
4.5 Cohas Brook

An IC method analysis for New Hampshire's Cohas Brook watershed was performed to complete a TMDL allocation. The IC method was applied to estimate existing and target % IC in the overall watershed and in each sub-watershed.

4.5.1 Watershed Description

The watershed for the Cohas Brook is located within the Manchester, Londonderry, Auburn, Derry, and Chester town boundaries and is shown on Figure 4-10. The watershed is characterized by forest, cleared land, roads (Table 4-14). The drainage area is 9,568 acres (14.95 sq. miles).

Cohas Brook is a part of the Merrimack River Basin, located in Southeastern New Hampshire. The Cohas Brook hydrologic unit code is 01070002-130 (NHDES, 2004). Cohas Brook begins at the outlet of Massabesic Lake in Manchester, NH and drains into Pine Island Pond which leads to the Merrimack River. The Merrimack River Basin covers 5,010 square miles in south-central New Hampshire, extending into Massachusetts.

Cohas Brook has been placed on the Clean Water Act 303(d) for the following: pH, habitat assessment, benthic-macroinvertebrate bioassessment, mercury, and *Escherichia coli* (NHDES, 2004). Under the 2004 New Hampshire Consolidated Assessment and Listing Methodology, impairment is listed for pH by having a pH less than 6.5 or greater than 8.0. Benthic-Macroinvertebrate Bioassessments were impaired due to a benthic index of biologic integrity score less than 45. The habitat assessment was listed due to a score less than or equal to ten, where for more than one parameter and biological assessment supports the designation. Mercury was listed based on results falling between 0.77ug/L to 1.40ug/L (based on dissolved metal results). According to the State of New Hampshire Section 305(b) and 303(d), Cohas Brook does not support aquatic life, fish consumption and primary contact recreation (NHDES, 2004).

Table 4-14 Cohas Brook: Major Landuse Distribution

Landuse	Percentage of Watershed
Mixed forest	34%
Cleared/other open Tundra	14%
Beech/oak	13%
Other hardwoods	10%
White/red pine	9%
Transportation Active agricultural land	6%
Open water Wetlands	4%
Disturbed	4%
Other	7%

4.5.2 Available Data

The New Hampshire Department of Environmental Services (NHDES), provided GIS coverage data for the Cohas Brook watershed. The other GIS coverages required for the analysis, including Landcover, were acquired from the NH GRANIT website. The 2001 New Hampshire Land Cover Assessment categorizes land cover and land use into 23 classes.

Figure 4-11 provides a landuse map for the Cohas Brook watershed. The coverage was created for to provide a multi-purpose data set to support regional analysis, with as much detail as possible in the forested and agricultural classes. The landcover dataset was based on LandSat TM Satellite Imagery.

The New Hampshire landcover dataset was problematic for the IC Method and required significant additional analysis to yield useful coverage information. Specifically, The NH landcover categories were focused on forest and agricultural classes and lumped all non-transportation development categories together (i.e., commercial, industrial, high density residential, medium density residential, and low density residential were considered the same category). This is problematic because the different development-related landuses have significantly different impervious cover characteristics. To refine the dataset to be more useful for impervious cover determination, we manually split the development class into five sub classes; commercial, industrial, high density residential, medium density residential, and low density residential. This was accomplished by comparing the development class to the Digital Ortho Quarter Quadrangles, and modifying it to one of the sub classes. The Cohas Brook watershed was split into five sub-basins.

4.5.3 Impervious Cover and Pollutant Load Calculation

To calculate watershed impervious cover, the Cohas Brook's sub-basins were digitally intersected with the revised NH landcover assessment, and the area of each landuse category in each sub-basin calculated. Sub-basin impervious percentages were then calculated based on the assumed impervious percentages for each landuse as shown in Table 4-15. The Impervious Cover Model predicts sensitive stream quality for less than 10 percent impervious cover and impacted stream quality for greater than 10 percent impervious cover. Thus, the impervious cover model predicts sensitive water quality in the Cohas Brook.

The assumed percentage of impervious cover for each landuse was derived using recommended percentages in TR-55, Urban Hydrology for Small watersheds (USDA, 1986). The results of this analysis indicate the Cohas Brook watershed is 7 percent impervious, with a sub-basin as high as 12 percent impervious.

Figure 4-12 shows impervious cover estimates for each Cohas Brook sub-basin. Table 4-16 provides percent impervious cover for each sub-basin in a tabular format. The Impervious Cover Model predicts sensitive stream quality for less than 10 percent impervious cover and impacted stream quality for greater than 10 percent impervious cover. Thus, the impervious cover model predicts sensitive water quality in the Cohas Brook.

Table 4-15 Cohas Brook: Estimated Percent Impervious Cover by Landcover

Landuse	Estimated Percent Impervious Cover
Commercial	85%
High Density Residential (smaller than 1/4 acre lots)	65%
Industrial	72%
Low Density Residential (greater than 1/2 acre lots)	16%
Medium Density Residential (1/4 to 1/2 acre lots)	31%
Transportation Active agricultural land	100%
Other	0%

Table 4-16 Cohas Brook: Sub-basin Estimated Impervious Cover

Sub-basin	Estimated Percent Impervious Cover
1	9.2%
2	11.6%
3	6.6%
4	3.7%
5	4.4%

Table 4-17 provides estimated existing % IC and target % IC values for the Cohas Brook watershed. For illustrative purposes, estimated annual stormwater runoff volume and estimated annual pollutant loads for selected parameters are also provided, using annual rainfall and estimated event mean concentration of pollutants from (Schueler, 2003). For this watershed, an annual rainfall of 36.4 inches (Concord, NOAA.com) and a fraction of annual rainfall events that produced runoff of 0.9 (Schueler, 2003) were used.

Table 4-17 Cohas Brook: Estimated Existing and Target TMDL Values for Key Parameters

Parameter	Estimated Conditions	
	Existing	TMDL Target
Impervious Cover	7%	9%
<u>Optional:</u>		
Annual Runoff Volume	2,860 acre-ft	3,420 acre-ft
Total Suspended Solids	630,000 lbs	730,000 lbs
Total P	2,600 lbs	3,000 lbs
Soluble P	1,000 lbs	1,200 lbs
Total N	19,000 lbs	22,000 lbs
TKN	14,000 lbs	16,000 lbs
Nitrate & Nitrite	5,300 lbs	6,100 lbs
Copper	110 lbs	120 lbs
Lead	540 lbs	630 lbs
Zinc	1,300 lbs	1,500 lbs

4.5.4 Summary and Conclusions

Cohas Brook, New Hampshire

Section 303(d) listed impairments: Aquatic life support
Fish consumption (mercury)
Primary contact recreation (e-coli bacteria)

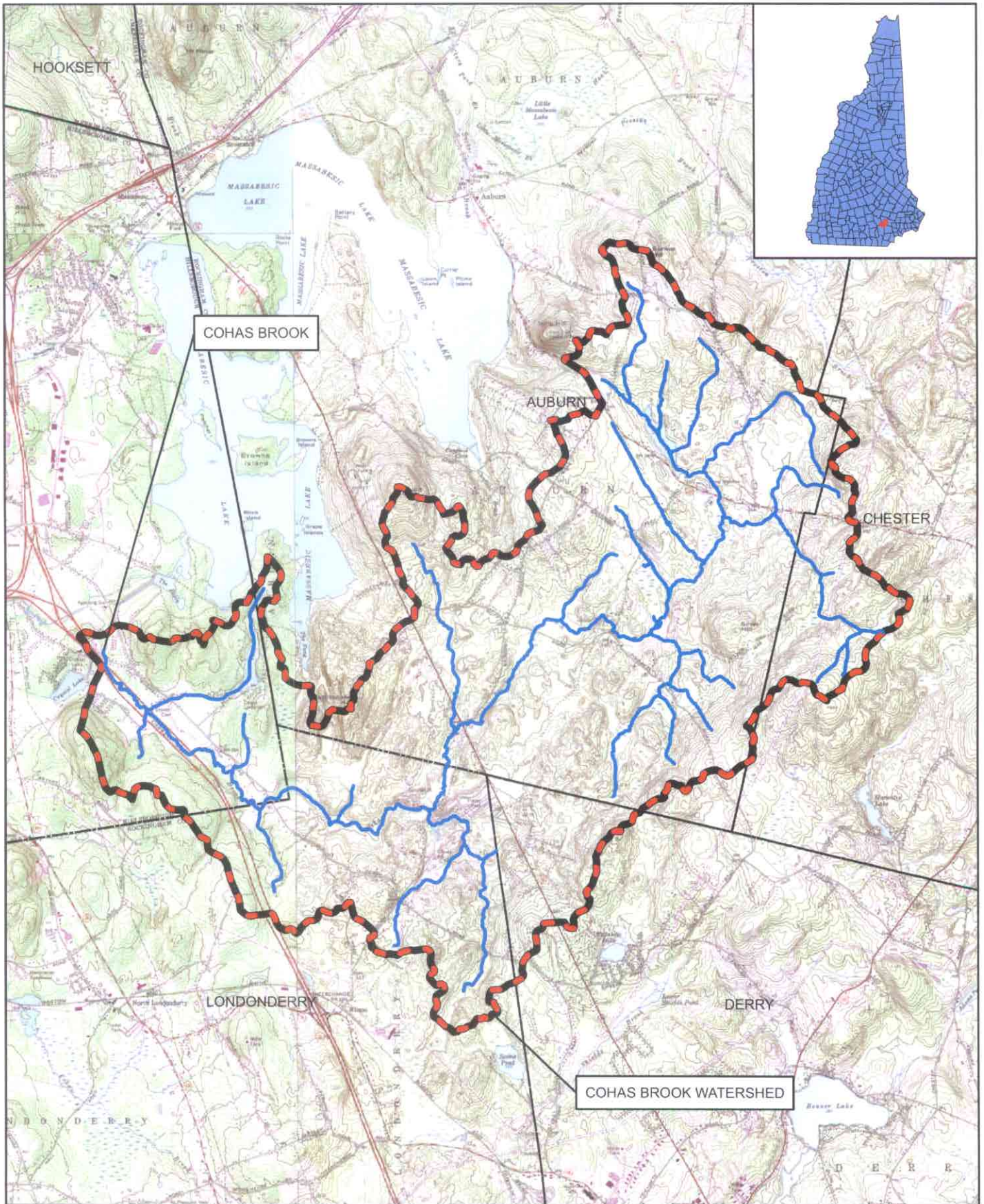
Size of watershed: 15 square miles

Percent of IC in watershed: 7% (sub-basin range = 4-12%)

Applicability of IC method to this watershed

As noted in the case study, the NH dataset proved problematic for the analysis, and required a lot of manipulation to generate the land use detail needed. Also, the watershed was medium sized and required breaking into 5 sub-basins, which were then analyzed for their percent IC. The resulting analysis showed that one sub-basin has an IC level higher than the target, one is at the target level, and another tributary whose IC level was not assessed has a substantial amount of development and might have an IC level higher than the target. This was helpful for identifying sub-watersheds in need of attention.

After careful analysis of the data available, it may be reasonable to apply the IC method to deal with aquatic life impairments in the areas of the watershed exceeding the IC target. Other causes for the types of impairment observed should also be carefully considered and additional TMDL targets developed as deemed necessary. EPA would expect additional specific TMDLs to be developed for the other 303(d)-listed impairments.






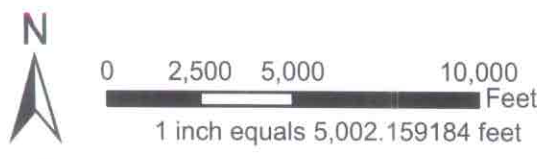
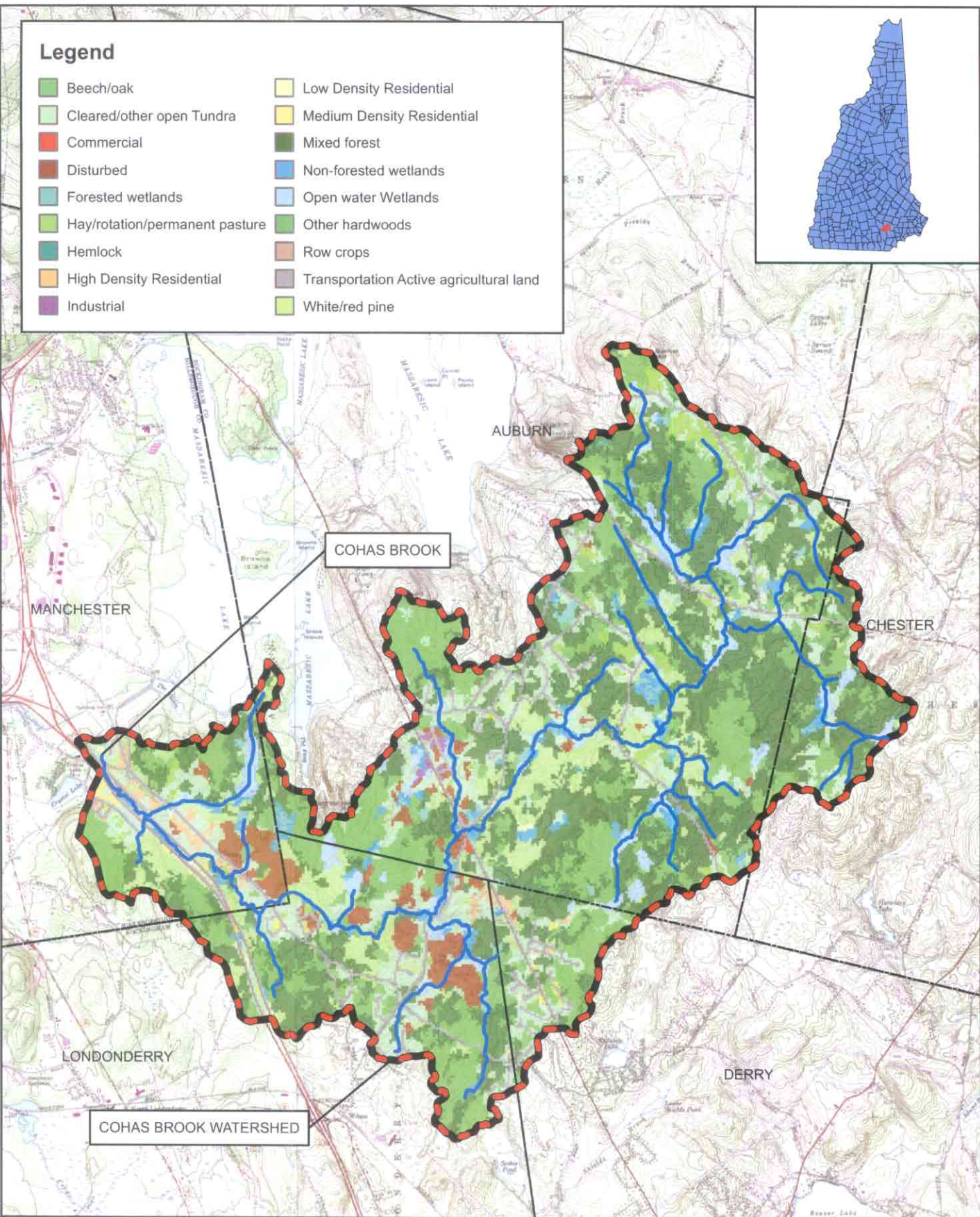
0 2,500 5,000 10,000 Feet
 1 inch equals 5,002.159184 feet

COHAS BROOK WITH
 WATERSHED BOUNDARY INDICATED
 MANCHESTER, NEW HAMPSHIRE

FIGURE
4-10

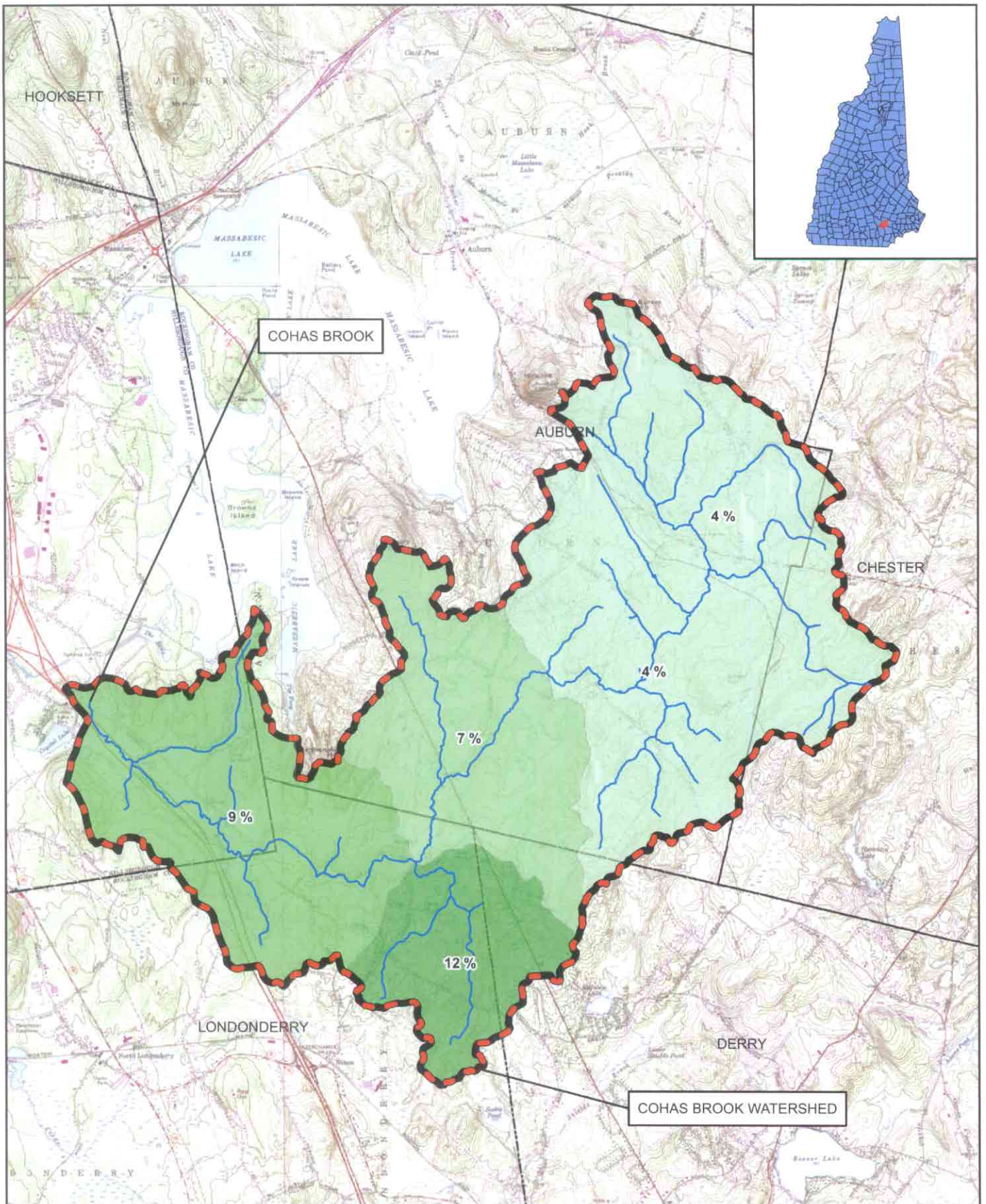
Legend

- | | |
|--|---|
|  Beech/oak |  Low Density Residential |
|  Cleared/other open Tundra |  Medium Density Residential |
|  Commercial |  Mixed forest |
|  Disturbed |  Non-forested wetlands |
|  Forested wetlands |  Open water Wetlands |
|  Hay/rotation/permanent pasture |  Other hardwoods |
|  Hemlock |  Row crops |
|  High Density Residential |  Transportation Active agricultural land |
|  Industrial |  White/red pine |



COHAS BROOK LANDUSE MAP
MANCHESTER, NEW HAMPSHIRE

FIGURE
4-11



COHAS BROOK SUB WATERSHED
 IMPERVIOUS COVER MAP
 MANCHESTER, NEW HAMPSHIRE

FIGURE
 4-12