# 7 Land Use and Land Cover

The type and distribution of land use and land cover within a watershed has a direct impact on nonpoint sources of pollution and water quality. This section describes the current and potential future land use and land cover patterns in the watershed, and the implications for water quality and stream health.

## 7.1 Current Conditions

### 7.1.1 Land Use

*Figure 7-1* depicts the generalized land use in the North Branch Park River watershed. The data in *Figure 7-1* are parcel-based land use categories for the watershed communities, provided by the Capital Region Council of Governments (CRCOG). The data include 20 land use categories, 14 of which are found in the watershed (*Table 7-1*). Approximately 63% of the watershed consists of developed land uses, with single-family residential comprising the largest percentage (27.3%). Highways and roads comprise approximately 8.2% of the watershed area. Commercial land use accounts for approximately 11% of the watershed area, with the majority of the commercial areas concentrated in the central and northern portions of the watershed along the Route 187/305 and Route 218 corridors in Bloomfield. Approximately 14% of the watershed is classified as undeveloped, while another 22.9% is classified as resource/recreation land use, including golf courses, conservation land, and other protected and unprotected open space. Large portions of the riparian areas adjacent to the North Branch Park River are located within resource/recreation areas.

**Approximately 63% of the watershed consists of developed land uses, with single-family residential comprising the largest percentage (27.3%)**

Development patterns and densities in the watershed are highly varied. The far western portion of the watershed is sparsely developed, with large undeveloped tracts of land in the West Hartford Reservoir subwatershed and Talcott Mountain State Forest area. The northern portions of the watershed are moderately developed, characterized by areas of low-density residential development, agricultural areas, golf courses, and flood control reservoirs. The northeast portion of the watershed contains large areas of former agricultural land that has been converted to commercial and industrial/office park land use along Route 187. The central and southern portions of the watershed are more densely developed with residential, institutional, and industrial land uses.

Figure 7-1

Table 7-1. Watershed Land Use

| Land Use Category | Acres | Percent of Watershed |
|---|---|---|
| Agriculture | 408 | 2.2% |
| Cemetery | 27 | 0.1% |
| Commercial | 1,947 | 10.6% |
| Government/Non-Profit | 1,302 | 7.1% |
| Group Quarters | 14 | 0.1% |
| Health/Medical | 96 | 0.5% |
| Mixed Use | 20 | 0.1% |
| Right-of-Way (ROW) | 1,495 | 8.2% |
| Residential Multi-Family | 1,132 | 6.2% |
| Residential Single-Family | 5,010 | 27.3% |
| Resource/Recreation | 4,192 | 22.9% |
| Undeveloped | 2,600 | 14.2% |
| Unknown | 7 | 0.0% |
| Water | 71 | 0.4% |

Source: Capitol Region Council of Governments (CRCOG), 2003

## 7.1.2 Zoning

*Figure 7-2* depicts the existing zoning in the North Branch Park River watershed, which is based on a generalized compilation, prepared by the Capitol Region Council of Governments, of zoning districts and designations established by the watershed municipalities. The specific zoning districts across the watershed are highly variable because they are defined at the city or town level. The pattern of existing zoning largely reflects the existing pattern of residential, commercial, office, and industrial uses in the watershed. The majority of the watershed (76.7%) is zoned as residential (*Table 7-2*).

Table 7-2. Watershed Zoning

| Zoning Category | Acres | Percent of Watershed |
|---|---|---|
| 1-3 Unit Residential, Low Density | 4,567 | 24.9% |
| 1-3 Unit Residential, Medium Density | 4,589 | 25.1% |
| 1-3 Unit Residential, Medium-Low Density | 4,895 | 26.7% |
| General Mixed Use | 760 | 4.1% |
| Industrial | 2,290 | 12.5% |
| Multi-Family | 255 | 1.4% |
| Neighborhood Scale Commercial | 63 | 0.3% |
| Planned Area Development Including Residential | 55 | 0.3% |
| Planned Residential | 487 | 2.7% |
| Public Land | 1 | <0.1% |
| Recreation | 84 | 0.5% |
| Town Scale Commercial | 265 | 1.4% |

Source: Capitol Region Council of Governments (CRCOG), 2003

Figure 7-2

## 7.1.3 Land Cover

*Figure 7-3* depicts the generalized land cover in the watershed. The data shown in *Figure 7-3* are land cover types derived from 2006 Landsat satellite imagery with a ground resolution of 30 meters. The land cover data in the watershed are classified into eleven categories (*Table 7-3*), which are used in the Connecticut Land Cover Map Series and described following the table (University of Connecticut Center for Land Use Education and Research).

Table 7-3. Watershed Land Cover

| Land Cover Type | 1985 | | 2006 | | Relative Change in Percent of Watershed (%)[1] | Relative Change in Acreage (%)[2] |
|---|---|---|---|---|---|---|
| | Acres | Percent of Watershed | Acres | Percent of Watershed | | |
| Developed | 5,118 | 28% | 5,966 | 33% | 5% | 17% |
| Turf & Grass | 3,046 | 17% | 3,361 | 18% | 1% | 10% |
| Other Grasses | 413 | 2% | 790 | 4% | 2% | 91% |
| Agriculture | 2,261 | 12% | 1,292 | 7% | -5% | -43% |
| Deciduous Forest | 5,757 | 31% | 5,200 | 28% | -3% | -10% |
| Coniferous Forest | 861 | 5% | 813 | 4% | -1% | -6% |
| Water | 280 | 2% | 255 | 1% | -1% | -9% |
| Non-forested Wetland | 19 | 0% | 20 | 0% | 0% | 6% |
| Forested Wetland | 395 | 2% | 364 | 2% | 0% | -8% |
| Tidal Wetland | 0 | 0% | 0 | 0% | 0% | 0% |
| Barren Land | 85 | 0% | 174 | 1% | 1% | 105% |
| Utility ROWs | 87 | 0% | 88 | 0% | 0% | 1% |

[1]Calculation = % land cover 2006 - % land cover 1985
[2]Calculation = (acres land cover 2006 - acres land cover 1985) / acres land cover 1985
Source: University of Connecticut Center for Land Use Education and Research (CLEAR)

The characteristics of each of these land cover types include the following:

- Barren Land– Mostly non-agricultural areas free from vegetation, such as sand, sand and gravel operations, bare exposed rock, mines, and quarries. Also includes some urban areas where the composition of construction materials spectrally resembles more natural materials. Also includes some bare soil agricultural fields.

- Coniferous Forest – Includes Southern New England mixed softwood forests. May include isolated low density residential areas.

- Deciduous Forest – Includes Southern New England mixed hardwood forests. Also includes scrub areas characterized by patches of dense woody vegetation. May include isolated low density residential areas.

Figure 7-3

- Developed – High density built-up areas typically associated with commercial, industrial and residential activities and transportation routes. These areas contain a significant amount of impervious surfaces, roofs, roads, and other concrete and asphalt surfaces.

- Forested Wetland – Includes areas depicted as wetland, but with forested cover. Also includes some small watercourses due to spectral characteristics of mixed pixels that include both water and vegetation.

- Non-forested Wetland – Includes areas that predominantly are wet throughout most of the year and that have a detectable vegetative cover (therefore not open water). Also includes some small watercourses due to spectral characteristics of mixed pixels that include both water and vegetation.

- Other Grasses – Includes non-maintained grassy areas commonly found along transportation routes and other developed areas and also agricultural fields used for both crop production and pasture.

- Turf & Grass – A compound category of undifferentiated maintained grasses associated mostly with developed areas. This class contains cultivated lawns typical of residential neighborhoods, parks, cemeteries, golf courses, turf farms, and other maintained grassy areas. Also includes some agricultural fields due to similar spectral reflectance properties.

- Utility ROWs – Includes utility rights-of-way. This category was manually digitized on-screen from rights-of-way visible in the Landsat satellite imagery. The class was digitized within the deciduous and coniferous categories only.

- Water – Open water bodies and watercourses with relatively deep water.

**Between 1985 and 2006, the watershed experienced a 5% increase in developed land cover and a corresponding loss of agricultural land and forest.**

A comparison of watershed land cover between 1985 and 2006 (*Table 7-2*) shows a moderate increase in watershed development during this period (9% increase in developed cover types) and a corresponding loss of agriculture (5% decrease) and forest (4% decrease). There was a significant percentage loss of barren land cover and percentage increase in other grasses; however these land cover categories comprise a very small percentage of the watershed area and could reflect construction or agricultural activity at the time the satellite data was obtained.

The North Branch Park River watershed is characterized by roughly equal amounts of forested and developed land cover. These land cover types are described below.

## 7.1.4 Forest Cover

Approximately 35% of the watershed consists of deciduous and coniferous forest cover, which is associated with open space, wooded portions of low-density residential properties, and forested wetlands. *Table 7-4* compares the total acreage and percentage of forest cover by subwatershed. The percent forest cover in each subwatershed ranges from a low of approximately 13% in the Filley Brook subwatershed to a high of approximately 80% in the West Hartford Reservoir subwatershed.

Table 7-4. Forest Cover - North Branch Park River Watershed

| Subwatershed Name | Forest Cover in Subwatershed (acres) | Percent Forest Cover in Subwatershed | Developable Forest Cover in Subwatershed (acres) | Percent of Forest Cover that is Developable |
|---|---|---|---|---|
| Beamans Brook East | 51 | 31% | 20 | 39% |
| Beamans Brook West | 195 | 16% | 31 | 16% |
| Blue Hills Reservoir | 411 | 40% | 94 | 23% |
| Cold Spring Reservoir | 646 | 56% | 168 | 26% |
| Filley Brook | 54 | 13% | 15 | 28% |
| North Branch Park River | 792 | 20% | 166 | 21% |
| Tumbledown Brook | 330 | 21% | 68 | 21% |
| Tumbledown Brook South | 486 | 30% | 61 | 13% |
| Tunxis Reservoir | 376 | 43% | 67 | 18% |
| Wash Brook North | 257 | 34% | 102 | 40% |
| Wash Brook South | 360 | 23% | 93 | 26% |
| Wash Brook West | 448 | 44% | 79 | 18% |
| West Hartford Reservoir | 1,645 | 80% | 203 | 12% |
| Wintonbury Reservoir | 326 | 37% | 129 | 40% |
| **Watershed (total)** | **6,377** | **35%** | **1,297** | **20%** |

Source: University of Connecticut's Center for Land Use Education and Research (CLEAR)

Based on literature threshold values documented in several studies (CLEAR, 2007), watershed forest cover of 65% or greater is typically associated with a healthy aquatic invertebrate community. Only one of the fourteen subwatersheds, West Hartford Reservoir, meets or exceeds this threshold value of 65%.

Based on a recommendation of the American Forests organization, 40% forest cover is a reasonable overall threshold goal for urban areas. The recommended tree canopy goal in suburban residential zones is 50%; the recommended goal for urban residential zones is 25%; and the recommended goal for central business districts is 15% due to constraints on open space typical of the urban environment (American Forests, 2009).

**Watershed forest cover of 65% or greater is typically associated with a healthy aquatic invertebrate community, while 40% forest cover is a reasonable overall threshold goal for urban areas (American Forests, 2009).**

*Table 7-5* compares the existing forest cover in each subwatershed with the tree canopy goals recommended by American Forests for urban land use. The green shaded cells indicate subwatersheds that are currently at or above the 40% general tree canopy goal for urban areas and at or above their respective goal for specific urban land uses (i.e., suburban residential, urban residential, central business district). The gray shaded cells indicate subwatersheds that are currently below the 40% general tree canopy goal and below their respective goal for specific urban land uses. The watershed as a whole (35%) is slightly below the 40% tree canopy goal for urban areas. Note that while this analysis provides preliminary insight into the existing forest cover in the watershed and potential priorities for establishing urban tree canopy goals for the watershed, the results should be refined using more detailed tree canopy information gathered from field inventories or higher-resolution satellite imagery due to the relatively coarse resolution of the CLEAR land cover data.

Table 7-5. Comparison of Forest Cover and Tree Canopy Goals

| Subwatershed Name | Percent Forest Cover in Subwatershed | American Forests Tree Canopy Goal |
|---|---|---|
| Beamans Brook East | 31% | >50% |
| Beamans Brook West | 16% | 25-50% |
| Blue Hills Reservoir | 40% | 25-50% |
| Cold Spring Reservoir | 56% | >50% |
| Filley Brook | 13% | 15-25% |
| North Branch Park River | 20% | 15-25% |
| Tumbledown Brook | 21% | 25-50% |
| Tumbledown Brook South | 30% | 25-50% |
| Tunxis Reservoir | 43% | 25-50% |
| Wash Brook North | 34% | 25-50% |
| Wash Brook South | 23% | 15-25% |
| Wash Brook West | 44% | >50% |
| West Hartford Reservoir | 80% | >50% |
| Wintonbury Reservoir | 37% | 25-50% |
| **Watershed (total)** | **35%** | **40%** |

Source: Forest cover estimated from data provided by University of Connecticut's Center for Land Use Education and Research (CLEAR). Tree canopy goals recommended by American Forests, 2009.

## 7.1.5 Developed Areas

Developed land cover, characterized by significant amounts of impervious surfaces such as roofs, roads, and other concrete and asphalt surfaces, accounts for approximately 33% of the watershed. When considered together with the turf/grass land cover category (primarily cultivated lawns typical of residential neighborhoods, parks, cemeteries, golf courses, turf farms, and other maintained grassy areas), approximately 51% of the watershed land area consists of developed land cover types. The percentage of developed land cover (not including turf/grass) in each subwatershed (*Table 7-6*) ranges from approximately 5% in the West Hartford Reservoir subwatershed to approximately 57% in the North Branch Park River subwatershed.

Table 7-6. Developed Land Cover by Subwatershed

| Subwatershed Name | Developed Land Cover in Subwatershed (acres) | Percent Developed Land Cover in Subwatershed (%) |
|---|---|---|
| Beamans Brook East | 32 | 20% |
| Beamans Brook West | 466 | 39% |
| Blue Hills Reservoir | 299 | 29% |
| Cold Spring Reservoir | 237 | 21% |
| Filley Brook | 208 | 52% |
| North Branch Park River | 2,295 | 57% |
| Tumbledown Brook | 466 | 30% |
| Tumbledown Brook South | 477 | 29% |
| Tunxis Reservoir | 181 | 21% |
| Wash Brook North | 226 | 30% |
| Wash Brook South | 615 | 39% |
| Wash Brook West | 168 | 16% |
| West Hartford Reservoir | 96 | 5% |
| Wintonbury Reservoir | 198 | 22% |
| **Watershed (total)** | **5,966** | **33%** |

Source: University of Connecticut's Center for Land Use Education and Research (CLEAR)

## 7.1.6 Impervious Cover

Impervious cover has emerged as a measurable, integrating concept used to assess the overall condition of a watershed. Numerous studies have documented the cumulative effects of urbanization on stream and watershed ecology (Center for Watershed Protection, 2003; Schueler et al., 1992; Schueler, 1994; Schueler, 1995; Booth and Reinelt, 1993, Arnold and Gibbons, 1996; Brant, 1999; Shaver and Maxted, 1996). Research has also demonstrated similar effects of urbanization and watershed impervious cover on downstream receiving waters such as lakes, reservoirs, estuaries, and coastal areas.

**Impervious cover has emerged as a measurable, integrating concept used to assess the overall condition of a watershed. These research findings have been integrated into a general watershed planning model known as the Impervious Cover Model (ICM).**

The correlation between watershed impervious cover and stream indicators is due to the relationship between impervious cover and stormwater runoff, since streams and receiving water bodies are directly influenced by stormwater quantity and quality. Although well-defined imperviousness thresholds are difficult to recommend, research has generally shown that when impervious cover in a watershed reaches between 10 and 25 percent, ecological stress becomes clearly apparent. Between 25 and

60 percent, stream stability is reduced, habitat is lost, water quality becomes degraded, and biological diversity decreases (NRDC, 1999). Watershed imperviousness in excess of 60 percent is generally indicative of watersheds with significant urban drainage. *Figure 7-4* illustrates this effect. These research findings have been integrated into a general watershed planning model known as the Impervious Cover Model (ICM) (CWP, 2003).

*Figure 7-4* also demonstrates the wide variability in stream response found in less-urban watersheds at lower levels of impervious cover (generally less than 10 percent). Stream quality at lower range of impervious cover is generally influenced more by other watershed metrics, such as forest cover, road density, extent of riparian vegetative cover, and cropping practices. Less variability exists in the stream quality at higher levels of impervious cover because most streams in highly impervious, urban watersheds exhibit fair or poor stream health conditions, regardless of other conditions (CWP, 2008).

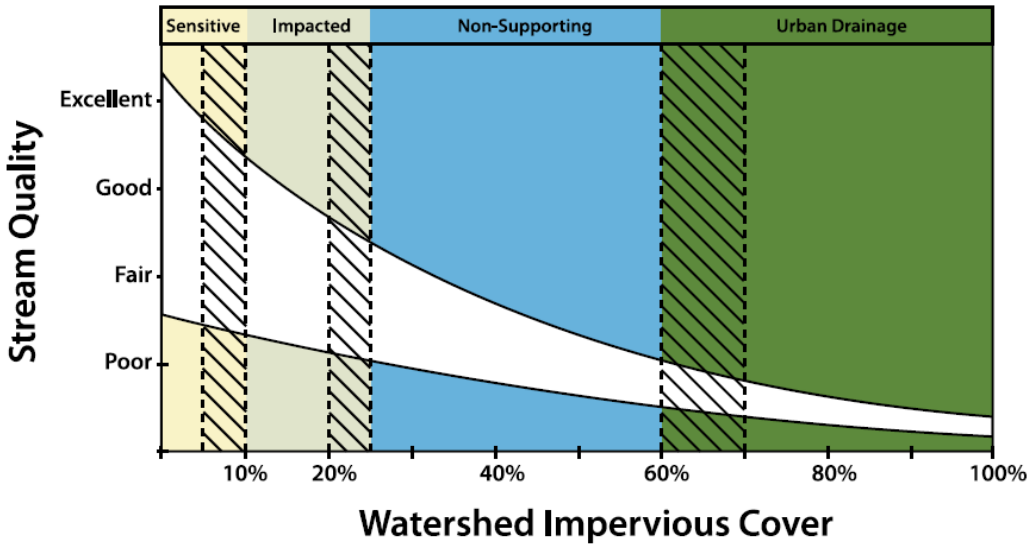


Figure 7-4. Conceptual Model Illustrating Relationship Between Watershed Impervious Cover and Stream Quality

A GIS-based impervious cover analysis was performed for the North Branch Park River watershed. The impervious cover acreage was calculated through direct measurement of buildings, parking lots, and roads from available GIS mapping of the watershed. Driveway areas in residential subdivisions were estimated using typical driveway dimensions based on parcel sizes and building density. The percent imperviousness by basin was calculated using the subwatershed GIS layer. *Figure 7-5* graphically summarizes the results of this analysis.

The overall impervious cover of the North Branch Park River watershed is estimated at approximately 15% (*Table 7-5*), which exceeds the 10% threshold in the ICM where ecological stress and stream impacts become apparent. As shown in *Figure 7-5*, impervious cover is generally highest (20% to 36%) in the urbanized central (Bloomfield) and southeastern portion (Hartford) of the watershed. Impervious cover in most of the residential areas of the watershed generally ranges from less than 10% up to 19.9%.

Figure 7-5

*Figure 7-5* and *Table 7-7* summarize estimates of impervious cover by subwatershed. Most of the subwatersheds fall into the "impacted" category (impervious cover between 10 and 25%) according to the ICM. Several of the subwatersheds have significantly less than 10% impervious cover, including the Wash Brook West and West Hartford Reservoir subwatersheds. The North Branch Park River subwatershed has the highest impervious cover (27.9%), which is consistent with the high-density development in this portion of the watershed and indicative of degraded stream conditions according to the ICM.

Table 7-7. Existing Subwatershed Impervious Cover

| Subwatershed | Percent Impervious Cover[1] |
|---|---|
| Beamans Brook East | 9.6% |
| Beamans Brook West | 16.6% |
| Blue Hills Reservoir | 14.9% |
| Cold Spring Reservoir | 6.2% |
| Filley Brook | 22.6% |
| North Branch Park River | 27.9% |
| Tumbledown Brook | 13.5% |
| Tumbledown Brook South | 11.5% |
| Tunxis Reservoir | 9.3% |
| Wash Brook North | 18.2% |
| Wash Brook South | 17.5% |
| Wash Brook West | 5.7% |
| West Hartford Reservoir | 1.1% |
| Wintonbury Reservoir | 13.2% |
| **Watershed (total)** | **15.0%** |

Source: Metropolitan District Commission GIS data, CT DEP GIS data.
[1]Percent impervious cover calculated based on total impervious area (TIA).

The results of this analysis provide an initial diagnosis of potential stream and receiving water quality within the watershed study area. The analysis method and ICM are based on several assumptions and caveats, which limits its application to screening-level evaluations. Some of the assumptions of the ICM include:

- Requires accurate estimates of percent impervious cover, which is defined as the total amount of impervious cover over a subwatershed area.
- Predicts potential rather than actual stream quality.
- Does not predict the precise score of an individual stream quality indicator but rather predicts the average behavior of a group of indicators over a range of impervious cover.
- The 10 and 25% thresholds are approximate transitions rather than sharp breakpoints.
- Does not currently predict the impact of watershed best management practices (treatment or non-structural controls).

- Does not consider the geographic distribution of the impervious cover relative to the streams and receiving waters. Effective impervious cover (impervious cover that is hydraulically connected to the drainage system) has been recommended as a better metric, although determining effective impervious cover requires extensive and often subjective judgment as to whether it is connected or not.
- Impervious cover is a more robust and reliable indicator of overall stream quality beyond the 10 percent threshold. The influence of impervious cover on stream quality is relatively weak compared to other potential watershed factors such as percent forest cover, riparian community, historical land use, soils, agriculture, etc. for impervious cover less than 10 percent.
- Use should be restricted to 1st to 3rd order alluvial streams with no major point sources of pollutant discharge and no major impoundments or dams.
- Stream slope, as measured across the subwatershed, should be in the same range for all subwatersheds.
- Management practices in the contributing watershed must be good (e.g. no deforestation, acid mine drainage, major point sources, intensive row crops, etc.).

### 7.1.7 Open Space

Open space areas were identified based on data compiled and published by the CTDEP, including federal land, state-owned property, and other municipal and private open space. Additionally, MDC watershed land associated with West Hartford Reservoir No. 6 were included as protected open space. Approximately 23% of the watershed consists of protected open space that is primarily conservation land and public parks (*Figure 7-6*). This land is protected against future development. In addition, recreational open space (golf courses, and private institutional open space) accounts for another 5% to 10% of the watershed area (*Figure 7-1*). Future development of these parcels is unlikely, unless their continued use becomes threatened. Additional privately held natural open space exists on already subdivided parcels and large estates.

The Town of Bloomfield, which comprises the majority of the land area in the watershed, has a total of approximately 1,800 acres set aside as open space, including school and park land that is used for both active and passive recreation. In addition to locally-controlled land, the state owns and manages a number of areas within the Town including Penwood State Park, West Hartford Reservoir No. 6, Talcott Mountain State Park, Cold Spring Flood Water Retention Reservoir and Dam, and the Wintonbury Flood Water Retention Reservoir and Dam. Public open space constitutes approximately 20% of the Town of Bloomfield.

Some of the notable or sizable open space areas within the watershed include:

- Samuel Wheeler Reed Park: (School Street, Bloomfield) hiking trails, passive recreation in the eastern portion of the watershed
- LaSalette Open Space: (120 Mountain Avenue, Bloomfield) located in a central area of the watershed, amenities include fishing, gardens/flowers, hiking trails, passive recreation, pond and Captain Oliver Filley House

Figure 7-6

- Wintonbury Flood Water Retention Reservoir No. 1 and Dam: (Bloomfield) located in the northeastern portion of the watershed
- Blue Hills Water Retention Reservoir No. 2: (Blue Hills Avenue, Bloomfield) located in the eastern section of the watershed, this area includes hiking trails, passive recreation, brooks, a radio-control model airplane flying field operated by Wintonbury Flying Club
- Tunxis Flood Water Retention Reservoir No. 3: (Tunxis Avenue) located in the northern section of the watershed, this area offers fishing, ponds, gardens/flowers, hiking trails, passive recreation, picnic area, tennis courts, and community gardens
- Cold Spring Flood Water Retention Reservoir and Dam: (Bloomfield) located in the western half of the watershed.
- Penwood State Park: (Gun Mill Road, Bloomfield) nearly 800 acres of maintained hiking/cross country skiing trials, biking, and picnic areas located in the western side of the watershed. It contains colorful wildflowers such as trillium, dutchman's breeches, hepatica, bloodroot, and trailing arbutus. Pileated woodpecker, turkey vulture, and bald eagle also inhabit this area.
- Talcott Mountain State Park:(Route 185, Bloomfield) approximately 557 acres of maintained hiking trails including the 1.25-miles Tower Trail leading to the 165 foot, Heublein Tower. Wildlife found in the area includes deer, fox, rabbits, turkey vulture, bald eagle, and pileated woodpecker. Flora includes wildflowers such as trillium, trout lily, wood anemone, and Dutchman's breeches. This state-owned park is located in the western portion of the watershed
- Filley Park: (Tunxis Avenue, Bloomfield) located in the center of the watershed, this park includes an elderly & children's fishing pond, garden/flowers, Scott Trail, winter ice-skating area with warming shelter.
- West Hartford Reservoir No. 6: (Route 44, West Hartford) this 3,000 acre parcel, located in the southwestern portion of the watershed, contains reservoirs, vast woodlands, and hiking, jogging, biking, cross-country skiing, and snow shoeing trails.
- Fisher Meadows Recreation Area: (West Hartford)
- Meadows Park: (West Hartford)
- Eisenhower Park: (Sheep Hill Drive, West Hartford) This parcel contains a playground, basketball courts, and ball fields.
- Elizabeth Park: (corner of Prospect Avenue and Asylum Avenue, West Hartford/Hartford) a horticultural park encompassing 102 acres located in the southern area of the watershed. This parcel contains garden areas, pathways, greenhouses, lawns, a picnic grove, a pond and recreation areas.

The Wintonbury Land Trust maintains various open space areas throughout the watershed with plans to preserve additional areas. The Land Trust's major property holdings in the watershed include Capewell Greene (21 acres, Adams Road, Bloomfield) and Sinnot Farm Knoll (29 acres, Terry Plains, Bloomfield).

## 7.2 Future Conditions

### 7.2.1 Watershed Buildout Analysis

A watershed buildout analysis was conducted to estimate future potential land use and impervious cover conditions in the watershed as a result of maximum development allowed by current zoning.

#### *7.2.1.1 Land Use*

Watershed lands that could be developed in the future (i.e., "developable" land) were subdivided into two categories, based on the CRCOG parcel-based land use data:

- *New Development* - areas that are currently undeveloped and could be developed in the future. New development parcels include those that are designated as "undeveloped" and "unknown" in the CROCG land use data and not identified as protected open space.

- *Redevelopment* - areas that that have existing development, but are below the allowable maximum lot coverage based on current zoning. Commercial and industrial parcels were included in the analysis. Existing residential lots in well-established subdivisions were excluded from the analysis since they are unlikely to be redeveloped.

Areas having the following physical and/or regulatory constraints were also removed from consideration for future development or redevelopment: water bodies, wetland soils, slopes exceeding 25%, and areas in the FEMA-designated 100-year flood zone. *Table 7-8* and *Figure 7-7* summarize the amount of developable land by subwatershed, including the new development and redevelopment categories.

Table 7-8. Developable Land – North Branch Park River Watershed

| Subwatershed | New Development (acres) | New Development Percent in Subwatershed | Redevelopment (acres) | Redevelopment Percent in Subwatershed |
|---|---|---|---|---|
| Beamans Brook East | 12 | 7.2% | 65 | 39.7% |
| Beamans Brook West | 60 | 5.0% | 90 | 7.6% |
| Blue Hills Reservoir | 60 | 5.8% | 353 | 34.1% |
| Cold Spring Reservoir | 166 | 14.4% | 117 | 10.1% |
| Filley Brook | 20 | 4.8% | 53 | 13.1% |
| North Branch Park River | 188 | 4.7% | 412 | 10.2% |
| Tumbledown Brook | 45 | 2.9% | 346 | 22.1% |
| Tumbledown Brook South | 175 | 10.8% | 12 | 0.7% |
| Tunxis Reservoir | 27 | 3.1% | 158 | 18.1% |
| Wash Brook North | 98 | 12.8% | 271 | 35.6% |
| Wash Brook South | 100 | 6.4% | 347 | 22.2% |
| Wash Brook West | 112 | 10.9% | 170 | 16.5% |
| West Hartford Reservoir | 234 | 11.4% | 23 | 1.1% |
| Wintonbury Reservoir | 126 | 14.1% | 188 | 21.1% |
| **Watershed (Total)** | **1,422** | **7.8%** | **2,605** | **14.2%** |

Figure 7-7

The future land use buildout scenario was estimated by assigning new land uses to developable areas, while maintaining the existing land uses for developed and unbuildable land (wetland soils, steep slope soils, floodplains and committed open space). The developable areas were assigned a future land use based on maximum degree of development allowed by existing zoning. Parcels that were developed prior to the promulgation of the existing zoning categories and regulations and may have a land use that is inconsistent with existing zoning. The current land use of these existing, non-conforming parcels is assumed to remain the same under future conditions for the purpose of this analysis.

*Table 7-9* summarizes the future land use category assigned to each developable parcel based on the existing zoning. This analysis assumes development of Public Act 490 (which provides tax incentives to preserve farmland, forest and open space land) parcels consistent with the underlying zoning and does not account for future zone changes or future land development regulatory changes.

Table 7-9. Assigned Future Land Use Categories

| Zoning Category | Assigned Future Land Use |
|---|---|
| 1-3 Unit Residential, Low Density | Single-Family |
| 1-3 Unit Residential, Medium Density | Single-Family |
| 1-3 Unit Residential, Medium-Low Density | Single-Family |
| Multi-Family | Multi-Family |
| Planned Residential | Multi-Family |
| Planned Area Development Including Residential | Mixed Use |
| Industrial | Industrial |
| General Mixed Use | Mixed Use |
| Neighborhood Scale Commercial | Commercial |
| Town Scale Commercial | Commercial |
| Recreation | Resource/Recreation |

The results of the watershed buildout analysis are summarized in *Table 7-10*, which compares acreage of existing and future land use in the watershed. Single-family residential and industrial land uses are predicted to increase by 13.5% and 9.4%, respectively. The majority of the increase in industrial land use is anticipated to occur in the northeast portion of the watershed, in an area of Bloomfield along Blue Hills Avenue (State Route 187) that is zoned for industrial use and is now largely undeveloped except for limited commercial development.

Approximately 4.7% of the existing commercial land use could be converted to industrial use in this area. There are also large areas of Bloomfield that are currently undeveloped and are zoned for low to medium density single-family residential use. The overall amount of resource/recreation and undeveloped land in the watershed is predicted to decrease by 42%.

Table 7-10. Watershed Buildout Analysis Results

| Land Use | $Acres_{Existing}$ | Percent of $Basin_{Existing}$ | $Acres_{Future}$ | Percent of $Basin_{Future}$ | Relative Percent Change[1] |
|---|---|---|---|---|---|
| Agriculture | 408 | 2.2% | 84 | 0.5% | -1.8% |
| Cemetery | 27 | 0.1% | 26 | 0.1% | 0.0% |
| Commercial | 1947 | 10.6% | 1086 | 5.9% | -4.7% |
| Government/Non-Profit | 1302 | 7.1% | 1114 | 6.1% | -1.0% |
| Group Quarters | 14 | 0.1% | 10 | 0.1% | 0.0% |
| Health/Medical | 96 | 0.5% | 68 | 0.4% | -0.2% |
| Industrial | 0 | 0.0% | 1721 | 9.4% | 9.4% |
| Mixed Use | 20 | 0.1% | 99 | 0.5% | 0.4% |
| Multi-Family | 1132 | 6.2% | 1147 | 6.3% | 0.1% |
| Single-Family | 5010 | 27.3% | 7478 | 40.8% | 13.5% |
| Resource/Recreation | 4192 | 22.9% | 3570 | 19.5% | -3.4% |
| ROW | 1495 | 8.2% | 1495 | 8.2% | 0.0% |
| Undeveloped | 2600 | 14.2% | 347 | 1.9% | -12.3% |
| Unknown | 7 | 0.0% | 7 | 0.0% | 0.0% |

[1]Calculation = % land use $_{future}$ - % land use $_{existing}$

### 7.2.1.2 Impervious Cover

The results of the watershed buildout and existing conditions impervious cover analyses were used to estimate future impervious cover in the North Branch Park River watershed. The difference between existing and future impervious cover was calculated as the potential increase in lot coverage for the developable parcels in the watershed. Future impervious cover for new development and redevelopment parcels was assumed equal to the maximum coverage allowed by zoning.

*Table 7-10* presents estimates of existing and future impervious cover by subwatershed. The blue shaded cells in the table highlight the subwatersheds for which impervious cover is predicted to change from "sensitive" (< 10% impervious cover) or "impacted" (10% to 25% impervious cover) to the "non-supporting" (25% to 60% impervious cover) category as described by the Impervious Cover Model. The Beamans Brook East subwatershed has the greatest predicted percent increase in impervious cover at nearly 50%, crossing the threshold from "sensitive" to "non-supporting." The gray shaded cells in the table highlight the subwatersheds for which impervious cover is predicted to change from "sensitive" to "impacted." The Cold Spring Reservoir, Tunxis Reservoir, and Wash Brook West subwatersheds are currently classified as "sensitive" but are predicted to exceed the "impacted" threshold under a future buildout scenario. Based on this analysis, the overall impervious cover in the North Branch Park River watershed is predicted to increase from 15.0% to 22.2% which is approaching the threshold for a "non-supporting" watershed.

Table 7-11. Percent Impervious Cover – Existing and Future Conditions

| Subwatershed | Existing Percent Impervious Cover | Future Percent Impervious Cover | Percent Change ($IC_{Future}$ - $IC_{Existing}$) |
|---|---|---|---|
| Beamans Brook East | 9.6% | 56.5% | 46.9% |
| Beamans Brook West | 16.6% | 20.4% | 3.8% |
| Blue Hills Reservoir | 14.9% | 27.3% | 12.4% |
| Cold Spring Reservoir | 6.2% | 11.9% | 5.7% |
| Filley Brook | 22.6% | 26.2% | 3.6% |
| North Branch Park River | 27.9% | 33.0% | 5.1% |
| Tumbledown Brook | 13.5% | 29.5% | 16.0% |
| Tumbledown Brook South | 11.5% | 15.2% | 3.7% |
| Tunxis Reservoir | 9.3% | 12.4% | 3.1% |
| Wash Brook North | 18.2% | 36.5% | 18.3% |
| Wash Brook South | 17.5% | 24.0% | 6.5% |
| Wash Brook West | 5.7% | 13.3% | 7.6% |
| West Hartford Reservoir | 1.1% | 2.4% | 1.3% |
| Wintonbury Reservoir | 13.2% | 24.7% | 11.5% |
| **Watershed (total)** | **15.0%** | **22.2%** | **7.2%** |

Another useful metric was developed by Goetz et al. (2003) for the Chesapeake Bay region, which combines subwatershed impervious cover and tree cover within the 100-foot stream buffer. Each of the subwatersheds within the North Branch Park River watershed was analyzed with regard to the combined impervious cover/riparian zone metric, which is summarized in *Table 7-21* by Goetz et al. (2003).

Table 7-12. Impervious Cover/Riparian Zone Metric

| Stream Health | % Watershed Impervious Cover | % Natural Vegetation in 100-ft Stream Buffer |
|---|---|---|
| Excellent | < = 6% | >=65% |
| Good | 6-10% | 60-65% |
| Fair | 10-25% | 40-60% |
| Poor | > 25% | < 40% |

The existing areas of natural vegetation were determined using the 2006 CLEAR land cover data. Natural vegetation was defined to include the deciduous forest, coniferous forest, forested wetland, and non-forested wetland categories. The future natural vegetation was determined to be areas within the 100 foot stream buffer that are currently vegetated and are not included in the potentially developable land areas identified in the buildout analysis. The Town of Bloomfield has a recommended riparian buffer of 75 feet along the banks of perennial streams, which was considered protected land in this analysis. (The Town of West Hartford does not have a riparian buffer recommendation in their zoning regulations, and negligible developable land exists within the riparian area in the Hartford portion of the watershed.) *Table 7-13* presents the results of the combined impervious cover/riparian zone metric for existing and future conditions. The color shading in the table corresponds to the metric classifications in *Table 7-11*.

Table 7-13. Impervious Cover/Riparian Zone Metric – Existing and Future Conditions

| Subwatershed | Existing | | Future | |
|---|---|---|---|---|
| | % Watershed Impervious Cover | % Natural Vegetation in 100-ft Stream Buffer | % Watershed Impervious Cover | % Natural Vegetation in 100-ft Stream Buffer |
| Beamans Brook East | 10% | 48% | 56% | 38% |
| Beamans Brook West | 17% | 48% | 20% | 43% |
| Blue Hills Reservoir | 15% | 61% | 27% | 56% |
| Cold Spring Reservoir | 6% | 64% | 12% | 58% |
| Filley Brook | 23% | 51% | 26% | 45% |
| North Branch Park River | 28% | 48% | 33% | 37% |
| Tumbledown Brook | 14% | 39% | 29% | 35% |
| Tumbledown Brook South | 12% | 40% | 15% | 32% |
| Tunxis Reservoir | 9% | 74% | 12% | 66% |
| Wash Brook North | 18% | 70% | 36% | 57% |
| Wash Brook South | 18% | 44% | 24% | 36% |
| Wash Brook West | 6% | 62% | 13% | 48% |
| West Hartford Reservoir | 1% | 86% | 2% | 77% |
| Wintonbury Reservoir | 13% | 73% | 25% | 67% |
| **Watershed (total)** | **15%** | **55%** | **22%** | **47%** |

Currently, the North Branch Park River subwatersheds are highly varied and are categorized as "excellent" to "poor" based on the riparian zone metric published by Goetz et al. (2003). The Cold Spring Reservoir, Tunxis Reservoir, Wash Brook West, and West Hartford Reservoir subwatersheds are rated as "excellent" or "good" based on the combined impervious cover/riparian zone metrics. The North Branch Park River and Tumbledown Brook subwatersheds have a "poor" rating for at least one of the metrics.

Under a watershed buildout scenario, many of the subwatersheds are predicted to experience a decline in stream health as a result of increases in impervious cover and development within the riparian corridor. One or both of the metrics are predicted to decline from a "good" or "fair" rating to a "poor" rating for the Beamans Brook East, Blue Hills Reservoir, Filley Brook, North Branch Park River, Tumbledown Brook, Tumbledown Brook South, Wash Brook North, and Wash Brook South subwatersheds.