

Indicator: Impervious Surfaces

Question

How much of the Piscataqua Region watershed is currently covered by impervious surfaces and how has it changed over time?

Short Answer

In 2015, 5.6% of the land area of the Piscataqua Region watershed was covered by impervious surfaces. This is an increase of 1,257 acres of impervious cover or 0.2% of the land area since 2010.

PREP Goal

No increase in the number of watersheds and towns with greater than 10% impervious cover and no decrease in the number of watersheds and towns with less than 5% impervious cover (from the PREP Comprehensive Conservation and Management Plan, PREP 2010).

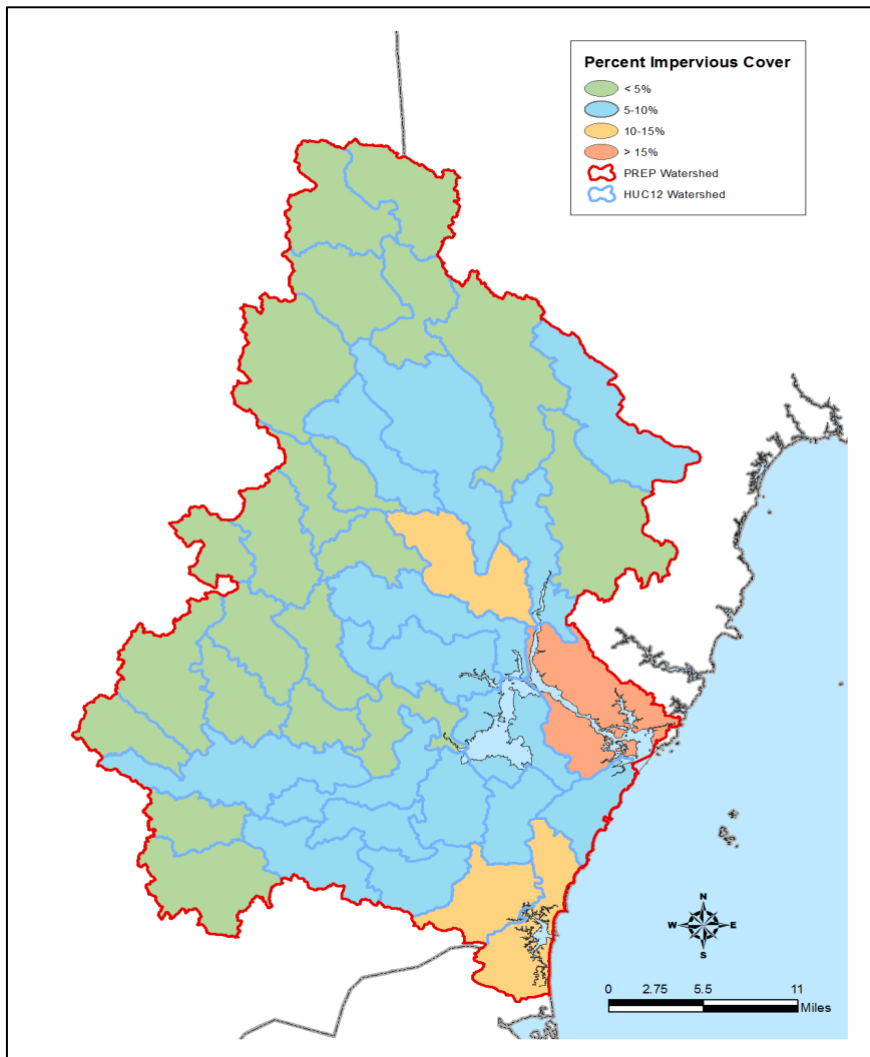


Figure IS-1. Percent impervious cover by subwatershed (HUC-12) as of 2015.
Data Source: UNH Earth Systems Research Center.

Why This Matters

Impervious surfaces are man-made features, such as parking lots, roads, and buildings, that do not allow precipitation to infiltrate into the ground. When precipitation falls on impervious surfaces, it runs off those surfaces carrying pollutants and sediments into nearby waterways. Watersheds reach a tipping point around 10% impervious cover (Mallin et al. 2000), beyond which water quality impacts become increasingly severe.

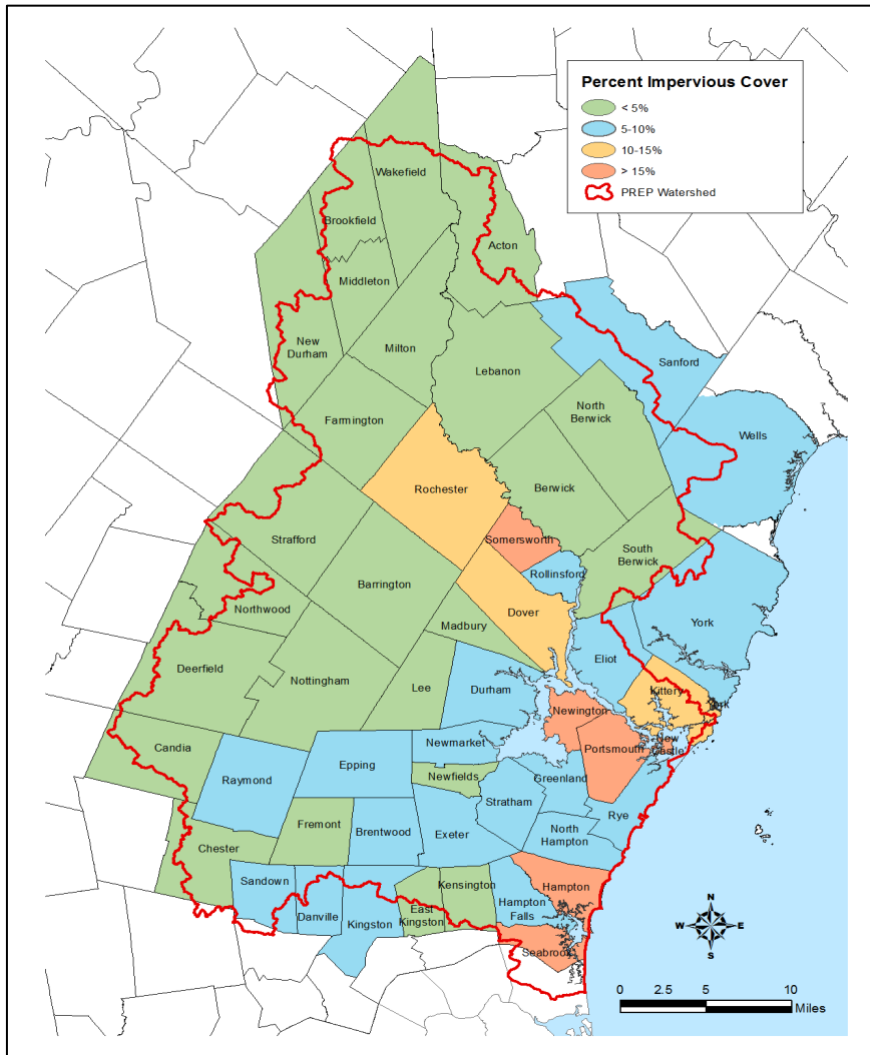


Figure IS-2. Percent impervious cover by town as of 2015. Data Source: UNH Earth Systems Research Center.

Explanation (from 2018 State of Our Estuaries Report)

The 2015 update to this dataset represents a new, improved baseline for impervious surface estimates across the region due to the use of higher resolution imagery and different processing methodology. Impervious surface values listed in the 2013 *State of Our Estuaries* report using 30-meter satellite imagery (63,214 acres) were greater than those reported using 1-foot orthoimagery (45,377 acres) in this report. In 2015, 46,634 acres (5.6% of the land area) of impervious surface were mapped representing an increase of 1,257 acres (0.2% of the land area) since 2010 (45,377 acres). Watersheds with greater than 10% impervious surface coverage of land area are around the Hampton-Seabrook estuary, the Piscataqua River and the Route 16 corridor along the Cocheco

River. Impervious surfaces in 2015 in each of the Piscataqua Region subwatersheds are shown as a percentage of land area in Figure IS-1.

Communities with the highest reported impervious surface percentages included Portsmouth (26.7%), New Castle (20%), and Seabrook (20%), while the largest increase of impervious surfaces between 2010 and 2015 occurred in Rochester (122 acres), Wells (64 acres), Seabrook (64 acres), Dover (56 acres), York (42 acres), and Sanford (39 acres). Communities with the smallest increases in impervious surfaces included Madbury (4 acres), New Castle (2 acres), and Brookfield (2 acres). Small increases in impervious surfaces may be a result of limited availability of buildable lots. Town-by-town information on impervious surfaces in 2015 is shown in Figure IS-2.

Between 2010 and 2015 population in the Piscataqua Region watershed increased 6% (21,760 people), and impervious surfaces increased 2.7% (1,257 acres). For every one person increase in population, impervious surface increased 0.06 acres. However, as shown in Figures IS-1 and IS-2, the amount of impervious cover is not evenly spread across the watershed. For more discussion on population and housing trends in the watershed refer to the Housing Permits indicator section of the 2017 PREP Technical Report (PREP 2017).

Methods and Data Sources

A more comprehensive description of methods can be found in Justice and Rubin (2017).

Data sets for the 52-town PREP footprint (see Figure IS-2) were assembled from the NH GRANIT Clearinghouse (granit.unh.edu) and the Maine Office of GIS (maine.gov/megis). The updated IC coverage was derived by displaying the 2010 IC datasets for the project area over the 2015 source imagery, and manually digitizing new IC features visible in the imagery. Data were initially displayed at a minimum scale of 1:2,000 to identify features to be digitized. The scale was typically increased to 1:1,000 (or greater) when actively digitizing features.

In addition to mapping 2015 features, updates were made to the 2010 features to capture or delete IC as appropriate. Most of the updates addressed prior errors of omission (i.e., missing features). Typically, these errors occurred because features on the ground were at least partially obscured by tree canopy in the 2010 imagery but became visible in the 2015 imagery. The errors were addressed by confirming their presence in the 2010 imagery, and then digitizing the features from the 2015 imagery. Errors of commission (i.e., adding features not actually present) from the 2010 data were also updated as appropriate.

After a comprehensive review of the data, the IC polygons were processed to derive the final data set for distribution. First, the vector polygons were converted to a 1-foot resolution raster. To fill any small gaps between features, the raster data set was expanded by 2 pixels and then contracted back by 2 pixels. Lastly, the raster was converted back to vector format, the IC polygons were generalized (using a maximum offset of 2 feet), and small features (less than 20 sq. ft.) were eliminated.

Data Sources

Data for this indicator derived from geographic data layers of impervious surfaces in the Piscataqua Region watershed produced by the UNH Earth Systems Research Center. The data are available for download from NH GRANIT. The primary source data for the project comprised 2015 1-foot resolution, 4-band orthophotography in New Hampshire; 2015 1-meter resolution, 3-band orthophotography in Maine; and existing 2010 impervious cover (IC) feature data sets. Older vintage orthophotography (2010 and 2005) was also used for reference.

Additional Results (Beyond the Data Reported in the SOOE)

The primary result of this project is a high resolution (HR) impervious cover data set capturing features for the year 2015 within the 52 town PREP footprint. Figure IS-3 displays the distribution of impervious cover mapped throughout the study area. Figure IS-4 graphically shows impervious cover by town. Tables LS-1 and LS-2 summarize the impervious cover by town and subwatershed.

PREP goals were earlier stated as: “No increase in the number of watersheds and towns with greater than 10% impervious cover and no decrease in the number of watersheds and towns with less than 5% impervious cover.” One additional municipality (Rochester, at 10.1% impervious cover) has been added to the list of towns with impervious cover over 10% (Table LS-1). One sub-watershed (Taylor River, at 10.3%) has been added to the list of sub-watersheds with impervious cover over 10% (Table LS-2).

There was no decrease in the number of towns with impervious cover less than 5% (Table LS-1). However, there was a decrease in the number of sub-watersheds at less than 5% impervious cover; the Bauneg Beg Pond/Great Works River sub-watershed went from 4.9% in 2010 to 5.0% in 2015 (Table LS-2).

Of the 52 towns, 48 saw slight increases (e.g., 1 – 2%) in impervious cover; four municipalities stayed the same. Of the 40 sub-watersheds, 33 saw slight increases in impervious cover; seven sub-watersheds remained at 2010 levels.

There were no decreases in impervious cover for any town or sub-watershed.

References Cited

Justice D, Rubin F. 2017. Developing 2015 High-Resolution Impervious Cover Estimates for the 52 Towns in the Piscataqua Region Estuaries Partnership: Final Report. *PREP Publications*. 395.
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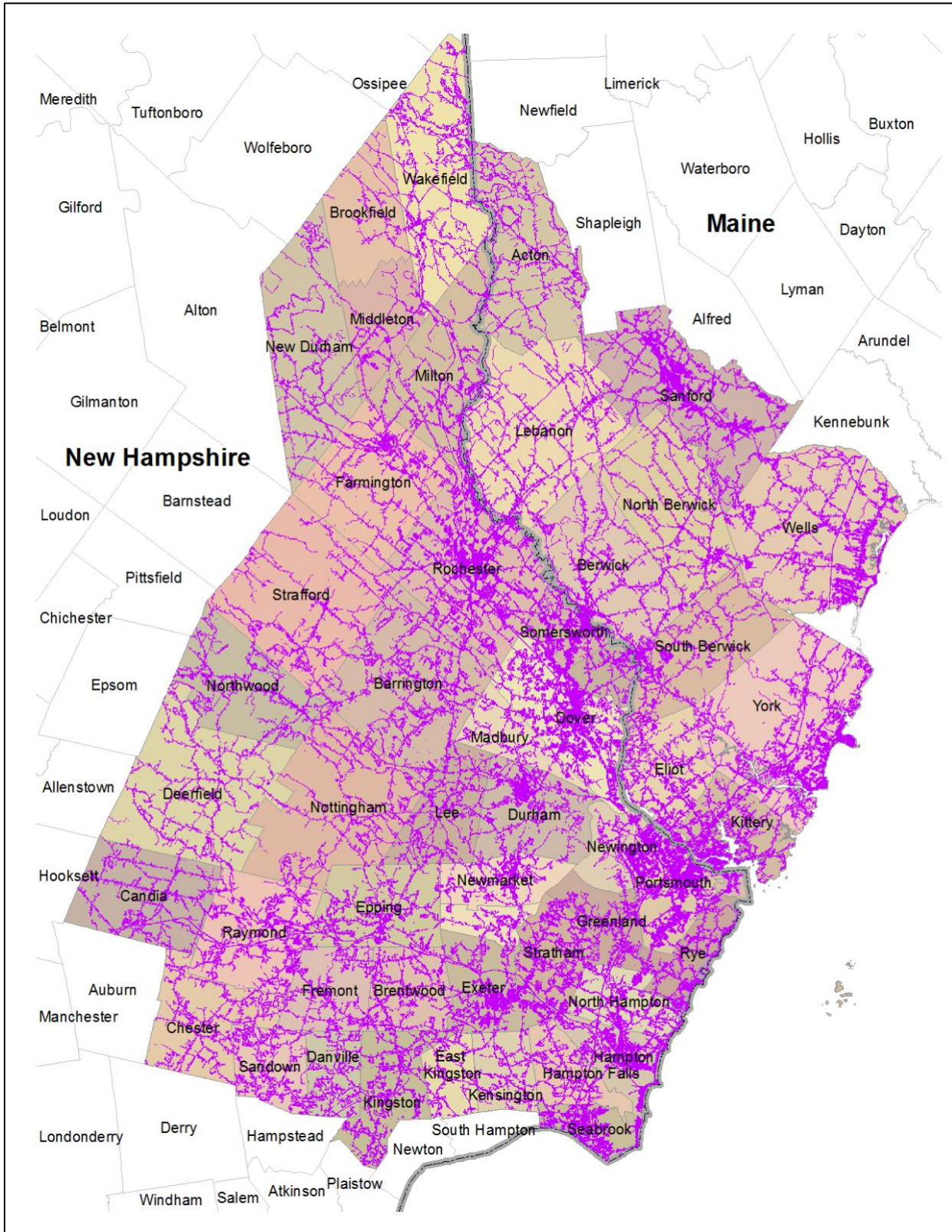


Figure IS-3. Distribution of 2015 impervious cover in the project study area. Impervious features displayed in purple.

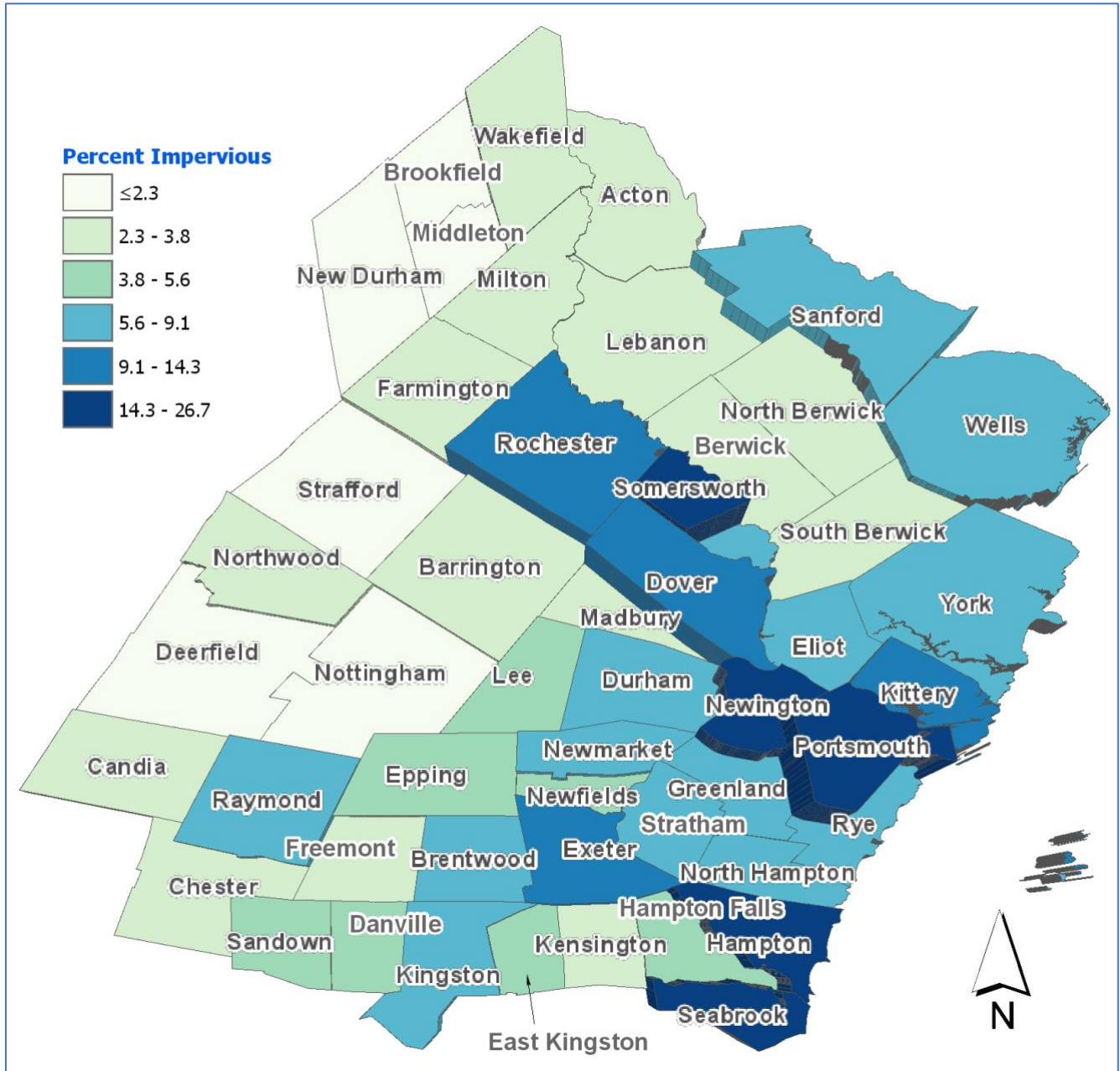


Figure IS-4. Percent impervious cover by town, 2015.

State	Town	Total Area (acres)			IC (acres)			Percent IC (Land Area)	
		Land	Inland Water	Total	2010	2015	Change	2010	2015
Maine	Acton	24,216.3	2,191.7	26,408.0	745.0	754.8	9.8	3.1%	3.1%
	Berwick	23,779.6	447.1	24,226.7	877.5	895.3	17.8	3.7%	3.8%
	Eliot	12,609.4	150.6	12,759.9	874.1	895.7	21.6	6.9%	7.1%
	Kittery ¹	11,548.0	168.2	11,716.1	1,304.2	1,315.8	11.5	11.3%	11.4%
	Lebanon	34,957.8	675.8	35,633.6	998.6	1,031.4	32.8	2.9%	3.0%
	North Berwick	24,265.1	157.6	24,422.7	737.8	765.1	27.3	3.0%	3.2%
	Sanford	30,314.8	890.3	31,205.1	2,427.9	2,466.7	38.7	8.0%	8.1%
	South Berwick	20,468.8	243.1	20,711.8	750.5	762.3	11.8	3.7%	3.7%
	Wells	36,427.3	125.1	36,552.3	2,134.3	2,198.4	64.1	5.9%	6.0%
	York	34,913.8	685.0	35,598.8	2,167.2	2,209.1	42.0	6.2%	6.3%
Total		253,500.6	5,734.4	259,235.0	13,017.2	13,294.6	277.5	5.1%	5.2%
New Hampshire	Barrington	29,719.0	1,398.3	31,117.3	967.0	1,004.3	37.3	3.3%	3.4%
	Brentwood	10,728.1	134.9	10,863.0	636.8	672.6	35.8	5.9%	6.3%
	Brookfield	14,593.0	287.3	14,880.4	132.6	134.3	1.7	0.9%	0.9%
	Candia	19,328.9	228.2	19,557.2	621.6	642.9	21.3	3.2%	3.3%
	Chester	16,606.2	111.6	16,717.8	537.5	566.7	29.2	3.2%	3.4%
	Danville	7,438.7	130.7	7,569.4	390.8	402.0	11.2	5.3%	5.4%
	Deerfield	32,575.7	772.1	33,347.8	660.1	697.3	37.2	2.0%	2.1%
	Dover	17,036.9	1,555.2	18,592.1	2,388.9	2,445.4	56.5	14.0%	14.4%
	Durham	14,251.1	1,601.2	15,852.3	890.3	923.9	33.5	6.2%	6.5%
	East Kingston	6,318.0	62.8	6,380.8	265.8	274.1	8.3	4.2%	4.3%
	Epping	16,476.6	299.1	16,775.7	879.9	932.6	52.7	5.3%	5.7%
	Exeter	12,540.6	272.3	12,812.9	1,205.8	1,227.0	21.3	9.6%	9.8%
	Farmington	23,213.0	427.0	23,640.0	771.0	782.6	11.6	3.3%	3.4%
	Fremont	11,033.1	109.3	11,142.4	406.9	425.6	18.7	3.7%	3.9%
	Greenland	6,722.5	1,801.4	8,523.9	560.0	586.2	26.2	8.3%	8.7%
	Hampton	8,287.3	785.5	9,072.8	1,380.0	1,403.9	23.9	16.7%	16.9%
	Hampton Falls	7,719.6	358.4	8,078.0	395.2	402.9	7.7	5.1%	5.2%
	Kensington	7,616.4	51.4	7,667.8	279.8	288.1	8.2	3.7%	3.8%
	Kingston	12,494.3	955.9	13,450.3	764.5	784.5	20.0	6.1%	6.3%
	Lee	12,685.0	242.2	12,927.3	581.7	600.4	18.8	4.6%	4.7%
	Madbury	7,383.6	415.5	7,799.1	272.1	276.4	4.3	3.7%	3.7%
	Middleton	11,559.0	284.0	11,843.0	254.7	269.7	15.0	2.2%	2.3%
	Milton	21,088.6	847.3	21,935.9	670.1	694.8	24.6	3.2%	3.3%
	New Castle	506.2	841.4	1,347.6	99.9	101.5	1.6	19.7%	20.0%
	New Durham	26,345.5	1,708.5	28,054.0	524.1	533.7	9.6	2.0%	2.0%
	Newfields	4,540.8	105.9	4,646.7	208.8	213.6	4.7	4.6%	4.7%
	Newington	5,214.5	2,702.2	7,916.8	851.2	886.7	35.5	16.3%	17.0%
	Newmarket	8,034.5	1,045.8	9,080.3	571.1	579.3	8.3	7.1%	7.2%
	North Hampton	8,861.8	61.0	8,922.8	717.7	732.8	15.1	8.1%	8.3%
	Northwood	17,965.0	1,391.9	19,357.0	601.5	611.8	10.3	3.3%	3.4%
	Nottingham	29,839.7	1,157.0	30,996.7	640.3	657.0	16.7	2.1%	2.2%
	Portsmouth	10,003.5	759.9	10,763.4	2,657.8	2,674.4	16.6	26.6%	26.7%
	Raymond	18,438.3	505.2	18,943.6	1,121.2	1,142.5	21.3	6.1%	6.2%
	Rochester	28,329.2	751.5	29,080.7	2,736.8	2,858.5	121.7	9.7%	10.1%
	Rollinsford	4,681.3	161.5	4,842.8	275.7	281.3	5.6	5.9%	6.0%
	Rye ¹	8,464.7	411.3	8,876.0	650.3	663.4	13.0	7.7%	7.8%
	Sandown	8,888.5	343.3	9,231.8	475.0	500.1	25.0	5.3%	5.6%
	Seabrook	5,664.7	496.6	6,161.3	1,069.7	1,133.6	63.9	18.9%	20.0%
	Somersworth	6,219.2	179.1	6,398.3	996.9	1,015.6	18.7	16.0%	16.3%
	Strafford	31,151.8	1,627.1	32,778.9	545.2	563.3	18.1	1.8%	1.8%
Stratham	9,655.1	246.5	9,901.6	849.0	874.4	25.4	8.8%	9.1%	
Wakefield	25,264.0	3,453.2	28,717.2	854.3	877.3	23.0	3.4%	3.5%	
Total		560,219.6	27,627.7	587,847.3	31,505.5	32,461.8	956.3	5.6%	5.8%
Study Total		838,984.2	36,815.3	875,799.5	45,376.9	46,633.7	1,256.8	5.4%	5.6%

¹ Acreage values for the towns of Kittery, ME and Rye, NH include the Isles of Shoals.

HUC 12 ID	HUC 12 Name	Total Area (acres)			Mapped Area (acres)			IC (acres)			Percent IC (Mapped Land Area)	
		Land	Inland Water	Total	Land	Inland Water	Total	2010	2015	Change	2010	2015
											2010	2015
010600030602	Axe Handle Brook	7,028	369	7,397	7,028	369	7,397	246	256	11	3.5%	3.6%
010600030401	Bauneg Beg Pond-Great Works River	23,128	393	23,520	23,127	393	23,520	1,126	1,156	30	4.9%	5.0%
010600030705	Bean River-North River	14,796	276	15,072	14,796	276	15,072	368	371	4	2.5%	2.5%
010600030903	Bellamy River	20,335	1,277	21,612	20,335	1,277	21,612	1,423	1,455	33	7.0%	7.2%
010600031002	Berrys Brook-Frontal Rye Harbor	10,285	333	10,618	10,282	332	10,613	935	948	13	9.1%	9.2%
010600030505	Bog Brook-Little River	34,702	170	34,872	34,363	169	34,532	777	799	22	2.3%	2.3%
010600030604	Bow Lake	7,885	1,240	9,125	7,882	1,240	9,121	200	206	6	2.5%	2.6%
010600030502	Branch River	17,268	235	17,504	17,268	235	17,504	333	358	25	1.9%	2.1%
010600030805	Exeter River-Squamscott River	12,189	174	12,363	12,189	174	12,363	607	618	11	5.0%	5.1%
010600030904	Great Bay	13,103	6,121	19,224	13,103	6,121	19,224	1,083	1,112	28	8.3%	8.5%
010600031005	Hampton River	18,059	1,341	19,400	12,931	1,229	14,160	1,862	1,935	73	14.4%	15.0%
010600030501	Headwaters Branch River	17,543	840	18,383	17,101	840	17,941	391	398	8	2.3%	2.3%
010600030801	Headwaters Exeter River	20,209	202	20,411	18,875	197	19,072	796	844	49	4.2%	4.5%
010600030701	Headwaters Lamprey River	21,718	209	21,927	21,718	209	21,927	460	486	27	2.1%	2.2%
010600030503	Headwaters Salmon Falls River	15,178	2,556	17,734	15,179	2,556	17,735	424	432	9	2.8%	2.8%
010600030607	Isinglass River	10,289	438	10,727	10,289	438	10,727	483	498	15	4.7%	4.8%
010600030709	Lamprey River	12,789	402	13,191	12,788	402	13,191	610	614	4	4.8%	4.8%
010600030402	Leighs Mill Pond-Great Works River	31,670	270	31,940	31,670	270	31,940	1,020	1,050	30	3.2%	3.3%
010600030707	Little River	12,585	359	12,944	12,585	359	12,944	367	377	11	2.9%	3.0%
010600030606	Long Pond	9,801	351	10,153	9,801	351	10,153	173	179	6	1.8%	1.8%
010600030608	Lower Cocheco River	19,479	583	20,063	19,479	583	20,063	2,270	2,331	62	11.7%	12.0%
010600030507	Lower Salmon Falls River	13,299	567	13,866	13,299	380	13,679	955	968	13	7.2%	7.3%
010600030603	Middle Cocheco River	16,025	276	16,301	16,025	276	16,301	1,525	1,585	60	9.5%	9.9%
010600030506	Middle Salmon Falls River	37,430	790	38,220	37,430	787	38,217	2,083	2,155	72	5.6%	5.8%
010600030605	Nippo Brook-Isinglass River	17,116	273	17,389	17,116	273	17,389	330	342	12	1.9%	2.0%
010600030702	North Branch River	10,901	146	11,047	10,901	146	11,047	323	334	11	3.0%	3.1%
010600030706	North River	8,786	65	8,851	8,786	65	8,851	240	251	11	2.7%	2.9%
010600030902	Oyster River	19,317	542	19,860	19,317	542	19,860	1,305	1,358	53	6.8%	7.0%
010600030704	Pawtuckaway Pond	12,107	945	13,052	12,107	945	13,052	180	187	6	1.5%	1.5%
010600030703	Pawtuckaway River-Lamprey River	25,584	638	26,222	25,584	638	26,222	1,478	1,528	49	5.8%	6.0%
010600030708	Piscassic River	14,407	103	14,510	14,407	103	14,510	750	783	33	5.2%	5.4%
010600031001	Piscataqua R.-Frontal Portsmouth Harbor	25,020	5,383	30,404	25,018	2,652	27,670	4,660	4,736	76	18.6%	18.9%
010600030804	Scamen Brook-Little River	10,109	38	10,147	10,109	38	10,147	671	699	29	6.6%	6.9%
010600030803	Spruce Swamp-Exeter River	14,999	182	15,181	14,999	182	15,181	783	816	33	5.2%	5.4%
010600030806	Squamscott River	12,445	544	12,989	12,445	544	12,989	1,161	1,188	26	9.3%	9.5%
010600031003	Taylor River	14,374	282	14,655	14,374	282	14,655	1,444	1,475	30	10.0%	10.3%
010600030601	Upper Cocheco River	27,143	515	27,657	26,787	514	27,302	806	822	16	3.0%	3.1%
010600030504	Upper Salmon Falls River	13,692	1,174	14,866	13,693	1,177	14,869	416	422	6	3.0%	3.1%
010600030802	Watson Brook-Exeter River	10,452	123	10,575	10,452	123	10,575	396	404	9	3.8%	3.9%
010600030901	Winnicut River	11,052	99	11,151	11,052	99	11,151	908	942	34	8.2%	8.5%
Total		664,298	30,824	695,122	656,692	27,785	684,477	36,366	37,419	1,053	5.5%	5.7%