

State Lands and Flood Resilience – Challenges and Opportunities

*A Blueprint for Enhancing Flood Resilience and
Improving Water Quality on ANR Lands*
ANR Lands Stewardship Team
June, 2016



Introduction

In the wake of Tropical Storm Irene in 2011 and numerous other recent flooding events, ANR is devoting significant staff time and resources to evaluating where we might improve state policies, programs and practices in support of greater flood resilience. This work has assumed a high priority Agency-wide in part because scientists are predicting an increase in both the frequency and intensity of storms in Vermont as climate changes. The Agency has partnered with the Vermont Land Trust, the Vermont Housing and Conservation Board, and other state and federal agencies, and non-profit land conservation organizations who share this priority.

Background

In 2013, as part of this broader, Agency-wide initiative on flood resilience, the ANR Lands Stewardship Team commissioned a flood resilience assessment of state lands. The study focused on a subset of state lands in central Vermont that were significantly impacted by TS Irene. The report was funded by \$10,000 in VHCB planning funds and \$10,000 in ANR Lands and Facilities Trust Fund monies. The consultants (Kristen Underwood of South Mountain Engineering and Consulting, and David Brynn from Vermont Family Forests) completed the state lands flood resilience report in June of 2015.

The report generated considerable interest and some concern among state lands managers and other ANR staff. The report contains much useful information and outlines many needs and opportunities for improving flood resilience of ANR lands. The report correctly points out that most of the problem areas on ANR lands that negatively affect flood resilience are “legacy” impacts associated with old roads and other transportation infrastructure that the Agency inherited with the State’s original acquisition of the land. The report highlights the need to work better across the Agency to incorporate flood resilience concerns into state lands management, and the need for additional funding to address this issue.

The report contains numerous recommendations, many which are already being implemented by state land managers, some which will require considerable additional funding, and others that are impractical or may conflict with other important state land management goals. In reviewing the report, it became clear that fully adopting the report recommendations without additional thought and careful consideration by the Agency could significantly impact other management priorities.

While there is broad agreement across the Agency regarding the overall goal of enhancing flood resilience values, the question is what actions can state land managers take to best achieve this goal on state lands. With this question in mind, the ANR Lands Stewardship Team convened a day-long meeting in early January of this year to further explore this issue and to develop a workable strategy for enhancing flood resilience on ANR lands. The purpose of this meeting was to move beyond the consultant’s report and develop a consensus approach for addressing flood resilience on ANR lands. State land managers from all five district offices along with other staff from across the Agency actively participated in this meeting. The meeting was successful and

provided a sound basis for developing a meaningful and practical action plan for enhancing flood resilience and improving water quality on ANR lands.

ANR Lands and Flood Resilience – Progress and Accomplishments

State land managers are keenly aware of flood resilience problem areas on state lands and have a long history of working systematically to improve flood resilience. This work begins at the district stewardship team level – an interdisciplinary group from all three ANR departments that collectively develop, review and implement long range management plans on ANR lands.

As budgets allow, district staff are working to properly size culverts that need replacing on ANR lands and where feasible, are replacing them with bridges or other Aquatic Organism Passage (AOP)-compliant structures. Adherence to established guidelines such as the AMPs, Voluntary Harvesting Guidelines for retention of coarse woody material on logging jobs, and the new Riparian Area Management Guidelines for ANR Lands is standard practice for work conducted on ANR lands. These and other related guidelines set a high standard that is often exceeded on ANR lands and serve to maintain and enhance the natural flood Resilience benefits of these lands.

District staff routinely conduct activities and carry out projects that enhance flood resilience and improve water quality on ANR lands. Over the last several years, district staff have planted thousands of trees along stream and river banks on state lands to buffer and stabilize streams and restore habitat. Impaired wetlands have been proactively restored by installing ditch plugs and restoring natural wetland hydrology. Roads that were poorly sited and prone to wash out and erosion have been decommissioned and restored. Trees, root wads, and other wood material have been strategically placed in streams to improve aquatic habitat and restore stream equilibrium. These and other stewardship activities go a long way towards improving the inherent flood resilience of undeveloped ANR lands. Below are just a few recent examples of the exemplary work being done on ANR lands that positively impact flood resilience:

West Mt. WMA – In compliance with the new long-range management plan for West Mt. WMA, district stewardship staff decommissioned 2.75 miles of road within the “Core” area of the WMA in 2015. Portions of these roads were badly eroded, improperly sited, and negatively impacted water quality and flood resilience. This work involved removal of 15 culverts and installation of 50 broad-based dips and cost approximately \$8,000. This work will encourage natural hydrology and forest cover to gradually be restored. Funding for this work was provided by a grant from The Nature Conservancy. (Plans are to decommission an additional 7 roads totaling 5.5 miles within the Core area over the next several years. Total estimated costs of this additional road decommissioning is \$38,000.)

Camel’s Hump State Park – Honey Hollow Road extends into Camel’s Hump State Park as a state forest highway and crosses Preston Brook. The large culvert and a good portion of the road at this crossing washed out in a flash flood a couple of months prior to TS Irene. The culvert was reinstalled but washed out again a year later during another flood event. Staff coordinated with FEMA and US Fish and Wildlife Service to secure funding to replace the culvert with a new 40’

bridge. Total project cost including bridge, abutments, excavation, and installation was approximately \$86,000. This structure both improves aquatic habitat and will help protect the road from future washouts.

Otter Creek WMA – District staff recently planted hundreds of flood tolerant tree species (mostly red and silver maple) adjacent to Otter Creek at Otter Creek WMA. Trees and rodent guards were donated by VTel. This project will help to stabilize the stream by restoring a forested riparian area and will improve wildlife habitat and water quality.

Coolidge East State Forest – In 2015, district staff installed a pipe arch culvert to replace an undersized, non-AOP compliant in-stream culvert at Pine Lee Road in Coolidge (East) State Forest. Stones, gravel, and sediment were pushed into the bed of the new culvert to provide a natural stream bottom for aquatic organisms. The finished project enhances both aquatic habitat and flood resilience. Total project cost was \$15,000.

CC Putnam State Forest – The Perry Hill Block of CC Putnam State Forest contains a network of forest roads and trails that are popular with mountain bikers. The main access road into the block from Waterbury is quite steep and contains numerous major waterbars that are a hazard to mountain bikers heading down the hill. District staff are working with a local engineer and trail builder to redesign/reroute a portion of this road to reduce the grade, improve user safety, and to better address water run-off at a site close to the Winooski River.

Flood Resilience Needs on ANR Lands

Despite the great work that has already been accomplished or is underway on state lands to address flood resilience and related water quality issues, state land managers agree there is much more that we can do if adequate resources were made available. State lands are often located in forested headwater areas which due to their topography and geologic setting, may be especially susceptible to generating runoff during storm events. The inherent vulnerability of these uplands is sometimes exacerbated by a legacy of old road networks with inadequate stream crossings and drainage, and other land use modifications. Addressing these “legacy” impacts associated with state lands is a major challenge that will require a substantial additional resources.

Most of the significant legacy impacts on state lands are associated with transportation infrastructure that came with the land when it was acquired by the State. This legacy includes roads and skid trails that were poorly sited and not designed to today’s standards. Some of these roads have outlived their purpose and should be decommissioned. This involves more than simply gating off the road and abandoning it. Done correctly, decommissioning requires removing culverts, restoring natural drainage flows, and revegetation. This work can be expensive, is often controversial, and is usually beyond the scope of existing department road budgets.

The road network on state lands is characterized by many undersized, perched, or twin culverts which do not adequately handle the increasing flows that are now associated with flood events. While culverts are upsized or replaced with bridges or other flood resilient and AOP-compliant structures as funding allows, the need far outweighs current funding levels. For example, culvert

assessments conducted on 30 structures within the West Mountain WMA indicate that 69% of the structures are currently less than 50% of the stream channel bankfull width and 80% are significant barriers to aquatic passage.

Additionally, ditches along many roads (particularly “legacy” roads) on ANR lands often directly discharge into streams altering the natural hydrology and resulting in accelerated stream flows. Alleviating this issue and restoring natural hydrology along roadways can be expensive and is a significant undertaking.

A look at the Department of Forests, Parks and Recreation’s road budget provides some useful context. Funding for the Department’s Forest Highway Maintenance program has plunged over time even as the road miles have increased and demands for use of these roads for recreation have grown. In 2004 the amount appropriated to FPR for Forest Highway Maintenance was just over \$406,500. For the last several years, the Department has received approximately \$180,000 in forest highway funding which has been split between state forest highways and the state park roads. This level of funding equates to about \$250/mile annually for road work on department lands. (By comparison, this ratio is less than 15% what the US Forest Service received for road funding in 2013, and about 6% of what Vermont local roads received in 2013.) Routine road maintenance costs for a single major forest highway such as the Cotton Brook Road at Mt. Mansfield State Forest or the Beaver Brook Road at Groton State Forest can exceed \$5000 in a single year. Simple culvert replacement projects can range from \$2000 to \$20,000, and considerably more for large concrete box culverts. Clearly, the current level of Forest Highway funding is not nearly sufficient to address even routine maintenance needs on FPR road networks such as clearing ditches, unplugging clogged culverts, installing waterbars, and grading. It doesn’t begin to address larger capital needs such as new bridges, large culvert projects, rerouting or decommissioning roads, etc.

Illegal ATV and off highway vehicular use on state lands continues to be a problem on certain ANR lands as well, and contributes to erosion and impairs water quality. Flood resilience suffers as a result.

Flood Resilience Action Plan

There is broad agreement and support for moving beyond the status-quo and doing more to address flood resilience on ANR lands. However, there are significant needs that are simply not being met. Securing additional funding to address the highest priority flood resilience needs on ANR lands is critical. Without additional substantial funding support, the Agency cannot make significant progress in meeting flood resilience goals for ANR lands. The ANR Lands Stewardship Team has identified high priority short-term actions that are practical, can readily be implemented, and will make a meaningful impact on flood resilience while improving water quality. Longer term actions have been identified as well. Many of the longer term actions require substantial additional funding support but if implemented will positively impact flood resilience and water quality on ANR lands.

Those actions with the greatest potential for positively impacting flood resilience are primarily related to the Agency’s extensive transportation infrastructure, in particular the many roads and

related structures the Agency inherited at the time of acquisition that do not meet today's standards or no longer serve an important access function. While addressing priority legacy transportation features on ANR lands should be a major focus of the Agency, the Action Plan identifies other actions that should also be pursued. Collectively, these actions will go far to raise the profile of flood resilience as an integral component of state lands planning and management, foster better understanding and appreciation of flood resilience and related water quality issues on the part of state lands managers and other Agency staff, and most importantly will enhance the natural flood resilience values and improve water quality of state-owned conservation lands.

Improvements to Transportation Network and other Developed Sites on ANR Lands

Short Term Actions:

- Continue to replace failing and/or undersized stream culverts with structures meeting stream equilibrium and connectivity standards, which include AOP-compliance such as (pipe-arches, bridges) as now required in the current Stream Alteration General Permit. (Could do a lot more in this area if additional funding was made available.)
- Continue to implement road and trail projects on state lands to maximize and enhance flood Resilience and reduce erosion potential.
- To the extent possible, minimize development of new skid roads on new logging jobs and work to design new skid roads for the least disturbance possible. Maximize use of portable skidder bridges where feasible. (This is already being done, but training for staff and contractors is important.)
- Continue to actively monitor and manage timber sales on ANR lands to ensure AMPs and Riparian Management Guidelines are being met.
- Step up enforcement of illegal ATV use on problem legacy roads and VAST trails on ANR lands. (This will require additional support and commitment from law enforcement and partner organizations. Additional financial resources may also be necessary.)

Long Term Actions (all of these actions will require additional funding support):

- Install new ditch culverts on existing truck roads where needed to conform with AMPs.
- Address legacy impacts associated with old logging roads on new timber sales by requiring the logger to restore these roads as part of timber sale. (This would reduce timber sale proceeds.)
- Pre-build skid roads with an excavator and dedicated contractor prior to timber sale.
- Disconnect all road ditches from streams
- Decommission and close problem legacy roads where feasible and desirable and restore natural drainage, hydrology, and vegetation.
- Work with towns on the management of Class 4 Roads that extend onto ANR lands to improve flood resilience.

Restoration Activities in Riparian Areas

Short Term Actions:

- Continue to manage ANR lands for high quality riparian forests and wetlands and provide for intact and functioning riparian management areas as recommended in new ANR Lands Riparian Management Guidelines.
- Establish or expand riparian management areas in developed settings on ANR lands where feasible and appropriate.

- Increase utilization of storm water control structures and green storm water infrastructure on developed ANR lands.
- Continue and expand efforts to restore impaired stream corridors on state lands by planting native trees to stabilize and revegetate these areas.

Long Term Actions:

- Plan and implement floodplain restoration efforts on ANR lands to naturally stabilize streambanks, restore natural drainage and native vegetation, and maximize flood resilience values.
- Implement priority stream restoration projects on state lands in areas that will positively impact flood resilience and improve water quality.

State Lands Management Planning

Short Term Actions:

- Require DEC Basin Planner or other DEC Watershed Management staff to actively participate as member on all district stewardship teams. The DEC representative would provide needed guidance on flood Resilience and other water-related management issues for state lands including LRMP development and implementation. (DEC is now represented to a certain degree in a couple of districts, but such participation needs to become a priority for DEC and formalized at the direction of ANR leadership.)
- Develop a standardized template for an expanded water resources assessment section of LRMPs that addresses flood resilience needs and issues on ANR lands.
- Identify flood resilience projects in district Annual Stewardship Plans through the LandManager database and develop annual (or biannual) capital improvement plans for enhancing flood resilience on ANR lands.
- Use LandManager database to document and report on watershed restoration/flood resilience accomplishments on state lands.
- Improve ANR emergency preparedness regarding ANR facilities and infrastructure that may be impacted by future flooding events as part of updating Agency's Continuity of Operations Plan (CoOP).
- Incorporate cost of needed improvements to existing transportation infrastructure into the overall budget for new state land acquisitions and work to secure necessary stewardship/management funding for this work from ANR land conservation partners.

Long Term Actions:

- Update the ANR Lands Conservation Plan to incorporate flood resilience as a priority for future ANR land acquisition projects.
- Investigate the potential for the development of a useful and practical GIS model for assessing hydrologic sensitivity of ANR lands and incorporate this assessment into LRMP process.

Securing Necessary Financial Resources

Short Term Actions:

- Create a comprehensive listing of grant and other funding opportunities for enhancing flood Resilience on ANR lands and share with district stewardship teams. Provide support for grant writing and administration where needed.

- Consider reserving a portion of DEC Clean Water Initiative funding to enhance flood resilience and water quality on ANR lands. (While this could happen in the short term, it would require careful thought and guidance by ANR leadership.)
- Consider increasing use of funds from timber sales for use on state land infrastructure needs to enhance flood resilience.

Long Term Actions:

- Secure additional funding via legislative appropriation for forest highway program so that ANR can address priority legacy needs, conduct high priority capital projects, and conduct necessary preventative maintenance projects on ANR management roads to enhance flood resilience on ANR lands. Needs identified in Annual Stewardship Plans could be compiled to demonstrate to the legislature the needs and opportunities for flood resilience projects and funding.
- Take full advantage of partnership opportunities to address flood resilience training, education and eligible funding needs for ANR lands- e.g., TNC, VLT, VHCB, NRCS, RCPs, municipalities, etc. (This is already happening to some degree, but could be expanded and formalized.)

Inventories, Assessments, Monitoring

Short Term Actions:

- Inventory and assess condition of stream crossing structures on ANR land using the ANR Bridge and Culvert Assessment protocol and other appropriate methods.
- Inventory ANR buildings and structures located in river corridors and flood hazard areas. (This effort is already underway and is being led by BGS.)

Long Term Actions:

- Review current road assessment techniques used on ANR lands and develop a standardized road assessment tool for assessing road condition and associated drainage system for erosion potential and flood resilience for ANR lands. Involve DEC staff in this effort.
- Use this road assessment tool to assess condition of road networks on ANR lands and to identify priority roads for improving, rerouting, or decommissioning.
- Expand inventory of ANR buildings and structures in flood hazard areas to include river corridors.
- Implement performance monitoring at sites where significant investments are made on ANR lands to determine flood resilience benefits and effectiveness.

Guidelines, Standards, and Practices

Short Term Actions:

- Comply with or exceed AMPs and Voluntary Harvesting Guidelines for retention of coarse woody material on logging jobs on ANR lands. (Already being done.)
- Implement new ANR Riparian Management Guidelines for ANR lands. (Currently underway.)
- Share flood resilience knowledge, practices, and resources with ski area lessees and encourage them to proactively work to enhance flood resilience within ski lease areas.

- Provide water resource rules and flood resilience training to ANR staff, lessees, and landowners with easements held by ANR. River and road training program could be expanded to include an add-on specifically geared to flood resilience issues pertinent to ANR lands for Agency staff. Provide cross training to ANR staff (i.e., DEC staff training to FPR and DFW on flood resilience and FPR/DFW training to DEC staff on other forest and wildlife management needs and goals.)

Long Term Actions:

- Develop “optimal conservation practices” (OCPs) for enhancing flood resilience and water quality in forested watersheds on ANR lands.
- Adopt standards for forest highway construction and maintenance that is used on all ANR lands.

Implementation Strategy

Successful implementation of the Flood Resilience Action Plan will require a concerted effort involving District Stewardship Teams, The ANR Lands Stewardship Team, and the ANR Leadership Team.

Role of District Stewardship Teams:

- Inventory, assess, monitor access network and associated infrastructure on state lands to more fully understand flood resilience challenges and opportunities on ANR lands (recognizing that a comprehensive inventory and assessment will require additional funding support.)
- Incorporate flood resilience into LRMP assessments for ANR lands.
- Prioritize district projects for enhancing flood resilience and improving water quality on ANR lands.
- Identify flood resilience projects in Annual Stewardship Plans (ASPs) via LandManager database. Continue to prioritize forest highway capital projects that improve stream crossings and reduce flood hazards.
- Consider and look to maximize flood resilience benefits as part of all state land management activities and proposed new state land acquisitions.
- Expand knowledge by participating in flood resilience-related training opportunities.

Role of ANR Lands Stewardship Team:

- Ensure LRMPs and ASPs address flood resilience needs on ANR lands.
- Establish a standing ANR Flood Resilience Committee composed of representatives from all three ANR departments to coordinate flood Resilience efforts related to ANR lands. This committee’s responsibilities would include but not be limited to:
 - Identify and pursue funding opportunities for conducting flood resilience and water quality projects on ANR lands.
 - Prioritize flood resilience projects from a statewide perspective.
 - Develop protocol and template for incorporating flood resilience/hydrologic sensitivity into water resource assessment of LRMP for ANR lands.
 - Organize and facilitate training for state land managers and other ANR staff related to flood resilience.

- Develop Optimal Conservation Practices for enhancing flood resilience and improving water quality on ANR lands.
- Develop clear messaging for staff and the public on flood resilience efforts on ANR lands and ties to forest fragmentation and wildlife habitat loss prevention and mitigation.

Role of ANR Leadership Team:

- Ensure active and meaningful DEC involvement and participation on all district stewardship teams.
- Advocate for enhanced road budget for maintenance and improvements of ANR roads.
- Provide financial resources through Clean Water Initiative Program (formerly ERP) and other Agency funding sources to conduct priority flood resilience and other water quality improvement projects on ANR lands.