6	1.4	0.1	0.0	0.0	91.1	8.0	0.0	0.8
Nottingham	1408.7	4.7	4.1	0.5	0.0	0.1	86.7	10.2	0.5	2.6
Pittsfield	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portsmouth	430.6	4.3	1.8	0.2	0.5	1.9	40.9	4.1	11.8	43.2
Raymond	1092.3	5.9	2.6	2.3	0.9	0.1	44.3	38.9	15.2	1.6
Rochester	1568.9	5.5	1.8	1.8	1.3	0.5	32.7	33.2	24.3	9.7
Rollinsford	296.1	6.3	3.2	0.0	2.8	0.3	50.8	0.0	43.8	5.4
Rye	554.3	6.9	4.7	1.1	0.5	0.7	68.2	15.5	6.8	9.5

Table 4. Town-level summary of 150-ft. stream buffers – percent by category (cont.)

Town Name	150' Buffer Area		Percent of Town Land Area Categorized as:				Percent of Buffer Acreage Categorized as:			
	Acres	% of Town	Intact	Mostly Intact	Somewhat Modified	Altered	Intact	Mostly Intact	Somewhat Modified	Altered
Sandown	290.3	3.3	2.6	0.4	0.2	0.0	80.6	13.0	6.4	0.0
Seabrook	721.0	12.7	10.4	0.5	1.4	0.4	81.6	4.2	11.0	3.3
Somersworth	280.3	4.5	2.1	0.4	1.3	0.8	46.1	9.0	27.7	17.2
South Hampton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Strafford	690.7	2.2	2.1	0.0	0.0	0.0	95.2	2.0	1.6	1.3
Stratham	438.8	4.5	3.1	0.9	0.4	0.1	67.7	20.6	9.5	2.2
Wakefield	451.0	1.8	1.2	0.2	0.3	0.0	68.8	11.0	17.9	2.3
Wolfeboro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**25279.5**	**3.6**	**2.3**	**0.7**	**0.4**	**0.2**	**63.5**	**20.2**	**11.1**	**5.2**

Table 5. Town-level summary of 300-ft. stream buffers – acreage by category.

Town Name	Total Acres	Land Area		Surface Water Area		300' Buffer Area		Town Buffer Acreage Categorized as:			
		Acres	% of Town	Acres	% of Town	Acres	% of Town	Intact	Mostly Intact	Somewhat Modified	Altered
Alton	53230.5	40628.6	76.3	12601.9	23.7	0.0	0.0	0.0	0.0	0.0	0.0
Barrington	31117.2	29718.5	95.5	1398.7	4.5	3210.2	10.8	2149.6	768.8	248.2	43.7
Brentwood	10863.0	10740.6	98.9	122.4	1.1	958.0	8.9	234.6	619.6	57.3	46.5
Brookfield	14880.3	14592.9	98.1	287.4	1.9	646.6	4.4	599.5	47.1	0.0	0.0
Candia	19557.1	19340.2	98.9	216.9	1.1	1035.2	5.4	815.7	85.8	131.0	2.7
Chester	16717.7	16617.6	99.4	100.1	0.6	1205.2	7.3	564.2	385.6	255.4	0.0
Danville	7569.4	7438.9	98.3	130.5	1.7	98.2	1.3	42.5	55.7	0.0	0.0
Deerfield	33347.7	32583.6	97.7	764.1	2.3	2160.8	6.6	1303.7	572.7	279.3	5.1
Derry	23225.6	22680.4	97.7	545.2	2.3	0.0	0.0	0.0	0.0	0.0	0.0
Dover	18592.1	17099.8	92.0	1492.3	8.0	2138.7	12.5	517.0	567.0	805.5	249.3
Durham	15852.2	14304.7	90.2	1547.5	9.8	1376.8	9.6	214.8	239.2	705.3	217.5
East Kingston	6380.7	6317.9	99.0	62.8	1.0	416.5	6.6	154.7	134.9	77.5	49.4
Epping	16775.6	16469.8	98.2	305.8	1.8	1979.9	12.0	664.4	871.1	392.4	52.0
Exeter	12812.9	12552.9	98.0	260.0	2.0	1926.8	15.3	786.5	321.7	521.5	297.2
Farmington	23639.9	23217.5	98.2	422.4	1.8	1548.1	6.7	581.0	471.9	308.1	187.2
Fremont	11142.4	11034.6	99.0	107.8	1.0	1126.6	10.2	582.2	181.6	235.8	127.1
Greenland	8523.8	6780.5	79.5	1743.3	20.5	670.1	9.9	134.4	377.0	107.1	51.7
Hampstead	9014.1	8543.4	94.8	470.7	5.2	0.0	0.0	0.0	0.0	0.0	0.0
Hampton	9072.7	8286.9	91.3	785.8	8.7	2241.9	27.1	1798.6	194.9	126.8	121.7
Hampton Falls	8078.0	7719.3	95.6	358.7	4.4	1751.6	22.7	1307.9	337.4	97.4	8.9
Kensington	7667.8	7635.4	99.6	32.4	0.4	815.0	10.7	463.7	59.3	283.8	8.2
Kingston	13450.2	12493.7	92.9	956.5	7.1	457.6	3.7	336.9	67.0	35.8	17.9
Lee	12927.2	12686.1	98.1	241.1	1.9	1541.3	12.1	723.7	370.5	380.8	66.2
Madbury	7799.0	7399.5	94.9	399.5	5.1	745.3	10.1	277.2	367.9	92.1	8.2
Middleton	11842.9	11558.9	97.6	284.0	2.4	842.7	7.3	713.7	108.8	0.0	20.2
Milton	21935.8	21088.5	96.1	847.3	3.9	1758.9	8.3	1265.1	175.0	284.2	34.7
New Castle	1347.6	506.3	37.6	841.3	62.4	269.4	53.2	28.8	0.0	0.0	240.6
New Durham	28053.8	26344.9	93.9	1708.9	6.1	703.0	2.7	650.9	24.0	28.2	0.0
Newfields	4646.7	4540.8	97.7	105.9	2.3	595.8	13.1	398.0	19.5	151.3	26.9
Newington	7916.7	5216.4	65.9	2700.3	34.1	364.0	7.0	44.7	39.1	116.3	163.9
Newmarket	9080.3	8037.6	88.5	1042.7	11.5	934.4	11.6	257.7	236.6	332.0	108.1
North Hampton	8922.8	8862.0	99.3	60.8	0.7	1027.7	11.6	524.1	294.4	153.4	55.8
Northwood	19356.9	17974.2	92.9	1382.7	7.1	611.7	3.4	415.8	159.3	27.1	9.4
Nottingham	30996.6	29881.6	96.4	1115.0	3.6	2927.8	9.8	2000.5	770.6	68.5	88.2
Pittsfield	15558.7	15189.6	97.6	369.1	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Portsmouth	10763.4	10002.0	92.9	761.4	7.1	857.7	8.6	342.9	41.3	71.6	401.9
Raymond	18943.5	18459.0	97.4	484.5	2.6	2187.5	11.9	618.4	623.9	813.6	131.6
Rochester	29080.6	28321.4	97.4	759.2	2.6	3012.0	10.6	692.5	605.7	1158.6	555.2
Rollinsford	4842.8	4681.5	96.7	161.3	3.3	581.9	12.4	143.8	138.4	159.3	140.3
Rye	8405.8	7997.8	95.1	408.0	4.9	1165.3	14.6	716.5	134.9	203.2	110.7

Table 5. Town-level summary of 300-ft. stream buffers – acreage by category (cont.)

Town Name	Total Acres	Land Area		Surface Water Area		300' Buffer Area		Town Buffer Acreage Categorized as:			
		Acres	% of Town	Acres	% of Town	Acres	% of Town	Intact	Mostly Intact	Somewhat Modified	Altered
Sandown	9231.8	8888.4	96.3	343.4	3.7	599.5	6.7	377.0	149.4	73.1	0.0
Seabrook	6161.3	5664.2	91.9	497.1	8.1	1696.7	30.0	1378.5	86.9	102.0	129.3
Somersworth	6398.3	6218.9	97.2	179.4	2.8	568.9	9.1	193.5	82.4	146.3	146.6
South Hampton	5146.6	5044.3	98.0	102.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Strafford	32778.8	31151.3	95.0	1627.5	5.0	1444.8	4.6	1324.6	76.1	6.9	37.1
Stratham	9901.6	9673.8	97.7	227.8	2.3	889.4	9.2	440.1	236.3	192.3	20.7
Wakefield	28717.1	25264.1	88.0	3453.0	12.0	947.5	3.8	554.5	193.3	155.2	44.5
Wolfeboro	37405.5	30693.0	82.1	6712.5	17.9	0.0	0.0	0.0	0.0	0.0	0.0
Total	**759673.0**	**708143.8**	**93.2**	**51529.2**	**6.8**	**52037.0**	**7.3**	**27334.4**	**11292.2**	**9384.1**	**4026.2**

Table 6. Town-level summary of 300-ft. stream buffers – percent by category.

Town Name	300' Buffer Area		Percent of Town Land Area Categorized as:				Percent of Buffer Acreage Categorized as:			
	Acres	% of Town	Intact	Mostly Intact	Somewhat Modified	Altered	Intact	Mostly Intact	Somewhat Modified	Altered
Alton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barrington	3210.2	10.8	7.2	2.6	0.8	0.1	67.0	23.9	7.7	1.4
Brentwood	958.0	8.9	2.2	5.8	0.5	0.4	24.5	64.7	6.0	4.9
Brookfield	646.6	4.4	4.1	0.3	0.0	0.0	92.7	7.3	0.0	0.0
Candia	1035.2	5.4	4.2	0.4	0.7	0.0	78.8	8.3	12.7	0.3
Chester	1205.2	7.3	3.4	2.3	1.5	0.0	46.8	32.0	21.2	0.0
Danville	98.2	1.3	0.6	0.7	0.0	0.0	43.3	56.7	0.0	0.0
Deerfield	2160.8	6.6	4.0	1.8	0.9	0.0	60.3	26.5	12.9	0.2
Derry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dover	2138.7	12.5	3.0	3.3	4.7	1.5	24.2	26.5	37.7	11.7
Durham	1376.8	9.6	1.5	1.7	4.9	1.5	15.6	17.4	51.2	15.8
East Kingston	416.5	6.6	2.4	2.1	1.2	0.8	37.2	32.4	18.6	11.9
Epping	1979.9	12.0	4.0	5.3	2.4	0.3	33.6	44.0	19.8	2.6
Exeter	1926.8	15.3	6.3	2.6	4.2	2.4	40.8	16.7	27.1	15.4
Farmington	1548.1	6.7	2.5	2.0	1.3	0.8	37.5	30.5	19.9	12.1
Fremont	1126.6	10.2	5.3	1.6	2.1	1.2	51.7	16.1	20.9	11.3
Greenland	670.1	9.9	2.0	5.6	1.6	0.8	20.1	56.3	16.0	7.7
Hampstead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hampton	2241.9	27.1	21.7	2.4	1.5	1.5	80.2	8.7	5.7	5.4
Hampton Falls	1751.6	22.7	16.9	4.4	1.3	0.1	74.7	19.3	5.6	0.5
Kensington	815.0	10.7	6.1	0.8	3.7	0.1	56.9	7.3	34.8	1.0
Kingston	457.6	3.7	2.7	0.5	0.3	0.1	73.6	14.6	7.8	3.9
Lee	1541.3	12.1	5.7	2.9	3.0	0.5	47.0	24.0	24.7	4.3
Madbury	745.3	10.1	3.7	5.0	1.2	0.1	37.2	49.4	12.4	1.1
Middleton	842.7	7.3	6.2	0.9	0.0	0.2	84.7	12.9	0.0	2.4
Milton	1758.9	8.3	6.0	0.8	1.3	0.2	71.9	10.0	16.2	2.0
New Castle	269.4	53.2	5.7	0.0	0.0	47.5	10.7	0.0	0.0	89.3
New Durham	703.0	2.7	2.5	0.1	0.1	0.0	92.6	3.4	4.0	0.0
Newfields	595.8	13.1	8.8	0.4	3.3	0.6	66.8	3.3	25.4	4.5
Newington	364.0	7.0	0.9	0.8	2.2	3.1	12.3	10.8	31.9	45.0
Newmarket	934.4	11.6	3.2	2.9	4.1	1.3	27.6	25.3	35.5	11.6
North Hampton	1027.7	11.6	5.9	3.3	1.7	0.6	51.0	28.6	14.9	5.4
Northwood	611.7	3.4	2.3	0.9	0.2	0.1	68.0	26.0	4.4	1.5
Nottingham	2927.8	9.8	6.7	2.6	0.2	0.3	68.3	26.3	2.3	3.0
Pittsfield	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portsmouth	857.7	8.6	3.4	0.4	0.7	4.0	40.0	4.8	8.3	46.9
Raymond	2187.5	11.9	3.4	3.4	4.4	0.7	28.3	28.5	37.2	6.0
Rochester	3012.0	10.6	2.4	2.1	4.1	2.0	23.0	20.1	38.5	18.4
Rollinsford	581.9	12.4	3.1	3.0	3.4	3.0	24.7	23.8	27.4	24.1
Rye	1165.3	14.6	9.0	1.7	2.5	1.4	61.5	11.6	17.4	9.5

Table 6. Town-level summary of 300-ft. stream buffers – percent by category (cont.)

Town Name	300' Buffer Area		Percent of Town Land Area Categorized as:				Percent of Buffer Acreage Categorized as:			
	Acres	% of Town	Intact	Mostly Intact	Somewhat Modified	Altered	Intact	Mostly Intact	Somewhat Modified	Altered
Sandown	599.5	6.7	4.2	1.7	0.8	0.0	62.9	24.9	12.2	0.0
Seabrook	1696.7	30.0	24.3	1.5	1.8	2.3	81.2	5.1	6.0	7.6
Somersworth	568.9	9.1	3.1	1.3	2.4	2.4	34.0	14.5	25.7	25.8
South Hampton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Strafford	1444.8	4.6	4.3	0.2	0.0	0.1	91.7	5.3	0.5	2.6
Stratham	889.4	9.2	4.5	2.4	2.0	0.2	49.5	26.6	21.6	2.3
Wakefield	947.5	3.8	2.2	0.8	0.6	0.2	58.5	20.4	16.4	4.7
Wolfeboro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**52037.0**	**7.3**	**3.9**	**1.6**	**1.3**	**0.6**	**52.5**	**21.7**	**18.0**	**7.7**

Table 7. Town-level summary of impervious surface acreage for 1990, 2000, and 2005.

Town Name	Impervious Surfaces, 1990			Impervious Surfaces, 2000			Impervious Surfaces, 2005		
	Acres	% of Town	% of Land Area	Acres	% of Town	% of Land Area	Acres	% of Town	% of Land Area
Alton	871.6	1.6	2.1	1208.2	2.3	3.0	1434.1	2.7	3.5
Barrington	763.5	2.5	2.6	1186.7	3.8	4.0	1387.0	4.5	4.7
Brentwood	532.1	4.9	5.0	828.8	7.6	7.7	1023.2	9.4	9.5
Brookfield	139.2	0.9	1.0	190.8	1.3	1.3	198.2	1.3	1.4
Candia	531.4	2.7	2.7	794.0	4.1	4.1	930.9	4.8	4.8
Chester	423.4	2.5	2.5	720.4	4.3	4.3	855.5	5.1	5.1
Danville	260.4	3.4	3.5	445.3	5.9	6.0	533.7	7.1	7.2
Deerfield	492.0	1.5	1.5	768.0	2.3	2.4	969.0	2.9	3.0
Derry	1825.7	7.9	8.0	2566.5	11.1	11.3	2966.2	12.8	13.1
Dover	1872.6	10.1	11.0	2626.4	14.1	15.4	3171.6	17.1	18.5
Durham	675.0	4.3	4.7	1025.6	6.5	7.2	1098.0	6.9	7.7
East Kingston	221.5	3.5	3.5	335.2	5.3	5.3	439.3	6.9	7.0
Epping	657.8	3.9	4.0	1070.8	6.4	6.5	1291.8	7.7	7.8
Exeter	937.4	7.3	7.5	1375.8	10.7	11.0	1559.3	12.2	12.4
Farmington	687.1	2.9	3.0	965.6	4.1	4.2	1089.5	4.6	4.7
Fremont	329.3	3.0	3.0	537.9	4.8	4.9	654.3	5.9	5.9
Greenland	455.0	5.3	6.7	712.6	8.4	10.5	844.9	9.9	12.5
Hampstead	640.1	7.1	7.5	974.3	10.8	11.4	1172.1	13.0	13.7
Hampton	1179.3	13.0	14.2	1605.5	17.7	19.4	1717.1	18.9	20.7
Hampton Falls	341.8	4.2	4.4	536.1	6.6	6.9	698.7	8.6	9.1
Kensington	243.3	3.2	3.2	378.4	4.9	5.0	469.8	6.1	6.2
Kingston	651.0	4.8	5.2	1018.7	7.6	8.2	1211.7	9.0	9.7
Lee	467.6	3.6	3.7	740.5	5.7	5.8	840.6	6.5	6.6
Madbury	251.5	3.2	3.4	393.7	5.0	5.3	391.7	5.0	5.3
Middleton	204.5	1.7	1.8	284.2	2.4	2.5	350.4	3.0	3.0
Milton	597.4	2.7	2.8	838.8	3.8	4.0	985.3	4.5	4.7
New Castle	108.1	8.0	21.4	155.0	11.5	30.6	170.9	12.7	33.8
New Durham	458.3	1.6	1.7	627.9	2.2	2.4	727.2	2.6	2.8
Newfields	141.6	3.0	3.1	250.6	5.4	5.5	307.5	6.6	6.8
Newington	686.9	8.7	13.2	941.0	11.9	18.0	1055.8	13.3	20.2
Newmarket	479.7	5.3	6.0	706.6	7.8	8.8	818.8	9.0	10.2
North Hampton	647.5	7.3	7.3	957.6	10.7	10.8	1100.2	12.3	12.4
Northwood	424.1	2.2	2.4	610.1	3.2	3.4	716.7	3.7	4.0
Nottingham	447.9	1.4	1.5	692.7	2.2	2.3	842.2	2.7	2.8
Pittsfield	428.6	2.8	2.8	555.2	3.6	3.7	702.0	4.5	4.6
Portsmouth	2128.3	19.8	21.3	2726.0	25.3	27.3	3054.3	28.4	30.5
Raymond	977.3	5.2	5.3	1483.6	7.8	8.0	1713.6	9.0	9.3
Rochester	2395.2	8.2	8.5	3304.5	11.4	11.7	3942.3	13.6	13.9
Rollinsford	265.5	5.5	5.7	381.3	7.9	8.1	437.4	9.0	9.3
Rye	586.5	7.0	7.3	877.9	10.4	11.0	1026.3	12.2	12.8

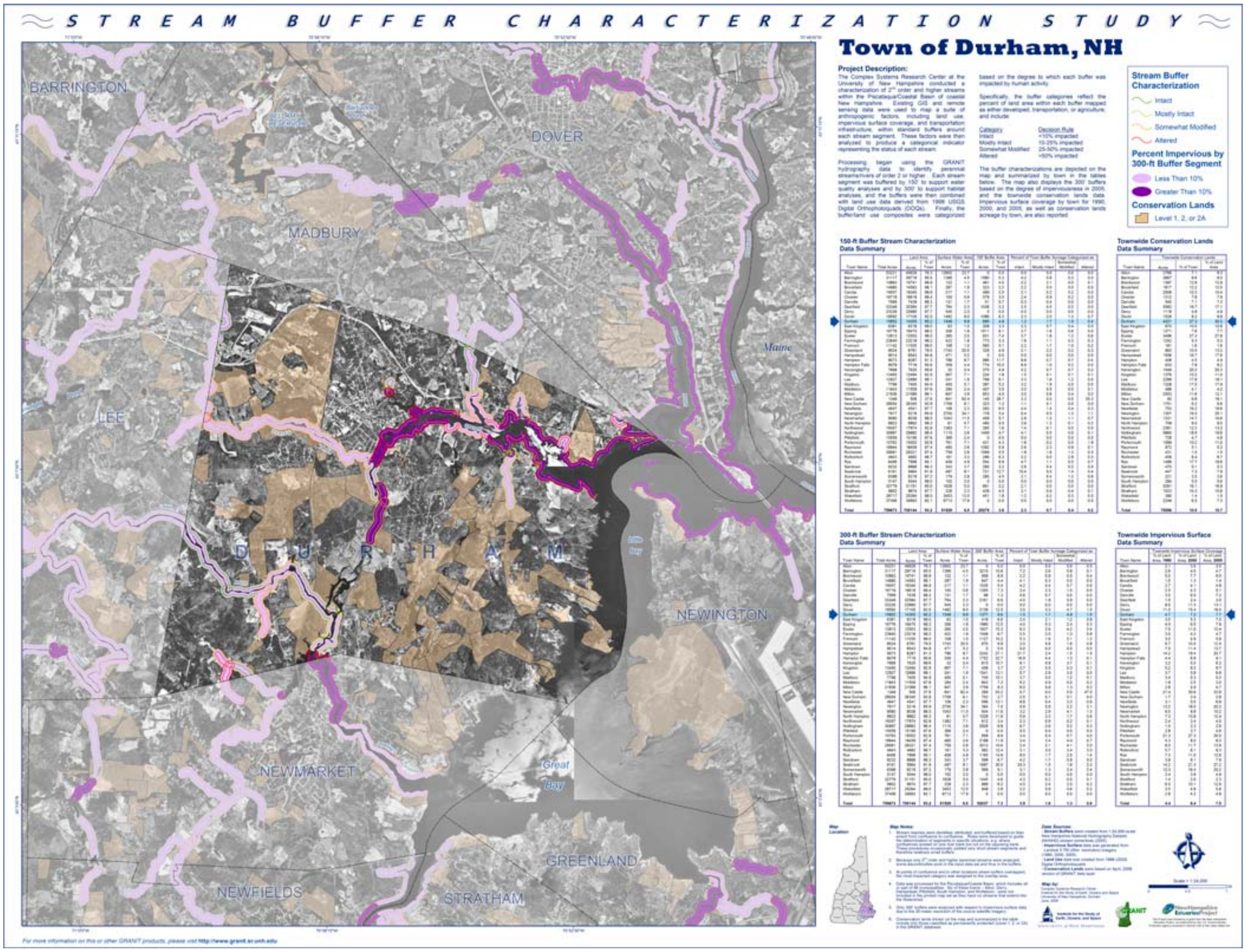
Table 7. Town-level summary of impervious surface acreage for 1990, 2000, and 2005 (cont.)

Town Name	Impervious Surfaces, 1990			Impervious Surfaces, 2000			Impervious Surfaces, 2005		
	Acres	% of Town	% of Land Area	Acres	% of Town	% of Land Area	Acres	% of Town	% of Land Area
Sandown	337.2	3.7	3.8	544.2	5.9	6.1	701.3	7.6	7.9
Seabrook	801.6	13.0	14.2	1206.1	19.6	21.3	1538.7	25.0	27.2
Somersworth	767.7	12.0	12.3	1021.2	16.0	16.4	1256.7	19.6	20.2
South Hampton	123.2	2.4	2.4	192.5	3.7	3.8	241.0	4.7	4.8
Strafford	434.0	1.3	1.4	637.9	1.9	2.0	726.6	2.2	2.3
Stratham	628.3	6.3	6.5	979.2	9.9	10.1	1245.7	12.6	12.9
Wakefield	877.9	3.1	3.5	1224.8	4.3	4.8	1407.1	4.9	5.6
Wolfeboro	870.4	2.3	2.8	1274.6	3.4	4.2	1399.1	3.7	4.6
Total	**31267.1**	**4.1**	**4.4**	**45478.8**	**6.0**	**6.4**	**53415.3**	**7.0**	**7.5**

Table 8. Town-level summary of conservation lands.

Town Name	Townwide Conservation Lands		
	Acres	% of Town	% of Land Area
Alton	3766.1	7.1	9.3
Barrington	2667.1	8.6	9.0
Brentwood	1386.6	12.8	12.9
Brookfield	1817.3	12.2	12.5
Candia	2007.9	10.3	10.4
Chester	1311.5	7.8	7.9
Danville	539.6	7.1	7.3
Deerfield	5582.5	16.7	17.1
Derry	1118.3	4.8	4.9
Dover	1529.0	8.2	8.9
Durham	4321.1	27.3	30.2
East Kingston	670.4	10.5	10.6
Epping	1270.6	7.6	7.7
Exeter	3495.7	27.3	27.8
Farmington	1242.0	5.3	5.3
Fremont	181.5	1.6	1.6
Greenland	893.4	10.5	13.2
Hampstead	1506.3	16.7	17.6
Hampton	407.6	4.5	4.9
Hampton Falls	633.4	7.8	8.2
Kensington	1548.5	20.2	20.3
Kingston	1375.8	10.2	11.0
Lee	2299.1	17.8	18.1
Madbury	1327.8	17.0	17.9
Middleton	488.5	4.1	4.2
Milton	2552.8	11.6	12.1
New Castle	91.8	6.8	18.1
New Durham	1750.6	6.2	6.6
Newfields	753.1	16.2	16.6
Newington	1307.1	16.5	25.1
Newmarket	1330.6	14.7	16.6
North Hampton	709.5	8.0	8.0
Northwood	2380.9	12.3	13.2
Nottingham	5859.8	18.9	19.6
Pittsfield	728.1	4.7	4.8
Portsmouth	1099.5	10.2	11.0
Raymond	971.9	5.1	5.3
Rochester	431.0	1.5	1.5
Rollinsford	408.6	8.4	8.7
Rye	1488.1	17.7	18.6
Sandown	470.0	5.1	5.3
Seabrook	447.2	7.3	7.9
Somersworth	221.3	3.5	3.6
South Hampton	284.5	5.5	5.6
Strafford	5261.0	16.1	16.9
Stratham	1023.0	10.3	10.6
Wakefield	390.2	1.4	1.5
Wolfeboro	2247.9	6.0	7.3
Total	**75596.1**	**10.0**	**10.7**

Figure 10. Final map output for town of Durham, NH.



Throughout the buffer characterization project, GRANIT staff coordinated with staff from The Nature Conservancy in order to identify areas of mutual interest/benefit. Of particular interest to TNC staff was the stream coding and attribution protocol we developed, as they were also engaged in an NHEP-funded stream-based initiative in coastal New Hampshire. We were able to share the core stream data set with TNC staff, and thereby ensure that our respective project results may be linked at some future point.

Conclusions

The stream buffer characterization study used existing GRANIT data layers to describe the condition of stream buffers within the Piscataqua/Coastal Basin of New Hampshire. The study documented that 2.3% of the total land area, or 63.5% of the buffer area, remains intact for the 150-ft. buffers. For the 300-ft. buffers, 3.9% of the total land area, or 52.5% of the buffer area, remains intact. On the other end of the continuum, the study showed that 0.2% of the total land area, or 5.2% percent of buffer area, for the 150-ft. buffers has been altered by human activity. The corresponding data for the 300-ft. buffers demonstrated that 0.6% of the total land area, or 7.7% of the buffer area, has been impacted. The impervious surface data indicated that the percent of total land area mapped as impervious increased from 4.4% in 1990 to 7.5% in 2005.

The stream characterizations will be valuable to the coastal management community by providing a baseline for developing and prioritizing future stream level protection recommendations. In concert with other buffer tools developed by the NHEP and its affiliated organizations, they will be particularly valuable to users interested in establishing and/or extending municipal buffer protection measures. Further, the data developed for the project, including the coded stream segments and the corresponding buffers, deliver useful datasets for future analyses in the coastal area of New Hampshire.

Recommendations

The study again demonstrated that standard GIS tools and analyses can provide effective management tools. However, the effectiveness of the results is somewhat limited by the vintage of the land use data available for the analysis. Given the explosive rate of growth in seacoast New Hampshire in recent years, we strongly recommend that updated land use data be developed and used to derive a more current assessment of stream buffers in coastal New Hampshire.

We also propose that the buffer characterization effort be applied to all riparian buffers. While the focus of this effort was mapping buffers associated with 2^{nd} order and higher streams, similar techniques could be utilized to allow for the categorization of all riparian features.

Finally, we recommend that this study be followed by continued outreach efforts to educate local decision-makers as well the public relative to the importance of stream buffers, and to encourage the establishment of local buffer protection regulations. One suggested resource to assist communities in understanding impacts of proposed buffer regulations is an online mapping tool that would allow users to visualize buffers of varying widths within their town, watershed, or other area of interest.

References

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