

# NATURAL RESOURCES



*Newbury* | © John Knox

## A. Introduction

Town Plans throughout the Region express a universal desire to maintain the rural character of their communities while allowing appropriate, compatible development. An essential part of the rural character is the quality and quantity of natural resources of the Region. This character is appreciated by residents and is a primary attraction to tourists, retirees, second home owners, and potential residents. The place and the natural resources that are its foundation are therefore important economically as well as ecologically.

Most of the Region is hilly, with the highest portions along the western edge of the Region in the spine of the Green Mountains and in central Orange County. The lower hills are predominantly covered in deciduous forest that is largely maple, while higher and northern slopes have conifers such as white pine and hemlock. Given the Region's geologic formation and glaciation, it is not surprising that most of

the valleys run north-south. Virtually the entire region drains south and east down these valleys to the Connecticut River. Seven rivers—the Connecticut, Ompompanoosuc, Ottauquechee, Tweed, Waits, Wells, and White—form the aquatic arteries of the Region. Along the rivers, especially the Connecticut and branches of the White, valley floors are large and fertile enough to have supported centuries of agriculture.

The diversity of plant and animal life within the Region are indicators of the health of the overall ecosystem to which all natural resources and human welfare are connected. Herbaceous and woody plants in the Region provide us with a myriad of benefits. Trees alone supply us with fuel, lumber, air and water filtration, carbon sequestration, scenic beauty, and that sweet sign of spring, maple syrup. Healthy wild animal populations provide us with opportunities including hunting and bird-watching and services such as pollination and pest control. Healthy surface waters support diverse aquatic plant and animal life and provide safe and beautiful areas

for swimming, boating, and fishing. Wetlands and large forested areas provide habitats for a variety of species native to Vermont and form a natural means of recharging groundwater for the health of the human inhabitants of the Region. The air gives us one of the basic needs of life.

Due to the rural nature of the Region and Vermont, the Region's natural resources are in better condition than in many of the other regions of the country, but they are vastly different from pre-settlement conditions. The topography has changed little, but rivers have been dammed and moved aside in valleys, and enormous swatches of wetlands have been filled. Virtually all of the timber has been cut over at least once, and immense amounts of soil have washed down from the hills. Native animals such as wolves and catamounts have been extirpated, trees such as chestnut and elm drastically reduced, and fish species such as Atlantic salmon almost lost. Still, we are left with fertile valleys, a returning forest, and many species of wildlife in healthy populations. If we can retain enough of our natural resources in good condition, then the place we cherish will continue to function as an ecosystem, a source of livelihood, and an integral part of the character of Vermont.

## B. Groundwater

### Background

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Virtually all of the Region relies upon groundwater for domestic and commercial water supply. Protecting the primary water supply of the Region requires protection of the groundwater from contamination. Given the limited budgets of our communities, it is fiscally prudent to thoroughly review and prevent potential threats to groundwater before they occur. Protection of groundwater requires protection of surface waters, wetlands, watersheds, and recharge areas in a coordinated, ecologically sound fashion.

The groundwater that supplies public and private wells is pumped or pushed to the surface from an underground aquifer. An aquifer is an

underground area of saturated sand, gravel, or fractured bedrock that is permeable enough to yield water through wells or springs. The surface area that drains into an aquifer is called a recharge area. Water tables are typically shallow, soils are thin except along valley floors, and fractured crystalline bedrock provides little in terms of filtration. The minimal groundwater data available in Vermont makes it difficult to distinguish, map, and protect vulnerable groundwater resources across the State.

The quality of the groundwater in the Region is generally good; however, there is potential for groundwater quality problems. Contamination sources of concern include old industrial and town solid waste disposal sites, leaking underground storage tanks, continuing use of improper industrial floor drains, accidental fuel or chemical spills, poor agricultural practices, road salt, natural nutrient runoff, and failed septic systems.

Many hazardous sites have been identified, and some cleanup actions and enforcement are taking place. Contaminated sites in need of public assistance can be assessed and brought back into productive use with public assistance from the state and regional brownfields programs with landowner permission. In the case of sites contaminated by oil products, new underground fuel storage tanks are much less prone to leaking, and sites must be tested for contamination when old tanks are removed. The State does have a Petroleum Cleanup Fund that helps pay for any cleanup at these sites. Though still too common, existing floor drains at industrial sites and garages are being either sealed or connected to treatment or capture systems that keep contaminants out of the groundwater. Fuel spills from rail or trucks are much more likely than a spill of any other toxic substance and are generally small. Well-trained and equipped road crews and fire departments are the best initial defense against a major spill becoming a groundwater nightmare.

Pesticides, herbicides, phosphorous, and nitrogen from manure can also infiltrate into groundwater. Proper use and storage of farm chemicals and manure can greatly reduce any negative effects on groundwater and limit impacts to surface water.

The hundreds of tons of salt brought into the Region each year for use on winter roads is a recognized ongoing groundwater threat. It is the salt leaching from uncovered storage piles that is a groundwater concern, which Vermont and the Environmental Protection Agency are in the process of addressing. The actual use of salt on roads is a surface water issue, however.

Lastly, there are failed septic systems. Many

residential systems in Vermont were installed prior to regulation and have long since ceased to keep septage out of the groundwater. Some “straight-pipe” systems, where waste is directly discharged to a wetland or stream, are still probably unwittingly in use. Prior to the 1990s, systems may have been properly designed but not correctly installed, as the auditing of installation was very weak. Until 2002, many systems on lots over 10 acres were still exempt from regulation. The passage of the 2002 Wastewater System and Potable Water Supply Rules closed the 10-acre loophole, increased scrutiny of permits and installation, and eliminated the occurrence of groundwater pollution from new septic systems.

## Goal, Policies, and Recommendations: **Groundwater**

### *Goal*

1. The quality and quantity of groundwater resources are maintained or enhanced.

### *Policies*

1. Commercial water withdrawal must be carefully monitored by the State and shall not lower aquifers and impact surface waters.
2. The Agency of Natural Resources will carefully review land use activities that potentially threaten groundwater quality, including the following:
  - a. Underground storage tanks for petroleum or other hazardous substances. Permits are required from the State for most underground storage tanks containing gasoline or heating oil; however, exceptions are made for fuel oil storage tanks used for on-premises heating purposes and residential tanks storing motor fuel.
  - b. Pesticide and herbicide applications on agricultural land, golf courses, resorts, residential properties, and railroad and utility rights-of-way.
  - c. Junk yards and solid waste disposal sites.
4. Groundwater contamination from commercial and industrial uses must be remedied by the parties causing such contamination with assistance from regional, state, and federal sources when responsible and viable parties cannot be found.
5. It is the policy of TRORC to permanently protect Class I groundwater. These are high-quality resource areas mapped by the Agency of Natural Resources and so classified by the Secretary as currently being used or suitable for a public water supply source. In undertaking the above, regional land use policy and decision making should limit human activities in these areas.

### *Recommendations*

1. TRORC will work with the Agency of Natural Resources and with towns to identify and map aquifers and aquifer protection areas.
2. Towns are encouraged to develop Source Protection Plans for public water supplies or aquifers that have been identified. Such programs may include limiting or prohibiting development and other land uses within wellhead or aquifer protection areas.

*Goal, policies, and recommendations continued on next page*



## Goal, Policies, and Recommendations: **Groundwater**

### *Recommendations (continued)*

3. The Legislature must keep the Petroleum Cleanup Fund at a level sufficient to meet all cleanup needs, including enforcement.
4. TRORC will work with the Agency of Natural Resources, town officials, and others on educational outreach about the proper use of floor drains and local spill response capacity.
5. TRORC will coordinate with the Agency of Natural Resources, other state agencies, and local officials in the assessment, cleanup, and redevelopment of contaminated (brownfield) sites.
6. TRORC will assist towns when requested to identify, monitor, and protect important local groundwater resources as part of their planning programs. Aquifers, public water supplies, and recharge areas should be mapped whenever possible in order to determine critical areas for protection of drinking water supplies.

## **C. Surface Water**

### Background

The surface waters of the Region are important resources for economic vitality and physical health. High-quality surface water attracts users and provides a source of direct and indirect livelihood for many of the Region's residents through various businesses related to sports and tourism.

The high quality and largely natural character of the surface waters are among the primary components of the quality of life deemed valuable to the Region. Surface waters are integrated with groundwater, land cover types, and land uses and should be considered in any decisions affecting those elements.

### Water Quality Standards, Classifications, and Designated Uses

The Vermont Water Quality Standards (VWQS) are rules that concern surface waters throughout Vermont. They have been established to achieve the goals of the Vermont Water Quality Policy as well as the objectives of the federal Clean Water Act, which relate to the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters. The VWQS, which were last updated in 2016, contain certain numeric and narrative criteria that describe the classification of all waters based on

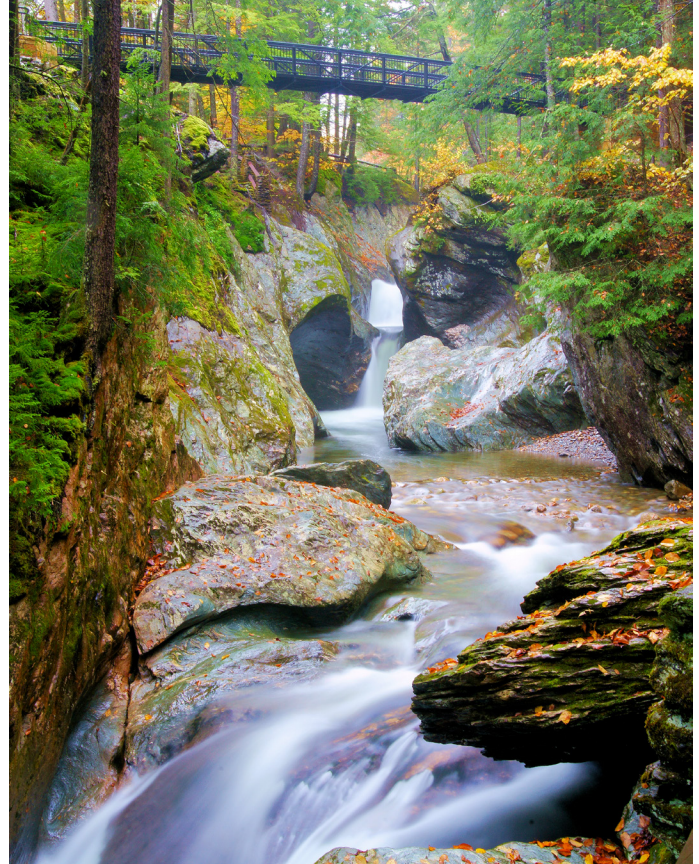
designated uses. Water quality classifications (A1, A2, B1, and B2) are administered by the Vermont Department of Environmental Conservation (DEC) which establishes water quality goals for each body of water in the State. These goals include protecting and enhancing the quality, character, and usefulness of surface waters; maintaining the purity of drinking water; controlling the discharge of wastes to waters; preventing degradation and preserving high-quality waters; and assuring maintenance of water quality to sustain existing aquatic communities. It is important to note that the classification assigned to any specific body of water does not necessarily represent a description of the existing conditions or quality of waters but may be a goal for improvement. A goal for lower quality than what presently exists is essentially illegal, except for minor impacts in very limited circumstances and only after a rigorous public benefit analysis.

The State's waters are currently classified as Class A1, A2, B1, or B2 with an overlay Waste Management Zone in Class B2 waters for public protection downstream of sanitary wastewater discharge points (10 VSA Chapter 47). Each classification is managed for specific designated uses. The same body of water may contain different classifications for different uses. Designated uses include aquatic biota and wildlife; aquatic habitat to support aquatic biota, wildlife, or plant life; swimming and other

primary contact recreation; boating; fishing; aesthetic condition; public water source; and irrigation of crops and agricultural uses. All waters of the State are required to be fishable and swimmable under state and federal law since 1983, and the gradations between A1 and B2 have to do both with the use of the water and its quality. B2 waters are the lowest legal classification, and most waters were placed into this classification when the Water Quality Standards were updated in 2016.

Class A waters are managed for enjoyment of water in its natural condition, as public drinking water supplies (the A2 classification is exclusively reserved for this use, and it includes the disinfection and filtration of waters) or as very high-quality waters in excellent condition that have significant ecological values. Class B1 waters are managed as waters that are in very good condition. The Secretary of the Agency of Natural Resources may designate by permit portions of Class B waters as “Mixing Zones” or “Waste Management Zones” for any waste that has been properly treated to comply with federal and state effluent requirements. Within a mixing zone or waste management zone, water conditions must not create a public health hazard; must not constitute a barrier to the passage or migration of fish or result in undue adverse effect on fish, aquatic biota, or wildlife; and must not interfere with any existing use of the waters.

Most waters in the Region are now classified as Class B2, with the exception of all surface waters above 2,500 feet elevation that are classified as A1. Other surface waters classified as A1 include waters within the Breadloaf Wilderness Area of the Green Mountain National Forest, surface waters within the Joseph Battell Wilderness Area of the Green Mountain National Forest, Bingo Brook in the White River watershed, Smith Brook in the White River watershed, and Beaver Meadows Ponds in the White River watershed. A few reservoirs and sections of tributaries have been classified as Class A2 and are designated as secondary sources of drinking water for the towns in which they are located.



*Texas Falls, Hancock* | © John Knox

All newly classified B2 waters that were previously simply Class B will be reviewed against the Vermont Water Quality Standards, and those that meet or could reasonably attain the criteria will be proposed for designation as A1 or B1 during the basin planning process. Nearly all of the Region’s surface water will be placed into either A1 or B1 in the future, depending on the degree of protection desired and the actual quality.

An additional designation of Outstanding Resource Water can be decided by the Agency of Natural Resources. There is currently only one “outstanding” water resource in the Region: the Great Falls of the Ompompanoosuc River, located in Thetford. The main stem of the White River has been proposed as a prospective outstanding resource water because it is undammed.

In classifying the surface waters of the State, the Agency considers any adopted basin plan, existing

uses, background conditions, and the degree of water quality to be obtained and maintained. Recommendations for use reclassifications are made during the tactical basin planning process of each watershed. The Agency, on its own motion or in response to a petition, will review an established classification to determine if it is contrary to the public interest and, if so, what classification is in the public interest.

### Sources of Water Degredation

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Non-point pollution sources are the greatest cause of water quality impairment in rivers and streams now that the State has completed the building of public wastewater treatment plants and largely eliminated individual straight pipes. The four most common water quality impairments caused by non-point sources are siltation, thermal modifications, pathogens, and nutrients. Other common causes of impairment to rivers and streams are habitat alterations and flow alterations. The principal sources of these impairments are agricultural runoff, streambank destabilization and erosion, removal of riparian (streamside) vegetation, flow regulations or modifications (largely due to dams and withdrawals), stormwater discharges from developed areas, and highway maintenance and runoff. Specific sections of watersheds may be more affected by one of these factors than another. Known and suspected problems are often detailed in the DEC's basin assessments and the 303(d) List of Impaired Waters, but considerably more work is needed to identify problems in sufficient detail to undertake planning to address them.

In lakes and ponds, many recreational and development activities are also those activities that can threaten water quality. Shoreline development can cause erosion and sedimentation. Failing septic systems and poor agricultural practices contribute pathogens and phosphorous. Motorboats and trailers transport invasive species such as Eurasian water milfoil and zebra mussels. Intentional water level

fluctuations from drawdowns harm bordering wetlands. Also, any entering rivers and streams can bring with them the above mentioned pollution.

### Watershed Management and Basin Planning

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A watershed or river basin is all of the land that drains into a certain point. The Vermont Watershed Management Division of the Vermont Department of Environmental Conservation has divided the State into fifteen basin areas, determined by the watersheds of major rivers and lakes, some of which actually combine the watersheds of two or more rivers that drain to different points for administrative reasons. The State has been required by federal law to adopt basin plans for decades, and state law requires that each of these plans be adopted by the Secretary of the Agency of Natural Resources. These plans have a duration of five years, and planning efforts typically commence one year prior to their expiration. TRORC is integrated into this basin planning process by statute.

The items that basin plans must cover are laid out by the Vermont Water Quality Standards and the federal Clean Water Act. Basin plans inventory the existing and potential causes and sources of pollution that may impair their surface waters and then establish a strategy to improve or restore waters. The plans form the basis for state implementation actions and should serve to coordinate stakeholders' efforts. In the development of plans, ANR seeks public participation to identify and inventory problems, solutions, high-quality waters, existing uses, and significant resources of high public interest and is required to consider approved municipal and Regional Plans. The plans will identify strategies, where necessary, by which to allocate levels of pollution between various sources as well as between individual discharges, and should, to the extent possible, contain specific recommendations by the Secretary of ANR regarding:



- Existing uses
  - Fish spawning or nursery areas important to the establishment or maintenance of fisheries
  - Reference conditions appropriate for specific waters
  - Any recommended changes in classification and designation of waters
  - Schedules and funding for remediation
  - Stormwater management
  - Riparian zone management
  - Other measures or strategies pertaining to the enhancement and maintenance of the quality of waters within the basin
- Second Branch of the White River in Royalton, Bethel, and Randolph
  - Third Branch of the White River in Bethel
  - Smith Brook in Randolph
- Basin 10: Ottauquechee Watershed and Connecticut River Tributaries
    - Neal Brook in Hartford
    - A small stream to the Ottauquechee River in Bridgewater

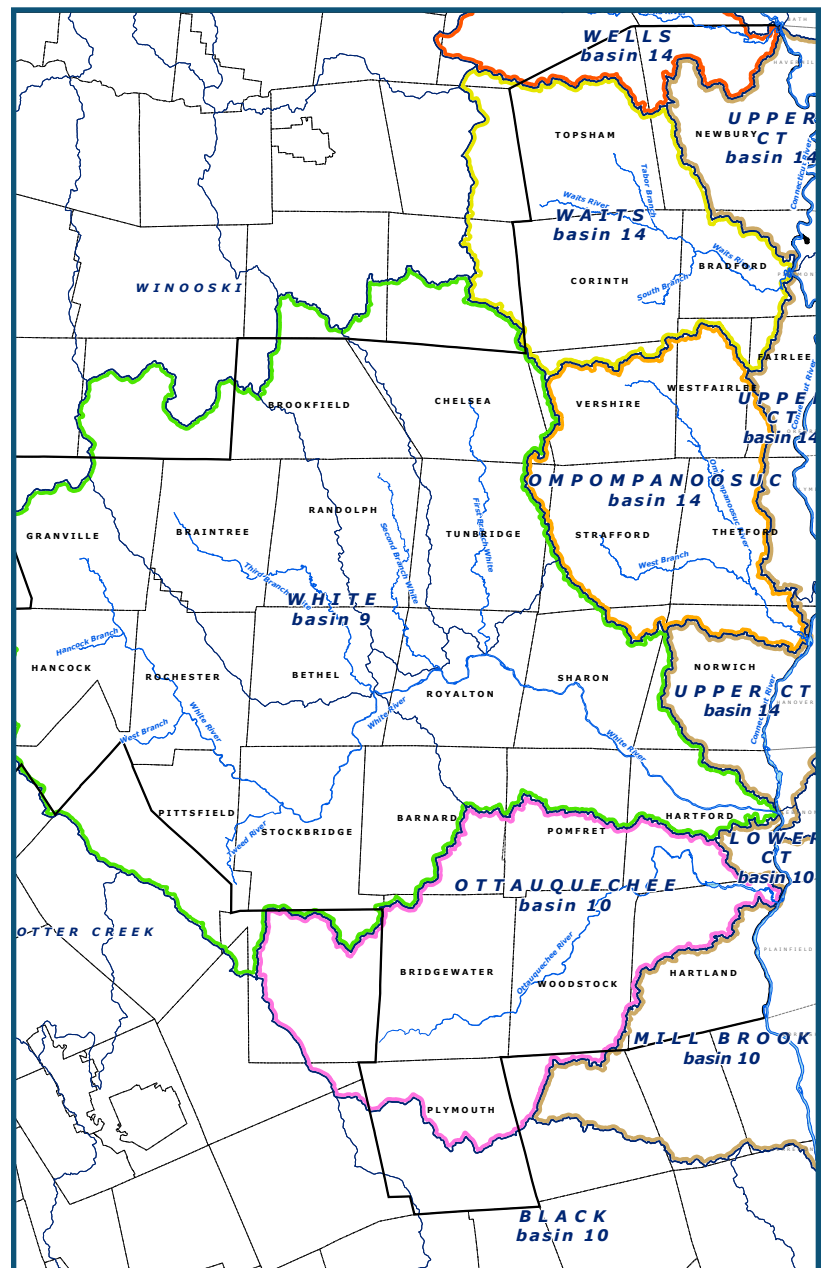
Tactical Basin Plans shall identify appropriate classifications for waters, including A1 for extremely high-quality waters and B1 for very high-quality waters based on existing and reasonably attainable uses as directed by water quality management goals.

Basins in the TRO Region include the Ottauquechee River, Black River, Lulls Brook, and Mill Brook (Basin 10); the White River (Basin 9); and the Wells River, Waits River, Ompompanoosuc River, and Upper Connecticut River tributaries (Basin 14). Very small portions of Otter Creek and the Winooski River are also in the Region.

The Watershed Management Division produces the State of Vermont Water Quality Integrated Assessment (305(b) report) every two years and the State Clean Water Strategy every five years, in which priority waters are targeted for remediation or protection. In the Region, several surface waters have been listed as impaired on the State’s 303(d) list:

- Basin 9: White River Watershed
  - First Branch of the White River in Royalton, Tunbridge, and Chelsea

**Figure 6-1: Watersheds and Basins**



Source: Vermont Agency of Natural Resources

- Basin 14: Ompompanoosuc and Waits River Watersheds
  - Lords Brook and Headwater Tributary #2 in Strafford and Thetford
  - Tabor Branch Tributary #6 in Topsham
  - Schoolhouse Brook in Vershire and West Fairlee
  - Copperas Brook in Strafford
  - Cookeville Brook Tributary in Corinth
  - Pike Hill Brook in Corinth

In addition, there are numerous threatened and stressed surface water bodies in the TRO Region.

### Shoreline Buffers and Riparian Areas

The maintenance and enhancement of streamside and lakeside vegetation is the easiest and most effective means of protecting the many benefits and values associated with surface waters. Setting aside unmowed areas of naturally growing grasses, shrubs, and trees is essential to the health of streams and lakes and to resource conservation. Appropriately vegetated shorelines contribute to the maintenance of water quality and shoreline protection because they:

1. Provide bank support and stabilization to reduce erosion
2. Help prevent bank undercutting and bank collapse
3. Provide food and shelter for fish, macroinvertebrates, and wildlife
4. Intercept, absorb, and filter out pollutants such as silt, fertilizers, toxic chemicals, and livestock wastes
5. Provide shade to keep water temperatures cool during hot summer months when fish are susceptible to heat stress
6. Slow surface water runoff
7. Increase wildlife diversity to include many amphibian, reptile, mammal, and bird species by providing habitat and travel corridors

8. Reduce flood and ice damage to stream channels, adjacent lands, and structures
9. Preserve the natural character of waters

The Connecticut River forms the eastern boundary of Vermont, and the entirety of the TRO Region lies within its watershed. The Connecticut River shoreline forms the border of the towns of Hartland, Hartford, Norwich, Thetford, Fairlee, Bradford, and Newbury. There are large sections of the shoreline area that have exhibited erosion. The Connecticut River features a major hydroelectric facility, the Wilder Dam, which is operated by Great River Hydro (formerly owned by TransCanada). The Wilder Dam's impoundment, or reservoir area, extends for 45 miles upstream to the Town of Newbury. The reservoir fluctuates daily as the owner of the facility increases the rate of water to the turbines to generate electricity during peak periods. However, the daily fluctuation, which can be up to five feet, can dramatically affect the shoreline areas of the Connecticut River. The rapid saturation and removal of water along streambank areas has caused erosion and the flooding of large areas along the Connecticut River, which impacts waterfowl nesting, fish habitat, transportation infrastructure, and private properties.



*Kingsbury Bridge, Randolph | © John Knox*



## Goals, Policies, and Recommendations: **Surface Water**

### **Goals**

1. Surface water quality and quantity for the purposes of recreation, aquatic habitat, and drinking water is improved.
2. A coordinated program for surface water quality and quantity is supported at municipal, basin, and regional levels.
3. High-quality waters, including fragile high-altitude waters, and the ecosystems they sustain are protected.

### **Policies**

1. Maintenance or enhancement of recreation, fisheries, wildlife habitats, and quality aesthetics are high priorities. Water use decisions at all levels of government and the private sector shall protect these resources and their existing and desired uses and conditions.
2. Within each of the watershed basins in the Region (see Figure 6-1), state, regional, and local decisions relating to surface water must reflect:
  - a. The public's high interest in the use and enjoyment of rivers and streams for recreation, fishing, and aesthetics
  - b. Existing and projected growth rates for towns in each watershed, including towns within the Region, towns bordering the Region, and towns within each specific basin
  - c. Present state water quality management plans and relevant portions of municipal and state plans
  - d. Established environmental, social, and economic goals and policies of the Region as expressed in local plans and bylaws and this Regional Plan.
  - e. Status of existing and proposed municipal and community wastewater treatment facilities, plans, and needs
  - f. Existing water quality conditions and known public and private pollution sources
3. Efforts by public and private sectors to abate pollution in the Region's rivers, streams, lakes, and ponds are required. Existing water pollution problems, as identified in the Agency of Natural Resources' Basin Plans, the Water Quality Integrated Assessment (305(b) report), the 303(d) List of Impaired Waters, and the Vermont Surface Water Management Strategy shall be considered high priority for abatement.
4. Discharges to any water in the Region shall be based upon assimilative capacity studies. Allocation and use of limited assimilative capacity shall be based on the following priorities from highest to lowest:
  - a. To abate pollution from existing and possible future sources
  - b. To hold in reserve some capacity to account for any uncertainties in mathematical assimilative capacity estimates
  - c. To accommodate new growth and development that is part of a detailed and publicly reviewed and accepted growth management plan or designated growth center
5. Class A1 and A2 waters shall be protected from development and other activities that diminish their purity, natural flow, or condition.
6. Vegetated buffer strips must be maintained in riparian zones and shoreland areas surrounding streams, rivers, lakes, and ponds. Rock rip-rap and retaining walls should only be used to the extent necessary and when bioengineering techniques may not be adequate to prevent significant loss of land or property.
7. Upland watersheds should be maintained predominantly in forest and low impact recreation use to ensure high quality of valley streams and their tributaries.

*Goals, policies, and recommendations continued on next page*

## Goals, Policies, and Recommendations: **Surface Water**

### ***Policies (continued)***

8. Preservation of the natural state of streams must be encouraged by the:
  - a. Protection of adjacent wetlands and natural areas
  - b. Protection of natural scenic qualities
  - c. Maintenance of existing streambank vegetation, which also supports wildlife habitat
  - d. Proper classification that reflects the condition of high-quality waters in areas with little development
9. Given the statewide recreational resource value of the free-flowing White River, new hydropower development on that river shall not be consistent with this Plan, except where it can be done in a “run of the river” manner that does not affect the river flow volume and does not create any significant impounding or dewatering of bypass reaches.
10. All wastewater and stormwater runoff discharges into surface waters shall comply with water quality standards as administered by the Vermont Agency of Natural Resources (24 VSA Chapter 47 and related rules).
11. Municipalities must employ road maintenance techniques to prevent soil erosion and road surface deterioration. Towns need to use the procedures contained in the Vermont Better Backroads Manual (2009) and should work to implement Best Management Practices (BMPs) on hydrologically connected road segments to comply with the Municipal Roads General Permit.
12. Great River Hydro, and its subsidiaries, shall carefully maintain the ramping rates associated with its hydroelectric facilities to prevent erosion and loss of land along the streambanks of the Connecticut River.

### ***Recommendations***

1. Municipalities need to review existing and proposed water quality classifications of surface waters within town boundaries, or within basins, to determine if classifications meet the uses and needs. Both TRORC and the Agency of Natural Resources are available to provide support.
2. Municipalities must play an active role in the basin planning process and prepare water resources elements in municipal plans that are in compliance with state and federal laws.
3. The Vermont Department of Environmental Conservation’s listing of threatened and impaired waters must be targeted for immediate attention by the Department.
4. Towns in the Region are encouraged to cooperate on a watershed-wide basis when planning for surface water quality and use.
5. TRORC, in cooperation with the Vermont Watershed Management Division, the Agency of Natural Resources, Vermont Local Roads Program, and the Agency of Transportation, should advise town officials on cost-effective road erosion and sediment control.
6. TRORC shall continue to participate in watershed and basin planning efforts.
7. Unless there are specific public benefits to lower classifications, the Agency of Natural Resources shall adopt the highest possible classification and uses for water bodies based on their actual conditions and uses or that which is reasonably attainable.
8. Public and private sectors should refrain from activities that spread invasive plants such as ill-timed roadside mowing, transporting invasive plants in ditch soil, and the cleaning of mowing and earthmoving equipment after working in an infested area. Road maintenance personnel should be trained to recognize the invasive plants on the Vermont Noxious Weed Quarantine List and Watchlist.

*Goals, policies, and recommendations continued on next page*

## Goals, Policies, and Recommendations: **Surface Water**

### **Recommendations (continued)**

9. The Agency of Natural Resources and local watershed groups are encouraged to monitor water quality, and when monitoring indicates a water quality violation, to promptly locate and address the source of degradation when possible.
10. In preparation for writing any basin plans, the Agency of Natural Resources must conduct a comprehensive assessment of water quality in such basins and identify the source(s) of any known water quality problems.
11. Proper erosion control procedures shall be applied in all construction activities, and all stormwater shall be treated through natural or mechanical systems to remove nutrients and sediments and to attenuate flood flows to natural levels before any stormwater reaches streams.
12. To protect high-quality forested riparian (riverbank, streambank, or lakeshore) habitat, towns should prohibit development near these areas and regulate the disturbance of vegetation in riparian zones through general, conditional use, and/or site plan standards.
13. The Agency of Agriculture, Food, and Markets must revise the Required Agricultural Practices to manage animal uses in buffer areas.

### **D. Fisheries and Aquatic Resources**

The Region's rivers and streams provide cold water habitat for brook, brown, and rainbow trout, long nose and black nose dace, sculpin, smallmouth bass, and several other species of fish including Atlantic salmon, which are being reintroduced to the Region's rivers through state and federal efforts. Several bodies of water have been classified as warm water fish habitats, including Lake Pinneo in Hartford, North Hartland Reservoir in Hartland and Hartford, Lake Abenaki in Thetford, the Ottauquechee River from the North Hartland Dam to its confluence with the Connecticut River, Lamson Pond in Brookfield, Silver Lake in Barnard, a section of the Waits River in Bradford, Halls Lake and Harriman Pond in Newbury, and Lake Morey in Fairlee. In order to support native fish populations, both warm and cold water habitats must be able to provide adequate supplies of oxygen and support the plant, animal, and insect life on which fish populations feed. Also, because many cold water species return annually to the same breeding areas, waterways must remain open to fish migration.

In order for species such as the Atlantic salmon to thrive as they once did, habitat areas must be suitable to their survival. Warm temperatures, low flow levels, and contaminants can all threaten the success of salmon restoration efforts. Protection and restoration of habitat must precede reintroduction of species into the natural environment. Development or construction in and around rivers and streams can be harmful to fish habitat unless care is taken to prevent turbidity, sedimentation, decreased dissolved oxygen, and flow alteration.

The damming of streams to create ponds, either within a stream channel or drawing from the stream channel, can damage fish habitat by increasing water temperature, decreasing dissolved oxygen, encouraging nuisance algal growth, creating barriers to fish passage, and increasing the potential introduction of non-native species. All of these factors damage the natural ecosystem of the stream and decrease native fish populations.



## Goals and Policies: **Fisheries and Aquatic Resources**

### *Goals*

1. The water quality and quantity necessary to sustain existing aquatic communities is maintained.
2. The natural diversity, population, and migratory routes of fish are maintained or improved.

### *Policies*

1. Manmade alterations to flows must ensure downstream protection of water quality and quantity for aquatic communities and stream functions and consider alternatives.
2. The design and construction of dams on rivers and streams, other than the White River where it is not consistent with this Plan, is discouraged except when the public interest is clearly benefited and the following criteria are met:
  - a. Projects operate as “run of the river” and do not affect the flow of river volume.
  - b. Fish passage and canoe portages are provided at dams.
  - c. Water quality and minimum flows are maintained.
4. Because of threats to the natural ecosystem, the construction of ponds is discouraged, unless fed by groundwater and/or overland drainage. Discharges from ponds, if any, shall be designed to withstand a 100-year storm event and operate in a “run of the river” mode.
5. In-stream ponds are discouraged on all stream segments that support fish life.
6. Permanently vegetated streamside buffer strips of at least 50 feet on small streams and 100 feet on rivers should be preserved except in those areas with dense development in connection with existing similar development such as adjacent to, or infill of, existing downtowns or village centers. This does not include agricultural activities allowed by the State of Vermont’s Required Agricultural Practices (RAPs).
7. New or replacement bridges and culverts must be adequately designed and constructed to handle stormwater, provide sediment transport, and accommodate fish and wildlife passage.
8. Bioengineered bank stabilization is the preferred method of streambank restoration. When rock armament of streambanks is necessary, efforts should be made to revegetate on top of the rock to reduce water temperature.
9. Fishing shall be considered an existing use in all waters of the State.
10. Increased public access to surface waters is the policy of TRORC.

## **E. Wetlands**

Wetlands provide an array of functions and values that support environmental health and benefit humans. Benefits include flood and stormwater control, maintenance of surface and groundwater quality, open space and aesthetic appreciation, and fish and wildlife habitat (including a large number of threatened and endangered species). Wetlands are also important for recreational activities such as hunting, fishing, bird-watching, and photography.

Draining, filling, and development have resulted in the loss of more than 35 percent of Vermont’s

original wetland acreage, primarily due to agricultural and large-scale development projects. At present, roughly 4 percent of Vermont’s lands are classified as wetlands, totaling 244,000 acres. The Vermont Wetlands Office estimates that an additional 80,000 acres of wetlands exist that have not been identified, bringing the actual total to about 5 or 6 percent of the State’s land. The current rate of wetland loss in Vermont has been estimated at eight acres a year through incremental destruction by numerous smaller projects, many of which are less than one acre, with serious implications for short- and long-term wetland values. Although methods

exist for creating areas that have many wetland characteristics, it is not possible to replicate the intricate complexities of a wetland formed over tens or hundreds or thousands of years.

**The State of Vermont defines wetlands as “those areas of the state that are inundated by surface or ground water with a frequency sufficient to support significant vegetation or aquatic life that depend on saturated or seasonally saturated soil conditions for growth and reproduction.”**

The State of Vermont defines wetlands as “those areas of the state that are inundated by surface or groundwater with a frequency sufficient to support significant vegetation or aquatic life that depend on saturated or seasonally saturated soil conditions for growth and reproduction.” Such areas include but are not limited to marshes, swamps, sloughs, potholes, fens, river and lake overflows, mud flats, bogs, and ponds.

The Vermont Wetlands Rules (2017) (10 VSA Chapter 37) classify all wetlands into three categories. Class 1 wetlands are those identified as “exceptional or irreplaceable in their contribution to Vermont’s natural heritage.” No Class 1 wetlands have been designated in the Region. Class 2 wetlands are those shown on the National Wetlands Inventory, as well as any wetlands contiguous to these mapped wetlands. Most wetlands considered Class 2 have areas of at least three acres. Class 3 wetlands are those that have not been evaluated or are not considered by the Agency of Natural Resources to be significant. The Vermont Wetland Rules require a 100 foot buffer for Class 1 wetlands and a 50 foot buffer for Class 2 wetlands.

In addition to state protection, wetlands are also overseen by the U.S. Army Corps of Engineers, which has the responsibility of administering Section 404 of the Clean Water Act, which regulates the dredging or placing of fill into any wetland. The Environmental Protection Agency and the U.S. Fish and Wildlife Service have review authority over any Army Corps permit. Several other federal agencies, including the National Park Service and the Natural Resources Conservation Service (NRCS), administer grant programs that encourage the protection of wetlands.

In the TRO Region, just over one percent (1.2%) of the land area has been identified by the State of Vermont as “significant” wetlands, eligible for state protection under the Vermont Wetlands Rules. However, there are a large number of smaller wetlands that may qualify for protection. According to the Wildlife Management Institute in Washington, D.C., “ten one-acre wetlands provide habitat for many more duck pairs than does one 10-acre wetland. Small wetlands also thaw faster and provide more high-protein foods for nesting hens than larger wetlands.” They are also critical in the flight paths of migrating mallards, pintails, teals, gadwalls, and shovelers. Forested wetlands have also been recognized as containing critical spring food sources for black bears and other species.

Wetlands are important feeding and breeding areas for a variety of plant and animal species. Certain freshwater fish species require wetlands as spawning grounds and as nursery areas for their young. Wetlands are also important for maintaining the quality of fish habitat by providing shade or discharging water from cold springs, both of which moderate surface water temperatures. Wetlands provide essential habitat for numerous wildlife species. The dense vegetation found in most wetlands provides a variety of foods and also nesting sites that are relatively safe from predators. Many species rely on wetlands for some or all of their life cycles, while for others, wetlands are important for a

part of their life cycle or during certain times of the year.

Wetlands provide necessary habitats for the survival of a high percentage of the threatened and endangered species in the State. Roughly 35 percent of plants and 21 percent of animals on the threatened and endangered lists are closely associated with, or are found exclusively in, wetlands.

A buffer zone is essential protection both for species in the wetland and for those species preferring the upland/wetland border. The trees and shrubs provide important food, cover, and nesting sites for large and small mammals, songbirds, reptiles, and amphibians. The vegetation also screens wetland wildlife from noise, light, and other human activities in

adjacent uplands. Municipalities are encouraged to map and preserve wetlands and vernal pools, especially in large areas of undeveloped land, as crucial habitat areas for a variety of native plant and animal species. State officials at the Vermont Department of Environmental Conservation recommend a setback of at least 200 feet for wildlife habitat protection around wetlands.

#### Wetlands Identification

In order to be protected by Criterion 1(G) of Act 250, wetlands must be listed as significant by the State. Municipalities, TRORC, or other interested parties may petition the Agency of Natural Resources to (1) have a wetland reclassified to a higher or lower classification, (2) determine which functions make the wetland significant, (3) determine whether the size or configuration of a buffer strip

associated with a significant wetland should be modified, or (4) determine the final boundaries of any significant wetland.

However, wetlands may be protected under several other sections of Act 250, including criteria dealing with water pollution (section 1), waste disposal (1(B)), floodways (1(D)), streams (1(E)), shorelines (1(F)), erosion control (4), natural areas and aesthetic considerations (8), wildlife habitat (8A), and public investments and facilities (9A), and under local and Regional Plans. TRORC recognizes the critical value of wetlands in relation to the health of the water, wildlife, and plant resources in the Region and to the ecosystem as a whole.

#### Vernal Pools

Vernal pools are temporary bodies of water that usually occur where small depressions, swales, or kettle holes collect spring runoff or intercept seasonally high groundwater tables. Although many vernal pools are small and isolated, they are often associated with more extensive wetland systems. In Vermont, most vernal pools occur in forested habitats, but they can also be found in meadows, sand flats, and river floodplains. It is estimated that each town in Vermont has at least one vernal pool.

Most vernal pools in Vermont are ephemeral, filled by spring rains and snow melt but dry during the summer. Some pools may become filled again in the fall and contain water during the winter, while others, during wet years, may contain water year round. Vernal pools are typically shallow (less than 3 feet deep) and can vary in size from just a few feet across to more than 150 feet in width. These habitats are safe breeding grounds for many amphibian and insect populations because they are not connected to stream systems and do not support fish populations.

Vernal pools provide important breeding habitat for amphibians, primarily the wood frog and Vermont's three species of "mole" salamanders,

**The purpose of the Vermont Wetlands Rules is "to identify and protect significant wetlands and the values and functions which they serve in such a manner that the goal of no net loss of such wetlands and their functions is achieved."**



and have characteristic populations of fairy shrimp, fingernail clams, snails, water fleas, and copepods. Since amphibians and many other species return to the same vernal pool each year to breed, destruction or alteration of vernal pools will result in the loss of local populations of some species.

**Vernal pools are a unique and vulnerable habitat that must be identified and protected under municipal regulations. It is estimated that every town in Vermont has at least one vernal pool.**

Because of their small size and temporary nature, vernal pools are not mapped very well, but they are now protected under the Vermont Wetland Rules as Class 2 wetlands. They are a unique and vulnerable habitat area. Scientists recommend a continuous forested buffer of roughly 500 feet

around vernal pools.

### Fens and Bogs

Fens and bogs are two rare natural communities found in the Region that are also host to several species of rare plants. Bogs typically receive their moisture from precipitation. Fens receive their moisture from groundwater resources. Whereas bogs tend to be found in areas with an acidic substrate, fens are usually found in areas of calcareous (limy) bedrock or till. Fens tend to have a diverse flora that includes many uncommon plants such as the showy lady’s slipper (*Cypripedium reginae*). There are many important fens in the Region, and Fairlee hosts a “quaking bog.” Most fens and bogs are identified by the Vermont Natural Heritage Inventory; however, towns are encouraged to identify and protect fens and bogs in municipal plans and bylaws as well.

## Goals, Policies, and Recommendations: **Wetlands**

### Goals

1. There is no net loss of wetlands that provide significant functions and values.
2. Critical natural communities such as vernal pools, fens, and bogs are identified and protected.

### Policies

1. Significant wetlands must be protected from development by maintaining an undisturbed buffer strip of naturally vegetated upland of at least 50 to 100 feet in width (or wider according to the type of development and the wildlife species to be protected) around the edge of each wetland and by preventing runoff and direct discharge into wetlands.\*
2. Development should not occur in wetland areas.
3. Vernal pools should be protected from development by establishing an overlay district that identifies vernal pools and their surrounding terrestrial amphibian habitat.

### Recommendations

1. The State of Vermont must more accurately identify and map significant wetland areas not currently classified as Class 1 or 2 wetlands and petition the Agency of Natural Resources to have such areas reclassified at a higher level.
2. TRORC should work with towns to establish a priority list of wetlands for protection and/or acquisition.
3. The State should provide property tax relief incentives for the protection of designated wetlands.

*Goals, policies, and recommendations continued on next page*

*\*Rivers and streams should have wide naturally vegetated riparian habitat (for example, greater than 100 feet wide on at least one side of a river or stream that appears to connect habitat)*

## Goals, Policies, and Recommendations: **Wetlands**

### *Recommendations (continued)*

4. To protect wetland functions, native biological diversity, and the loss of habitat, towns should adopt zoning and/or subdivision regulations that discourage development near wetlands and vernal pools that are not already protected under state or federal law. They should consider restricting development within 500 feet of all wetlands in conservation districts.
5. TRORC supports and encourages community efforts to identify and inventory wetlands, including vernal pools, and to adopt mechanisms for their increased protection, including formal petitions to be shown on the Vermont Wetlands Inventory Map. This information can increase the effectiveness of the state and federal regulatory process.

## **F. Wildlife Resources**

Wildlife habitat is defined as the physical and biological environment in which a particular species of plant or animal lives. Large wildlife species such as black bear, moose, deer, and bobcat, as well as large birds of prey and many varieties of songbirds require larger expanses of contiguous habitat to survive. In addition, large mammals serve as indicators of ecosystem health, so the health of one species may indicate the health of all. To maintain or improve the populations and diversity of these species, their habitat must be managed wisely and protected from unreasonable fragmentation and alteration. Wildlife of the Region is one of the primary attractions to the area and provides many of its citizens with direct and indirect livelihoods.

Wildlife management requires controlling human activities around animals as much as management of animals around human activities. Many wildlife cannot live where there is any amount of development, no matter how seemingly unobtrusive. Managing for specific species is not as desirable as managing for the entire ecosystem supporting the species. Parochial wildlife management programs usually manage for one species at the expense of others, while a more ecological approach is to ensure healthy habitat for all members of the food chain because they all have intrinsic value. Habitat that is productive for most species of wildlife in the Region requires a diversity of forest type and

maturity. Forests that are carefully managed, for the benefit of both humans and animals, support older nut-producing trees, medium-sized trees for firewood, and an undergrowth of young trees and shrubs that provide food and cover for a variety of species. In addition, occasional clear-cuts, if done according to accepted management practices, can provide browse for moose, deer, and bear, and can be followed by planting trees such as oak. An Intent-to-Cut Notification must be submitted to the Vermont Department of Forests, Parks, and Recreation when a landowner plans to conduct a heavy cut of 40 acres or more.

### **Bird Habitats**

Because of the diverse habitat types that range from the high elevation woodlands of the Green Mountain National Forest to the low grassland areas in the Connecticut River Valley, the Region is host to a variety of bird species, many of which depend on unique habitat areas in the Region for migration corridors, wintering areas, or breeding sites.

The Connecticut River Valley offers breeding habitat for a wide variety of birds and serves as a migration flyway for waterfowl and neo-tropical songbird species such as warblers and vireos. Many songbirds require wooded corridors for stopover sites during their annual migrations to and from the tropics. Grassland areas in the Valley are home to species such as eastern meadowlark, vesper sparrow, Savannah sparrow, upland sandpiper, and bobolink, some of which



*Barred Owl at King Farm* | © Tory Littlefield

have been declining in number in recent years. Rivers in the Region also provide important habitat for waterfowl such as snow geese and several varieties of ducks as well as herons and rails. Some sections of rapidly moving water in Bridgewater have been used by bald eagles during migration, and great blue heron rookeries are located in Hartland and Tunbridge.

High elevation areas (over 2,500 feet) support a unique assemblage of birds including Bicknell's thrush, Swainson's thrush, and blackpoll warblers. Cliff areas such as Eagle Rock in Vershire, the Palisades and Sawyer Mountain in Fairlee, and Vulture Mountain in Stockbridge are breeding areas for the endangered peregrine falcon. Wildlife biologists are well aware of the diversity of bird species in the Region; however, unlike deer and bear habitats, these important areas have not yet been thoroughly mapped.

Vermont occupies an important position in the conservation of North American bird populations. The diversity of Vermont's habitats, from northern hardwood and spruce/fir forests to farmlands and wetlands, support an equally

diverse array of avian species. State endangered species and other species of concern have significant populations in Vermont. Conserving essential habitats for these species and others is the highest priority if we are to maintain Vermont's avian richness.

Important Bird Areas (IBAs) are sites that support significant populations of one or more species of breeding, migrating, or wintering birds. IBAs can be as small as two-tenths (0.2) of an acre or as large as thousands of acres, but usually they are discrete sites that stand out from the surrounding landscape. The identification and conservation of these important sites is a vital component of global efforts to sustain viable bird populations. In Vermont, seventeen IBAs and four IBA complexes (IBAs focusing on individual species at multiple sites) totaling more than 115 sites have been identified across the State.

Bird-watching is an important economic driver in this Region because of its unique habitat areas. According to the U.S. Fish and Wildlife Service, more than 66 million people over the age of sixteen spent over \$38.4 billion in 2001 on trips and equipment for observation, feeding, and photography of wildlife in the United States. Communities can encourage birding and ecotourism and improve their local economies.

## Mammal Habitats

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### *Black Bear*

The black bear is native to Vermont and is found primarily in remote, forested habitat. An estimated 5,400 black bear live in the State; they are a particularly good indicator of remote forestland. The mountainous, forested landscape we appreciate for recreation and beauty is the stronghold of bear; these animals will only exist as long as there is habitat to support them. Minimum habitat requirements must be maintained for black bear survival: adequate food supplies; forest blocks that meet home range needs; and connectivity to large blocks of forestland that serve as population sources. Simply conserving individual parcels



of land containing critical bear foods will not ensure a future bear population. If Vermont's forested landscape continues to be fragmented into progressively smaller, discontinuous units, the bear will likely decline and ultimately may disappear.

The Vermont Department of Fish and Wildlife has mapped two types of black bear habitat areas in the State: bear production habitat and seasonal bear habitat. Bear production areas are described as “generally contiguous and remote forestland, containing critical habitats necessary to bear survival.” Production areas support relatively high densities of cub-producing females. Seasonal bear habitats are “regions frequently used by bears, including some cub-producing females. These habitats often contain critical seasonal feeding area and vital travel corridors.” Bear production habitat covers much of the western part of the Region throughout the towns of Granville, Hancock, Pittsfield, and Plymouth, as well as sections of Barnard, Bridgewater, Braintree, Rochester, Stockbridge, and Woodstock. Seasonal bear habitat is also found in the eastern part of the Region throughout the towns of Corinth, Topsham, and West Fairlee and in sections of Bradford, Fairlee, Newbury, and Vershire.

Within bear production areas there are “critical habitat areas,” which are defined by Act 250 as “concentrated wildlife habitat which is identifiable and is demonstrated as being

decisive to the survival of a species of wildlife at any period of its life.” Critical habitat for black bear includes hard mast stands (beech and oak), wetlands, and travel corridors within the production or seasonal bear habitat areas. However, such critical habitats have not been mapped.

### *Deer*

Deer wintering areas provide relief from harsh climatic conditions by providing protection from deep snow, cold temperatures, and wind chill. These habitats are characterized by a high degree of softwood cover (primarily hemlock), steep slopes, or areas that receive low snow accumulation, southerly or westerly aspects, generally moderate elevation, and low levels of human disturbance in winter.

The Vermont Department of Fish and Wildlife has been working to discover the habits and lifestyle of white-tailed deer during the past twenty years. Much of this effort has included the mapping of deer wintering areas. Overall, wintering areas have not changed significantly over time. Evidence shows that deer usually travel considerable distances to the same wintering areas. If habitat conditions are maintained, deer will utilize the same sites for a long period of time.

Residential, commercial, or industrial development that is within or adjacent to a deer wintering area decreases the amount of land available to deer and erodes a town's deer population, eventually decreasing the number of deer within the town. According to Department of Fish and Wildlife maps, deer wintering areas in the Region are widespread, with the largest concentrations existing in the towns of Bradford, Brookfield, Hartford, Norwich, Randolph, Royalton, Tunbridge, and West Fairlee.

### *Moose*

The Vermont Department of Fish and Wildlife's 2010–2020 Big Game Management Plan contains objectives to allow for controlled growth of the moose population in most parts of Vermont and

**According to the U.S. Fish and Wildlife Service, more than 66 million people over the age of sixteen spent over \$38.4 billion in 2001 on trips and equipment for observation, feeding, and photography of wildlife in the United States. Bird watching has an underestimated and under-appreciated economic impact.**

to monitor populations to determine when and if population regulation is necessary. Modern moose management began in Vermont in 1992, followed by the State's first moose hunt in 1993, a hunt which has continued annually since then. During the 2008 season, 605 moose were harvested. Currently, Vermont's estimated moose population is 2,200.

Moose use different habitats during different seasons, preferring thick, brushy habitat for concealment and food. They have a large home range, often from four to ten square miles, making habitat management specifically for moose impractical. Critical habitat areas for moose include late-winter concentration areas, which include mature spruce/fir stands (older than 20 years) with nearby regenerating forests for food, wetland feeding areas, and salt licks.

Moose benefit from logging practices that create abundant browse (leaves, tender shoots, or other soft vegetation) on recently logged or burned land. A stable moose population relies on a balance of forest age classes. While moose and deer share similar habitats in non-winter months, there is not sufficient evidence to suggest that an increase in the population of one will cause a decrease in the population of the other. There is some concern, however, that larger deer populations will increase the likelihood of moose contracting the brainworm that is carried by deer but has a deleterious effect only on moose. Another concern for moose in the area is the presence of winter ticks. Winter ticks suck the blood of moose, leaving them weak and anemic.

Most moose in Vermont are located in the Northeast Kingdom; however, many have been sighted in the TRO Region. In order to maintain or increase the population of moose in the Region, towns may prohibit or limit development in large contiguous tracts of forested land.

### ***Bobcat***

Although once fairly common in the State, populations of bobcats and other large cats such as the legendary catamount, were greatly

diminished in the early part of the century, when most of the land was cleared for agriculture. The transformation of land use over the last century from open fields to brush land and regenerating forests has expanded the habitat of the bobcat and the snowshoe hare, one of the bobcat's primary sources of food. As a result, populations of bobcats have shown an increase, but development pressures continue to threaten these animals.

The habitat of the bobcat is typically low to medium elevation spruce forest with the presence of rocky outcroppings for den sites and access to forest openings that sustain rodents and other small mammals. Large ski areas such as Killington, with open slopes next to dense forest, have shown fairly healthy populations of bobcats in recent years. In the TRO Region, bobcats are known to live in the Delectable Mountain range in the Chateaugay No Town Conservation Area. Uneven age management and occasional small clear-cutting of forested areas could provide beneficial habitat for bobcat production. Deeryards and wetlands provide benefits to the habitat.

### ***Bats***

Habitats critical to bat survival include "hibernacula" (usually caves or mines) where they can hibernate and summer roosting and maternity colony areas. This Region hosts two significant bat hibernacula: unused mines in Strafford and Vershire. Nine species of bats are found in Vermont: big brown bats, small footed bats, Indiana bats, northern long-eared bats, tri-colored bats, little brown bats, silver-haired bats, hoary bats, and red bats.

Bats congregate to give birth and raise young during the summer in maternity colonies. Tree cavities and trees with exfoliating bark are

**Towns are encouraged to map any newly discovered bat hibernacula and restrict access to the caves during the winter season.**

important to maternity colonies, but the colonies may also use buildings. Bats congregate to feed during the summer months in foraging colonies; these colonies may be small and dispersed or may contain a large number of individuals. The bigger colonies are the most critical and often occur in the same habitats as maternity colonies. Lower elevations in the Region, near rivers, provide a warm climate and an abundance of insects for bats. A summer netting survey of the Union Village Dam by the U.S. Army Corps of Engineers indicated the presence of little brown bats, big brown bats, northern long-eared bats, and small-footed bats. All four species were using the area for maternity colonies. Small-footed bats are known to roost in rock cracks and talus slopes; they may also roost on the face of the dam. The Region's forests provide foraging habitat for this species.

It is important to protect the winter habitat of bats, particularly the endangered species, which include the state endangered northern long-eared bat, tri-colored bat, little brown bat, and the federally endangered Indiana bat. During hibernation, Indiana bats cluster together on the walls of caves and abandoned mines to conserve energy and maintain a constant humidity. If the bats are disturbed while hibernating, their energy levels may decline, weakening their condition. The Vermont Agency of Natural Resources has worked with other groups to block human access to bat hibernacula.

Another threat to bat conservation is White-Nose Syndrome, a disease associated with millions of North American bat deaths. White-Nose Syndrome was first discovered in Vermont in 2008 and has been destructive to the cave bat population since. A White-Nose Syndrome steering committee has formed nationally to coordinate a response to the devastating bat disease.

## Threatened and Endangered Species and



*Turtles—Integral Species in the Region's Ecosystem* | © K. Kanz, 2002

## Critical Natural Communities

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Rare plants and animals are important for a variety of reasons. Some are indicators of unusual habitats or of colder or warmer climates in Vermont's distant past. Some serve as indicators of environmental quality. Some species may provide compounds for medicines and agricultural or industrial products. Some species are attractive and add beauty to the landscape. And most importantly, the presence of a diversity of plant and animal species is vital to a healthy, functioning ecosystem. Many uncommon species will disappear if not recognized and protected.

Species with a state status of "threatened" or "endangered" are protected by Vermont's Endangered Species Law (10 VSA Chapter 123); a federal status of "threatened" or "endangered" is protected by the Federal Endangered Species Act (P.L. 93-205). The Vermont Department of Fish and Wildlife maintains lists of threatened or endangered plants and animals. The State also publishes a list of rare native fauna to inform naturalists, biologists, planners, developers, and the general public. These animals may be rare because they have very particular habitat requirements, are at the edges of their ranges, are vulnerable to disturbance or collection, or have difficulty reproducing for unknown reasons.

The Vermont Nongame and Natural Heritage Program in the Department of Fish and Wildlife has identified and mapped special natural features or species and natural communities; there are 463 such features in the Region. Several

species of grassland birds, including the upland sandpiper, and other endangered birds such as the bald eagle, depend on critical habitat areas in the Region. In addition to animals on the Threatened and Endangered Species of Vermont list, the Vermont Institute of Natural Science (VINS) has recognized several species such as the wood turtle that are in decline and may soon become endangered.

### Climate Change and Forest Shifts

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As the climate warms, tree species need to shift their geographies northward in order to remain within an inhabitable environment. It is expected that under the best scenario the Northeastern United States will lose spruce/fir/paper birch type forests and that more oak/hickory forests will move in. Under high emissions scenarios (which is the current track) the maple/beech forests may also be largely replaced by oak/hickory.<sup>1</sup>

A study on the pace of tree species migration suggests that natural species migration rates in undisturbed forests range from 100 to 200 meters per year and will not match the speed of climate change, which is on the order of at least 350 meters per year. Therefore, while maintaining continuous forests for southern species to move northward will be critical, assisted colonization programs will also be needed, which will require large-scale environmental intervention. If tree movement is unable to keep up with temperature gradient shifts, this will result in fragmented landscapes. Invasive woody plant species may also colonize new forest areas, as they grow faster than trees and can take advantage of forest clearings. Invasive forest diseases and pests will also be worsened by climate change.<sup>2</sup>

### Mast Stands

“Mast” is a term used by foresters and wildlife biologists to describe the fruit and seeds of trees and shrubs that are a source of food for wildlife. Hard mast, such as the nuts of oak and beech, is a critically important source of food for many kinds of wildlife. The Vermont Department of Fish and Wildlife considers areas of beech or oak with a

history of bear feeding use to be necessary wildlife habitat, as these stands are absolutely essential for the survival and reproduction of black bear in Vermont. While scarred beech stands signify important bear habitat, their increasing susceptibility to death and disease make mature oak stands possibly more important and reliable resources. Because of their value as timber logs, mature oak are fairly rare in the Region. Since only older trees produce mast, mature oak trees are considered a critical resource to all forms of wildlife and should be inventoried and protected.

### Invasive Species

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The Region is currently undergoing changes to our woods, fields, wetlands, and waters due to invasive species. Invasive species are non-native species (both plant and animal) that flourish to the detriment of native species.<sup>3</sup> They occur in lakes and rivers, as with Eurasian milfoil or the algae didymo (“rock snot”); in wetlands, as with species such as purple loosestrife; fields, as with wild parsnip or buckthorn; and in forests, as with the emerald ash borer. Invasives are best managed by avoiding infestations through management actions that limit spread, such as the ban on moving untreated firewood across state lines. Some species can be managed through well-timed mowing or manual removal. A well-educated citizenry is one of the best defenses against inadvertent spread. Once established, invasives are very difficult to control. As climates shift northward, species that had been kept at bay due to extreme cold will be on the rise.



*A Monarch Butterfly* | © Rosalie Geiger



## Goals, Policies, and Recommendations: **Wildlife Resources**

### **Goals**

1. The biodiversity and population of wildlife, including natural predators, is maintained or enhanced.
2. Stable populations of state and federally designated threatened or endangered wildlife and their associated habitat areas are restored.
3. Game species populations are healthy and support sport and subsistence hunting in an ecologically sound manner.

### **Policies**

1. Development should be designed and sited in a manner to preserve contiguous areas of active or potential wildlife habitat. Corridors connecting habitat areas for large mammals must be incorporated in plans for management and conservation of forested areas. Fragmentation of critical wildlife habitat should not be approved.
2. Conserve large tracts of bear habitat when possible and adopt cluster land use concepts in zoning bylaws as a mechanism for maintaining contiguous areas of forest cover.
3. Large contiguous tracts of forest should be managed so as to maintain the diversity of tree cover necessary for shelter and food supply for deer, black bear, and other large mammals and for birds.
4. The rate of harvest of wildlife for sport or subsistence must not exceed the capacity of an area to replenish the species.
5. Development, including roads and power line corridors, within designated bear habitat areas must be minimized.
6. Development should utilize existing roads and field edges to avoid additional fragmentation.
7. Deer wintering areas should be protected from development and other uses that threaten the ability of this habitat to support deer.
8. Developers must demonstrate that they have taken reasonable steps during development planning to minimize impacts on critical habitats, including, but not limited, to the following:
  - a. Habitat connectors.
  - b. Grassland regions.
  - c. Cliff areas identified as potential or active nesting places for peregrine falcons.
  - d. Areas over 2,500 feet in elevation.
  - e. Large tracts of contiguous forest land identified as priority or high priority forest blocks.
9. Landowners, foresters, and developers must be sensitive to critical bear habitat areas in their management plans.<sup>4</sup>
10. Buffer zones, necessary for species' health, should be maintained between land development and critical habitat.
11. Actions to monitor and curb the spread of invasive species are encouraged.

### **Recommendations**

1. With the help of specialists from the Department of Fish and Wildlife or the Vermont Institute of Natural Science, towns in the Region should work to inventory wildlife species; sensitive areas including wetlands, vernal pools, bogs, and fens; mature oak trees; and critical habitats for birds, deer, bear, bobcats, heron, and threatened or endangered plant species.
2. Towns should establish Conservation Commissions that work alongside VTrans, Vermont Fish and Wildlife, and nonprofit conservation organizations to maintain wildlife corridors.

*Goals, policies, and recommendations continued next page*

## Goals, Policies, and Recommendations: **Wildlife Resources**

### *Recommendations (continued)*

3. Towns are encouraged to use mechanisms such as cluster zoning, conservation districts, transferring or purchasing of development rights, or purchasing of land containing critical habitat areas in order to maintain the integrity of large forest blocks and preserve critical habitat and habitat connectors.
4. Towns should work cooperatively with and seek assistance from land trusts to maintain large tracts of undeveloped habitat that cross political boundaries.
5. Town Plans and zoning regulations should protect significant natural features and sensitive habitat areas by using setbacks and buffers.
6. Local officials are encouraged to work with staff from regional offices of the Vermont Department of Fish and Wildlife and wildlife biologists from VINS to assist in identifying and creating inventories of the critical habitat areas and significant natural communities in their municipalities.
7. Towns should attempt to identify critical bear habitat areas within the broader areas identified on Vermont bear habitat maps.
8. VTrans and towns should always consider terrestrial and aquatic wildlife passage as part of a design when constructing bridges and culverts, especially in areas along known wildlife corridors.
9. Towns should time roadside mowing to limit spread of plants such as wild chervil and wild parsnip.
10. When using heavy machinery near streams, machinery operators must clean them before and after use to avoid inadvertent spread of species such as Japanese knotweed.

## **G. Air Quality**

### **Background**

The air quality of Vermont and the TRO Region is a primary attraction to its inhabitants and visitors and is a major component of the quality of life and health in the area. Although air polluting industries are not a major component of our economy, automobile traffic, transregional pollution, illegal open burning of garbage, and wood-burning activities pose some threats to air quality and should be managed wisely in the short and long term.

### **Stoves**

The Region has a traditional dependence upon wood-burning stoves for heating homes and businesses. The narrow topography and tendency for thermal inversions in the cooler months in these areas can potentially cause unhealthy and undesired pollution concentrations. Federal air quality regulations require stove manufacturers

to produce cleaner burning stoves. However, the life span of older woodstoves is often several decades. These older, less efficient stoves will stay in use for many years to come and will continue to pollute unless replaced. Another heat source is outdoor wood-burning furnaces. Older heaters of this kind may not disperse smoke efficiently, which can have negative health impacts. Pellet stoves offer an alternative to traditional wood-burning stoves. Wood pellets produce less ash and lower emissions. A multi-town or sub-regional approach to woodstove pollution may be the most acceptable resolution to these potential problems, since airsheds do not limit themselves to political boundaries.

### **Garbage Burning**

Because of the implementation of solid waste disposal fees, there has been an increase in illegal open burning of garbage in the Region. Open burning can cause wildfires and releases toxins into the air that cause health and environmental

impacts and impair general air quality. Such toxins include heavy metals, dioxins, toxic gases, and carbon monoxide.

### Air Pollution

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Trans-regional air pollution, where the Region is impacted by air pollution from hundreds or even thousands of miles away, will become more important in the future. Trans-regional air pollution should be addressed by the state and federal government, as the Region's communities may be the recipients of pollution that could affect them or their natural resources but will have little ability to deal with these issues.

### Carbon Dioxide

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With 81 percent of the Region being forested, it hosts a unique vegetative cover that processes a large volume of carbon dioxide and regulates air temperatures. Air quality is directly influenced by tree cover and biomass transpiration, and any land uses affecting the composition of the land cover of the Region or sub-regions must be reviewed in relation to their cumulative and incremental impact upon air quality and the factors influencing it.

The release of carbon dioxide and other gases responsible for global warming is a local issue and is therefore the responsibility of the people of the regions that produce them. Increases in carbon dioxide emissions, primarily as a result of combustion of fossil fuels, are a leading cause of the buildup of greenhouse gases in the atmosphere. Greenhouse gases warm the atmosphere by acting as an insulator that prevents some heat from escaping the earth's atmosphere. Forest growth naturally stores or "sequesters" carbon, and that carbon remains in the wood after it is processed into a product. It is estimated that an amount equal to half of the carbon emitted in Vermont is sequestered by our forests.<sup>5</sup> Harvesting operations that mimic conditions more akin to old growth forests have been shown to better retain carbon in the forest while also producing more wood than traditional

harvest methods.<sup>6</sup> Activities that increase the biomass accumulation in a forest or in forest products increase carbon sequestration.

As climate change and potential regulations to curb its impact grow in importance to national policy makers, business leaders are considering forest growth as an inexpensive way to mitigate atmospheric carbon. Forest managers may be able to receive financial benefit from the value of carbon storage, in effect selling another product off their land, and thus increasing the economic viability of sustainable forest management in the Northeast.



*Snow Covered Firewood* | © John Knox

## Goals, Policies, and Recommendations: **Air Quality**

### **Goals**

1. Air quality in local and regional airsheds is maintained or improved.
2. Dependence upon fossil-fueled and single-occupant automobiles for transportation is reduced.
3. The transfer of pollution into the Region from outside sites is reduced.

### **Policies**

1. Proposed developments must be reviewed for their direct and indirect impact upon air quality and acceptability by local and regional airshed users.
2. Wood burning as a method of disposal should be reduced; as a source of heat, wood burning should be continued, but efforts should be made to update wood stoves.
3. Air pollution impact review should include visual quality in addition to contaminant concentrations over time and distance.
4. Any emissions of hazardous or toxic air pollutants by commercial operations shall be controlled and monitored for public health and safety so that concentrations of hazardous or toxic air contaminants in local and regional airsheds are below those listed for human health protection by federal and state regulations.
5. Backyard burning of trash is illegal, and local education and enforcement activities are strongly encouraged to eliminate this practice.
6. The development and use of more energy-efficient devices and renewable energy resources is promoted.

### **Recommendations**

1. Install and maintain a regional air quality monitoring network in cooperation with the Vermont Agency of Natural Resources so as to determine current and potential threats to air quality. Potential impact areas include village centers or other areas of traffic congestion and high elevations, where pollutants and acidic levels are potentially greater and more harmful to fragile vegetation.
2. Municipalities and state agencies should educate communities about the impacts of trash burning and develop more effective mechanisms to enforce laws prohibiting backyard burning of trash, including the adoption of civil ordinances.
3. Woody debris from site clearing or forestry operations should be left on site or chipped, instead of being burned, in order to reduce pollution and to enable this material to contribute to soil formation.
4. TRORC should be prepared to comment upon projects outside the Region that may potentially impact air quality within the Region.



## H. Mineral Resources

### Background

The wise use and management of the Region’s earth and mineral resources are matters of public good. Maintenance of sustainable quantities of gravel, sand, crushed rock, and other materials are essential for the development industry as well as maintenance of state and local highways. Public and private interests are often in conflict over utilization of the resource. It is in the interest of the Region to enable utilization of these resources when such uses do not unduly threaten or significantly inhibit or conflict with other existing or planned land uses. TRORC recognizes the need to balance the rights of the owners of these resources with the public’s right to minimize the nuisance potential resulting from mineral extraction.

### Act 250

Vermont’s Act 250 includes a project review criterion that protects land with the high potential for the extraction of earth resources and also requires planning for the future rehabilitation of the site. Generally recognized issues incidental to mineral extraction include:

1. Creation of excessive dust and noise as a result of truck traffic and operations at the site, thus denying reasonable use of neighboring properties.
2. Degradation of the site or adjacent areas that cause aesthetically displeasing conditions in the vicinity.
3. Undue deterioration of and traffic congestion on town and state highways.
4. Improper management practices that result in unnecessary soil erosion and inadequate site restoration.

The Region is host to three former copper mines that are now federally listed “Superfund” sites: the Elizabeth Mine in Strafford, the Ely Mine in Vershire, and the Pike Hill Mine in Corinth. Each mine was operated during the nineteenth and twentieth centuries and extensive remediation is required by the U.S. Environmental Protection Agency according to CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act), the federal law that governs cleanup of these sites. Remediation is taking place at the Elizabeth Mine. Cleanup plans are in place at the Ely Mine, and investigation activities are ongoing at the Pike Hill Mine.

## Goals, Policies, and Recommendations: **Mineral Resources**

### Goals

1. Wise utilization of mineral resources occurs to accommodate growth and development of the Region and adequate maintenance of transportation infrastructure.
2. Extraction and processing of resources happens in a way that such activities are appropriately managed and the public interest is clearly benefited.
3. Remediation of extraction and mining sites in the Region occurs in every instance.

### Policies

1. Mineral extraction and processing facilities shall be planned, constructed, and managed:
  - a. To not unduly, adversely impact existing or planned uses within the vicinity of the project site
  - b. To provide direct access to Class 3 or better highways
  - c. To not cause a burden to the function and safety of existing roads and bridges serving the project site. Factors to be considered in determining impacts are:
    - Extent of increase in heavy vehicular traffic
    - Effects of weight loads on roadbeds and bridges

*Goals, policies, and recommendations continued next page*

## Goals, Policies, and Recommendations: **Mineral Resources**

### *Policies (continued)*

- Conflicts with pedestrians or bike users
  - Numbers and frequency of heavy vehicles traveling through dense residential areas
  - d. To minimize loss of significant prime agricultural land
  - e. To minimize any adverse effects on water quality, fish and wildlife habitats, and adjacent land uses
2. Extraction sites must be screened to the extent practical if topography and vegetation allow.
  3. Commercial extraction of gravel from streams is prohibited by law, and private extraction is strongly discouraged due to the destabilizing effects it can have. All streambed extraction should only be done after careful consideration of the site by qualified professionals and in consultation with the Vermont Department of Environmental Conservation's River Management Section.
  4. Future extraction activities of copper or other metals must safely deal with mine wastes and not impact ground or surface water.

### *Recommendations*

1. All sites must plan for their eventual rehabilitation so that slopes are stable and the surface is revegetated. To that end, topsoil shall not be removed from sites and excavations shall stop early enough so that stable slopes can be established on the property.
2. Mineral extraction and processing facilities must be planned and developed so they do not place an excessive or uneconomic burden on local and state highways and bridges.
3. All extraction sites must maintain at least a 50-foot buffer of undisturbed land by any wetland or surface water and sufficient additional land above the grade of adjacent streams to preclude a danger of avulsion of the stream into any working areas under flood conditions.

## Natural Resources Endnotes

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