06 | Natural Resources

Newbury Wells River | ©John Knox

A. Introduction

Town Plans throughout the Region express the desire to maintain the rural character of their communities while allowing compatible development. An essential part of the rural character is the quality and quantity of natural resources of the Region. 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 have disappeared. Still, we are left with fertile valleys, large amounts of 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

Virtually all of the Region relies upon groundwater[1] for domestic and commercial water supply, whether it is individual wells or larger town systems. Quality groundwater is a basic human need. It is fiscally prudent to review and prevent threats to groundwater before they occur. Protection of groundwater requires protection of surface waters, wetlands, watersheds, and recharge areas.

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 fuel tanks, continuing use of improper industrial floor drains, accidental fuel or chemical spills, poor agricultural practices, road salt, PFAS, natural nutrient runoff, and failed septic systems. Many residential septic systems in Vermont were installed prior to regulation and do not adequately treat septic discharge prior to entering groundwater. Straight pipe[2] systems, where waste is directly discharged to a wetland or stream, are illegal but some are likely still in use.

C. Surface Water

Background

The streams, rivers, ponds, and lakes of the Region are critical resources for economic vitality and physical health. These surface waters support direct and indirect livelihoods for many of the Region's residents through sports and tourism-related businesses.

Vermont's high-quality surface water also support the existence of the quality of life deemed valuable to the Region. Surface waters integrated with groundwater, wetlands, land cover types, and land uses should be considered in any decisions affecting those elements.

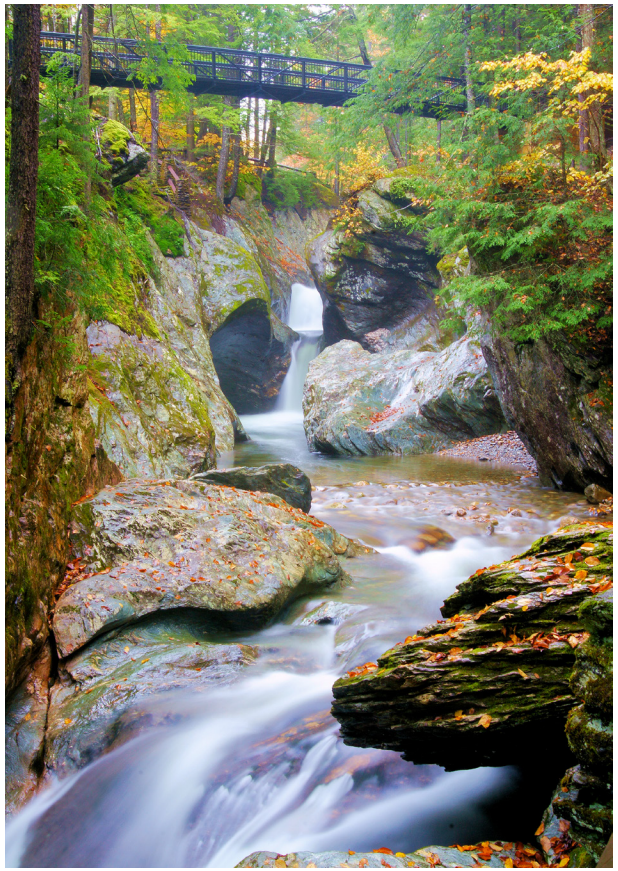
Water Quality Standards, Classifications, and Designated Uses

The Vermont Water Quality Standards (VWQS)[3] are rules that establish the goals of the Vermont Water Quality Policy and the objectives of the federal Clean Water Act—which enforces the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters. The 2022 VWQS[4] contain numeric and narrative criteria that describe the classification of all waters based on designated uses. Water quality classifications that are administered by the Vermont Department of Environmental Conservation (DEC) establish water quality goals for each body of water in the State.

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.

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.

Despite data showing many small streams are B1 quality, 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). 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*

Outstanding Resource Water can be designated 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 Surface Water Degradation

Non-point source pollution[5] is run-off from our roads, parking, and fields that carry pollutants into our waterways, but are not directly carrying a pollution source in a pipe. 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. Known and suspected problems are often detailed in the DEC's basin assessments[6] and the 303(d) List of Impaired Waters[7], but considerably more work is needed to identify problems in sufficient detail to undertake planning to address them.

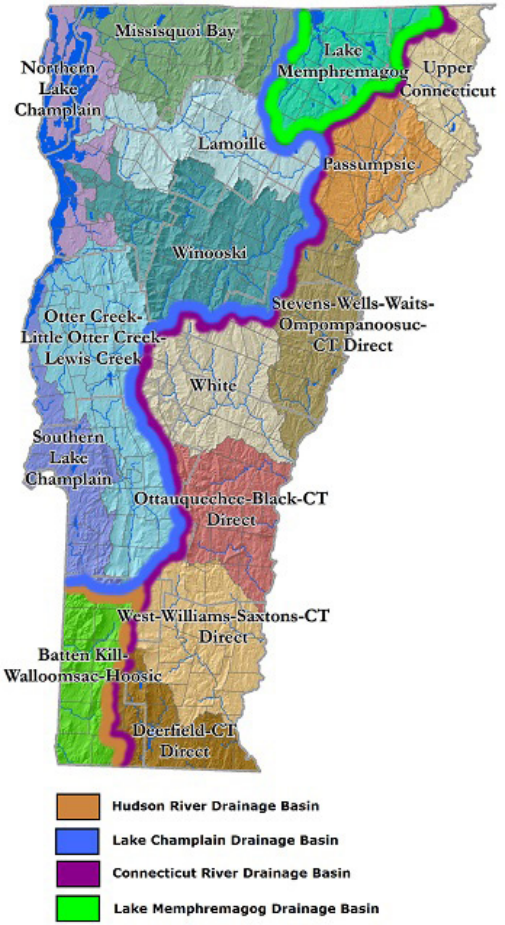
In lakes and ponds, many recreational and development activities can also threaten water quality. Shoreline development can cause erosion and sedimentation. Failing septic systems and poor agricultural practices contribute pathogens, nitrogen, and phosphorous. Motorboats and trailers transport invasive 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. Vermont regulates all development within 250 feet of lakes and ponds of at least 10 acres, but unfortunately this regulation took effect after most shoreline areas were developed.

Watershed Management and Basin Planning

A watershed is all of the land that drains into a certain point. The Vermont Watershed Management Division[8] of the Vermont Department of Environmental Conservation has divided the State into fifteen basin areas[9]. Designated basins in the TRO Region include the Ottauquechee River (including Black River)[10] (Basin 10), the White and Tweed Rivers[11] (Basin 9), the Wells River, Waits River, Ompompanoosuc River, and Upper Connecticut River tributaries[12] (Basin 14). Very small portions of Otter Creek[13] (Basin 3) and the Winooski River[14] (Basin 8) are also in the Region.

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 White River Natural Resources Conservation District (White River NRCD[15]) and Ottauquechee Natural Resources Conservation District (ONRCD[16]) are also involved in water quality planning.

Figure 6-1: Watersheds and Basins



Source: Vermont Agency of Natural Resources

The items that tactical basin plans[17] must cover are laid out by the Vermont Water Quality Standards[18] and the federal Clean Water Act[19]. 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 maintenance and enhancement of streamside and lakeside vegetation are 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. The many benefits of vegetated shorelines are included in this link[20].

The Watershed Management Division produces the State of Vermont Water Quality Integrated Assessment (305(b) report)[21] every two years and the State Clean Water Strategy every five years, in which priority waters are targeted for remediation or protection.

Shoreline Buffers and Riparian Areas

The Connecticut River forms the eastern boundary of Vermont, and nearly the entirety of the TRO Region lies within its watershed. With the exception of impounded areas, the Connecticut River is in New Hampshire. There are large sections of the shoreline area that exhibit erosion. The Connecticut River features a major hydroelectric facility, the Wilder Dam, which is operated by Great River Hydro[22] (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, as well as boat wakes, cause erosion, and fluctuating water levels impact waterfowl nesting and fish habitat.

Setting aside unmowed areas of naturally growing grasses, shrubs, and trees is essential to the health of streams and lakes and to resource conservation.

D. Fisheries and Aquatic Resources

The Region's rivers and streams provide cold and warm water habitat for many species of fish[23]. 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.

The damming of streams to create ponds, either within a stream channel or drawing from the stream channel, damages fish habitat by increasing water temperature, decreasing dissolved oxygen, encouraging nuisance algal growth, creating barriers to fish passage, and increasing the potential introduction of nonnative species.

E. Wetlands

Wetlands[24] 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[25], 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.

The Vermont Wetlands Rules[26] classify all wetlands into three categories. Class 1 wetlands are those identified as "exceptional or irreplaceable in their contribution to Vermont's natural heritage." The Eshqua Pond in Hartland[27] is the only Class 1 wetland 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 a half-acre, but many vernal pools are smaller and still protected. Class 3 wetlands are those that have not been evaluated. The Vermont Wetland Rules require a 100 -foot buffer for Class 1 wetlands and a 50 -foot buffer for Class 2 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. Forested wetlands have also been recognized as containing critical spring food sources for black bears and other species. 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[28], which regulates the dredging or placing of fill into any wetland.

Wetlands are important 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 plant and wildlife species, some of which only live in wetlands. Many species rely on wetlands, especially amphibians, for some or all of their life cycles; for others, wetlands are important for a part of their life cycle or during certain times of the year. A forested 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. State officials at the Vermont Department of Environmental Conservation recommend a setback of at least 200 feet for wildlife habitat protection around wetlands.

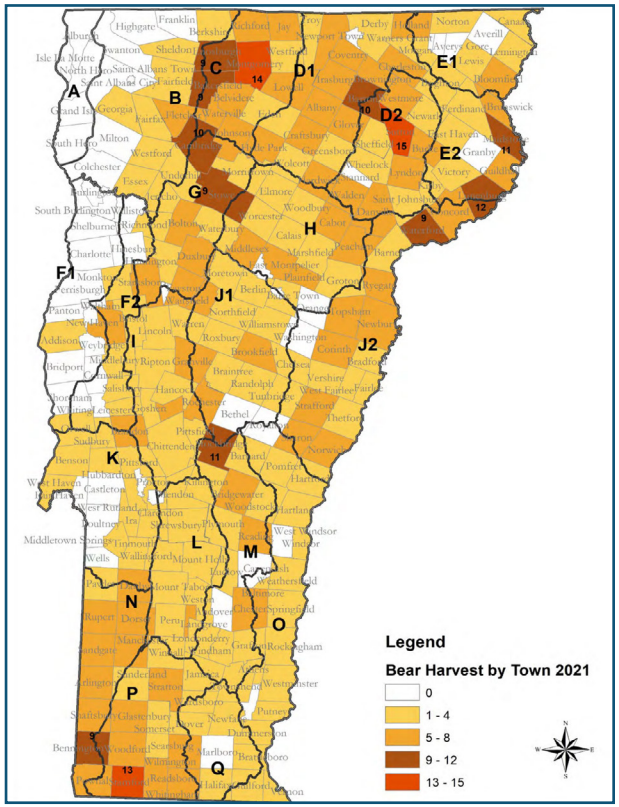
Wetlands Protection

In order to be protected by Criterion 1(G)[29] of Act 250, wetlands, including vernal pools[30], 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 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 (9K), 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 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, as 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. To see real-time locations of potential and verified vernal pools throughout the state, visit Vermont Center for Ecostudies' VPAtlas[31], an interactive map showcasing almost 4,000 vernal pools.

Figure 6-2: Bear Harvest by Town 2021



Source: VT Fish & Wildlife

F. Wildlife

Wildlife habitat is 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. 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 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.

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. 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 bears in Vermont. Since only older trees produce mast, mature oak trees are considered a critical resource to all forms of wildlife. However, cutting trees is largely unregulated in Vermont. Unless a project is in Act 250, an intent-to-Cut Notification[32] must only 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.

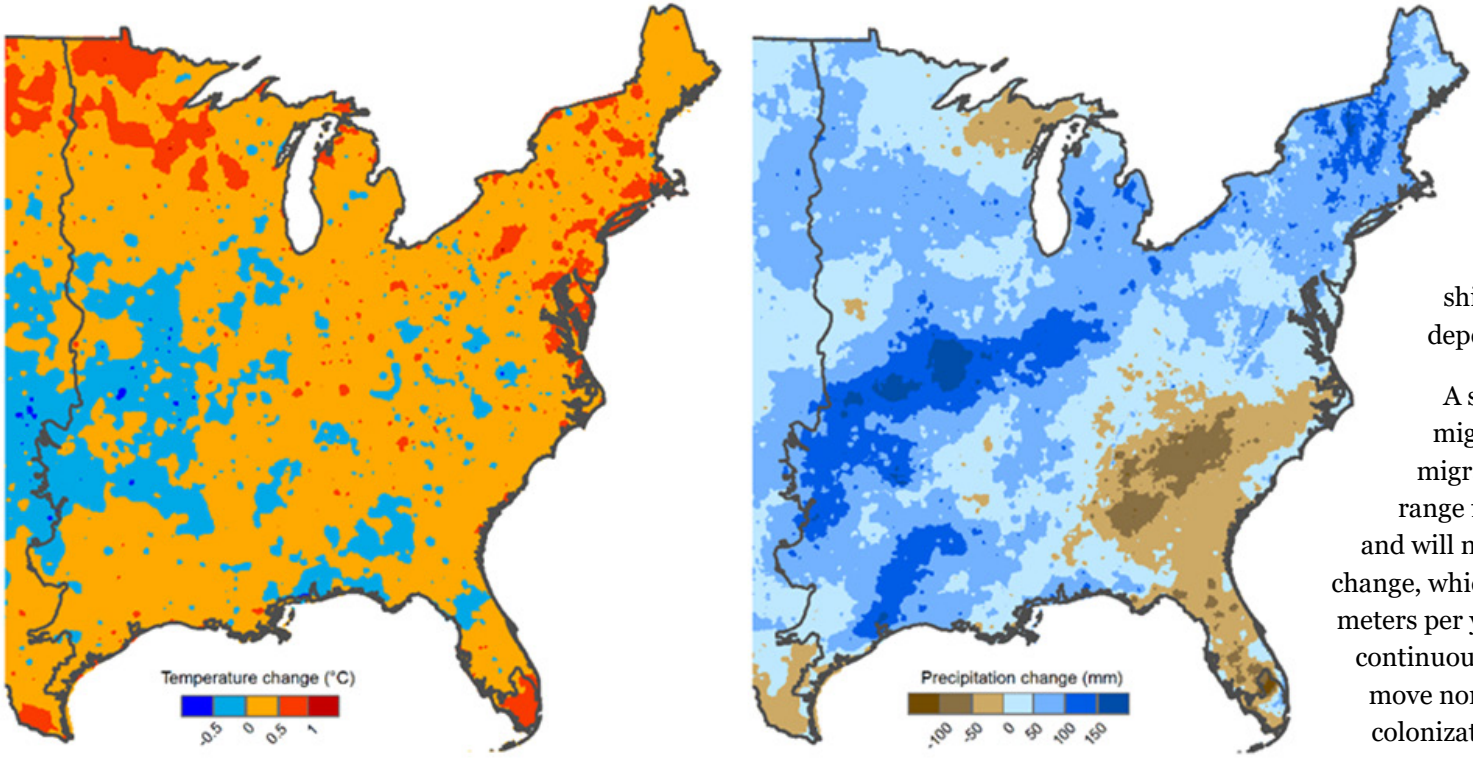
Barred Owl at King Farm | *© Tory Littlefield*

Threatened and Endangered Species and Critical Natural Communities

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)[33], as well as being protected by the Federal Endangered Species Act (P.L. 93-205)[34]. The Vermont

Figure 6-3: Temperature and Precipitation Change in the Past 30 Years



Source: Songlin Fei, Purdue University

Department of Fish and Wildlife maintains lists of threatened or endangered plants and animals[35]. These animals and plants 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[36] in the Department of Fish and Wildlife has identified and mapped special natural features or species and natural communities. 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)[37] has recognized several species, such as the wood turtle, that are in decline and may soon become endangered.

Climate Change and Habitat Shifts

As the climate warms, tree species need to shift their geographies northward to remain within an inhabitable environment (a phenomenon called range migration[38]). It is expected that, under the best climate scenario, the Northeastern United States will lose spruce/fir/paper birch type forests and that more oak/hickory forests will move in. This shift in forest will also mean a shift in other species as well that are dependent on the forest.

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[39]. This is being studied at UVM for its pros and cons. Keeping contiguous areas of forests will enable wildlife to migrate northward as well, although some slower species, such as amphibians, may need assistance.

Invasive Species and Diseases

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. 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 major epidemic that plagues Vermonters is Lyme disease. Vermont is well-known for its working landscapes for our farmers, hunters, and foresters, and expansive outdoor recreational opportunities that span all seasons. In 2017, Vermont had the highest rate of reported confirmed and probable Lyme disease cases in the nation[40]. There are many preventative measures that people can take to avoid contracting Lyme, such as wearing long socks and pants, bug spray, and checking for ticks upon returning home. According to the Centers for Disease Control and Prevention (CDC)'s annual survey of Lyme disease, Vermonters reported having less Lyme since the pandemic; however, we are not in the clear, and Vermont is still categorized as having a "high incidence" of Lyme, more than any other state.

Deer are plentiful in Vermont, and many Vermonters rely on wild game for food. Chronic wasting disease (CWD)[41], or "zombie deer disease", have been found in wild deer in more than half of United States; however, CWD in deer has yet to be reported in Vermont. CWD isn't passed down to people, but exposure through contaminated soils and infected venison may increase the possibility of the disease jumping the species barrier and transferring to humans. Currently, there is no contingency plan if an outbreak were to happen, as there is no treatment or vaccine for CWD.

G. Air Quality

Background

The air quality of Vermont and the TRO Region appeals greatly to its inhabitants and visitors, and contributes to the high quality of life and health in the area. Although air polluting industries are not a major component of our economy, many activities threaten the Region's air quality and should be managed wisely in the short and long term.

Wood Stoves

While federal air quality regulations require stove manufacturers to produce cleaner burning stoves—and there are incentives like tax credits and rebates to residents to swap out their older wood-burning stoves—woodstoves often last several decades longer than modern stoves. Pellet stoves are an alternative to traditional woodburning stoves, as they produce less ash and lower emissions. A multi-town or subregional approach to woodstove pollution may be the most acceptable resolution to these potential problems.

Garbage Burning

Because 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 of toxins (such as heavy metals, dioxins, toxic gases, and carbon monoxide) into the air that impair the health and environmental quality.

Air Pollution

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

With 74 percent of the Region's land forested[42], it hosts a unique vegetative cover that processes a large volume of carbon dioxide and regulates air temperatures. 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. It is estimated that an amount equal to half of the carbon emitted in Vermont is sequestered by our forests. 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. 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.

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

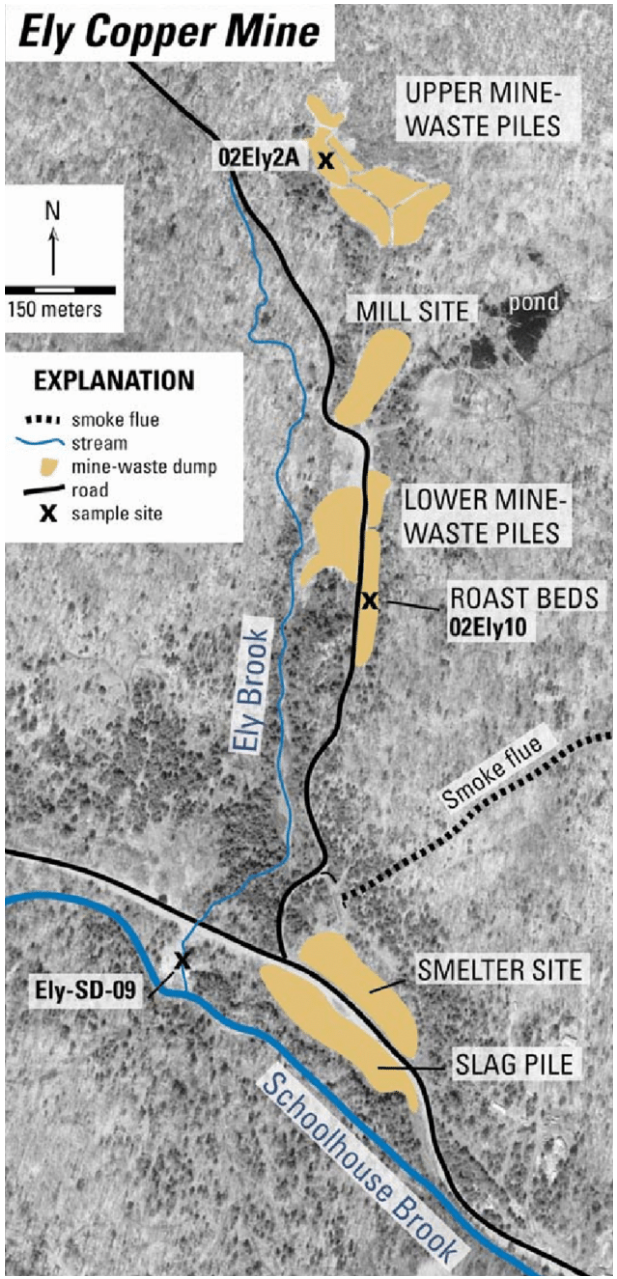
Vermont's Act 250 includes a project review criterion that protects land with the high potential for the extraction of earth resources and also requires planning for the future rehabilitation of the site. Generally recognized issues incidental to mineral extraction include:

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 unpleasing 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.

Contaminated Sites

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. As of now, each site is at a various remediation stage.

The Region also has hundreds of smaller contaminated sites from a variety of industrial and commercial activities. TRORC has been fortunate to receive several EPA grants to assess such sites. Recent contamination concerns are focusing on PCBs in public buildings, PFAS in water supplies, and PCE in indoor air from old solvent products.



Locations of Samples from the Ely Copper Mine, Vershire | *Source: Nadine Piatak (2007)*

Goals, Policies, and Recommendations: **Groundwater**

Goal

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

Policies

1. Commercial water withdrawal must be monitored by the State and shall not lower aquifers and impact surface waters.
2. The State should review land use activities that threaten groundwater quality, including the following:
    a. Underground storage for petroleum or other hazardous substances,
    b. Pesticide and herbicide applications on agricultural land, golf courses, resorts, residential properties, and railroad and utility rights-of-way; and
    c. Junk yards and solid waste disposal sites.
3. It is the policy of TRORC to permanently protect Class 1 groundwater. These are high-quality resource areas mapped by the Agency of Natural Resources and classified by the Secretary as currently being used or suitable for a public water supply source.

Recommendations

1. TRORC will work with the Agency of Natural Resources and with towns to identify and map aquifers and aquifer protection areas to determine critical areas for protection of drinking water supplies.
2. Towns should 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.
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 EPA, 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 search for federal funding programs to conserve and protect important local groundwater resources as part of their planning programs.

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

Goals

1. Surface water quality and quantity are 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 and reclassified.

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; and
    f. Existing water quality conditions and known public and private pollution sources.
3. 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 estimate; and
    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.

Policies (continued)

6. Vegetated buffer strips (area of controlled landscape designed for filtering pollution and erosion control) 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, property, or infrastructure.
7. Upland watersheds should be maintained predominantly in forest and low impact recreation use to ensure high quality of valley streams and their tributaries.
8. Given the statewide recreational resource value of the free-flowing White River, new hydropower development on that river shall not be constructed, except where it is 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.
9. Great River Hydro, and its subsidiaries, shall maintain the ramping rates associated with its hydroelectric facilities to prevent erosion and loss of land along the streambanks of the Connecticut River.
10. 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.

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 their 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 comply 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 must adopt the highest possible classification, water management types, and uses for water bodies based on their actual conditions and uses, or that which is reasonably attainable if higher.
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.
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.

Recommendations (continued)

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. TRORC will help Municipalities employ road maintenance techniques to prevent soil erosion and road surface deterioration to comply with the Municipal Roads General Permit.

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

Goals

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

Policies

1. Manmade alterations to flows must ensure downstream protection of water quality and quantity for aquatic ecosystems.
2. The construction of dams on rivers and streams, other than the White River where it is not consistent with this Plan, are 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; and
    c. Water quality and minimum flows are maintained.
3. The construction of ponds is discouraged, unless fed by groundwater and/or overland drainage. Discharges from ponds shall be designed to withstand a 100-year storm event and operate in a run of the river mode.
4. In-stream ponds are discouraged on all stream segments that support fish life.
5. 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).

Policies (continued)

6. New or replacement bridges and culverts must be adequately designed and constructed to handle stormwater, provide sediment transport, and accommodate fish and wildlife passage.
7. 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.
8. Fishing shall be considered to be an existing use in all waters of the State in basin plans and water quality planning.
9. Increased public access to surface waters is the policy of TRORC.

Goals, Policy, 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.

Policy

1. Significant wetlands must be protected from development by maintaining an undisturbed buffer strip of naturally vegetated upland of at least 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.

Recommendations

1. The State of Vermont must 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.
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 all types of wetlands, including seeps and vernal pools, and to adopt mechanisms for their increased protection, including formal petitions to be shown on the Vermont Wetlands Inventory Map, and adding Vernal pools to the Vernal Pools Atlas (VPAtlas). This information can increase the effectiveness of local, state, and federal regulatory process.
6. Vernal pools should be protected in local zoning from development by establishing an overlay district that identifies vernal pools and their surrounding terrestrial amphibian habitat.

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

Goals

1. Wildlife biodiversity and population are maintained or enhanced.
2. Stable populations of threatened or endangered wildlife (at both state and federal level) and their habitats are restored.
3. Sport and subsistence hunting is done in an ecologically sound manner.
4. Increase people's access to public green spaces without increasing Lyme and other tick-borne disease cases.

Policies

1. Development should preserve contiguous areas of active or potential critical 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. Large contiguous tracts of forest should be managed to maintain the diversity of tree cover necessary for shelter and food supply for wildlife.
3. The rate of harvest of wildlife for sport or subsistence must not exceed the capacity of an area to replenish the species.
4. Development should utilize existing roads and field edges to avoid additional fragmentation.
5. Deer wintering areas should be protected from development and other uses that threaten the ability of this habitat to support deer.
6. Developers subject to Act 250 and Section 248 or 248a 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; and
    f. Oak mast stands and designated bear habitats.
7. Landowners, foresters, and developers must be sensitive to critical bear habitat areas in their management plans.
8. Buffer zones must be maintained between land development and critical wildlife habitat.
9. Actions to monitor and curb the spread of invasive species are encouraged.
10. Efforts to raise public awareness of climate change-related hazards and mitigate its impacts on the natural environment are supported.

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 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.
3. Towns are encouraged to use cluster zoning, conservation districts, transferring or purchasing of development rights, or purchasing of land containing critical habitat areas to maintain 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. 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.
7. Towns should time roadside mowing to limit spread of plants such as wild chervil and wild parsnip.
8. When using heavy machinery near streams, machinery operators must clean them before and after use to avoid the spread of invasive species.
9. Towns should conserve large tracts of bear habitat and adopt cluster land use concepts in zoning bylaws as a mechanism for maintaining contiguous areas of forest cover.
10. TRORC should work with municipalities to distribute information on Lyme disease and prevention.

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

Goals

1. Air quality in local and regional airsheds is improved.
2. Dependence upon fossil-fueled and single-occupant automobiles for transportation is reduced.

Policies

1. Proposed developments must be reviewed for their direct and indirect impact on air quality.
2. As a source of heat, wood burning should be continued, but efforts should be made to update wood stoves.
3. Wood burning as a method of disposal should be reduced.

Policies (continued)

4. Proposed developments must be reviewed for their direct and indirect impact on air quality.
5. As a source of heat, wood burning should be continued, but efforts should be made to update wood stoves.
6. Wood burning as a method of disposal should be reduced.
7. 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.
8. Local education and enforcement activities are strongly encouraged to eliminate backyard burning of trash.
9. 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 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 engage in projects outside the Region that may potentially impact air quality within the Region.

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

Goals

1. Mineral resources accommodate growth and development of the Region.
2. Extraction and processing of minerals are appropriately managed and benefits the public interest.
3. Extraction and mining sites in the Region are remediated.

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 burden 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;
        - 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; and
    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. All streambed extraction should be done after the site is assessed by professionals and in consultation with the Vermont Department of Environmental Conservation's River Management Section.
4. Future extraction activities of copper and other metals must follow protocols for safe mine waste disposal.

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 burden 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

1 https://dec.vermont.gov/geological-survey/groundwater
2 https://www.house.mn.gov/hrd/pubs/ss/sspipe.pdf
3 https://dec.vermont.gov/watershed/tasc/water-quality-standards
4 https://dec.vermont.gov/sites/dec/files/documents/2022-Vermont-Water-Quality-Standards.pdf
5 https://dec.vermont.gov/sites/dec/files/12.3.20_PointingoutNonpointSources_HelenCarrPresentation.pdf
6 https://dec.vermont.gov/watershed/tasc/assessment-and-listing
7 https://dec.vermont.gov/sites/dec/files/wsm/stormwater/docs/PriorityWatersList_PartD_2022.pdf
8 https://dec.vermont.gov/watershed
9 https://dec.vermont.gov/watershed/map/program/major-basins
10 https://dec.vermont.gov/sites/dec/files/wsm/mapp/docs/mp_basin10final.pdf
11 https://dec.vermont.gov/sites/dec/files/wsm/mapp/docs/pl_WhiteRiverTacticalPlan.pdf
12 https://dec.vermont.gov/sites/dec/files/documents/2020%20Basin%2014%20Tactical%20Basin%20PlanSigned.pdf
13 https://dec.vermont.gov/sites/dec/files/wsm/mapp/docs/B3_TBP_FINAL_ARA.pdf
14 https://dec.vermont.gov/sites/dec/files/documents/2018%20Winooski%20River%20TBP.pdf
15 https://www.whiterivernrcd.org/
16 http://onrcd.org/
17 https://dec.vermont.gov/water-investment/watershed-planning/tactical-basin-planning
18 https://dec.vermont.gov/watershed/tasc/water-quality-standards
19 https://www.epa.gov/laws-regulations/summary-clean-water-act
20 https://dec.vermont.gov/sites/dec/files/wsm/rivers/docs/rv_riparianvalues.pdf
21 https://dec.vermont.gov/document/2022-2023-water-quality-monitoring-and-assessment-summary-report
22 https://www.greatriverhydro.com/
23 https://vtfishandwildlife.com/conserve/conservation-planning/animal-inventory/fish
24 https://dec.vermont.gov/watershed/wetlands/what
25 https://dec.vermont.gov/sites/dec/files/wsm/wetlands/docs/2014_Wetlands%20101.pdf
26 https://dec.vermont.gov/sites/dec/files/documents/wsmd_VermontWetlandRules.pdf
27 https://dec.vermont.gov/sites/dec/files/wsm/wetlands/docs/2020-214.P_Determination.pdf
28 https://www.epa.gov/cwa-404/overview-clean-water-act-section-404
29 https://dec.vermont.gov/sites/dec/files/documents/wsmd_VermontWetlandRules.pdf
30 https://dec.vermont.gov/sites/dec/files/wsm/wetlands/docs/5._Seeps_and_Vernal_Pools.pdf
31 https://vpatlas.org/
32 https://fpr.vermont.gov/heavy-cut-law
33 https://legislature.vermont.gov/statutes/section/10/123/05403
34 https://www.fws.gov/law/endangered-species-act
35 https://vtfishandwildlife.com/conserve/endangered-and-threatened-species
36 https://vtfishandwildlife.com/about-us/department-divisions/wildlife-division
37 https://vinsweb.org/
38 https://www.americanforests.org/article/trees-on-the-move/
39 https://www.uvm.edu/news/story/save-forest-should-we-move-trees
40 https://www.healthvermont.gov/disease-control/tick-bite-illnesses/lyme-disease
41 https://vtfishandwildlife.com/learn-more/living-with-wildlife/wildlife-diseases/chronic-wasting-disease
42 https://www.fs.usda.gov/nrs/pubs/ru/ru_fs337.pdf