Instream Flow Program Summary
August 25, 2015

The New Hampshire Department of Environmental Services (NHDES) submits this final Report of the Instream Flow Pilot Program to the General Court as part of the Instream Flow Pilot Program requirements. The report summarizes how protected instream flows and water management plans in the Lamprey and Souhegan rivers were developed and what lessons have been learned through that process since the Pilot Program was established in 2002. It also documents the results and impacts of the first two years of pilot program implementation, and proposes next steps for applying the instream flow provisions to other designated rivers.

Pilot Program Overview:

The purpose of the Instream Flow Pilot Program was to develop a methodology to implement the protected instream flows on designated rivers as required by the Rivers Management and Protection Program (RSA 483). Two rivers, the Lamprey and Souhegan, were chosen as the test rivers. The Lamprey River is located in the southeast coastal region of New Hampshire. The Souhegan River is located in south central New Hampshire and is a tributary of the Merrimack River. For each river, minimum flow criteria called protected instream flows were developed that would support both aquatic life, such as fish and turtles, and human uses, such as boating and hydropower. Then, Water Management Plans were developed for each river. Each Plan contains a conservation plan and a water use plan for every major water user along and upstream of the designated river, and a water use plan and dam management plan for every dam on and upstream of the river. Compliance with the Water Management Plans is required for all major water users and dam owners, but only during abnormally dry periods as defined by the protected instream flows are mandatory water conservation and flow augmentation actions necessary in order to maintain the minimum instream flows.

Key Lessons Learned:

The Instream Flow Pilot Program Approach is Viable

Overall, the pilot program demonstrated that numerical flow criteria can be applied to the state's rivers that define the difference between low flow conditions that support, and those that do not support, aquatic life and human water use. In other words, the program is capable of distinguishing between normally low flow and abnormally low flow.

During the two-year implementation period, the protected instream flow criteria successfully identified those rare periods of very low flow in which water withdrawals from the rivers should be limited and water releases from impoundments should occur. This is a good indication that the protected flows are inciting management actions that are sustainable for both users and the natural environment.

Similarly, Water Management Plans have been shown to be effective at helping users conserve water and defining when to utilize alternate sources of water. The plans were developed in an interactive process with water users and outline the expectations for each water user and dam owner that will result in the survival of fish and other aquatic life while also allowing users access to a minimal amount of water at any flow.

The Pilot Program Emphasized the Need for a Watershed Perspective, Stakeholder Communication and Applying Instream Flows on a River-by-River Basis

The need to use lakes and ponds to augment river flows highlighted the interconnected nature of New Hampshire's waterbodies. Raising water levels in impoundments in order to allow for later flow releases, and the subsequent drop in water level during a flow release, demonstrated the need to manage rivers and lakes in coordination so as not to damage one waterbody while improving another.

The Instream Flow Program recognized the need for public input from the outset, but the pilot project emphasized the need to specifically involve certain types of stakeholders, particularly lake-front property owners of lakes that will be used to create pulse flow releases. Likewise, careful outreach to all water users and dam owners is necessary during the development, and later implementation, of Water Management Plans. In the future, public participation plans will be developed for the application of the instream flow program to each designated river.

The results of the pilot program confirmed the need for river specific instream flow studies for each river, rather than generalizing protected flows. For example, the Lamprey and Souhegan watersheds are similarly sized, but given their unique geology and geography, it is not surprising that the same methods resulted in different flow protection criteria. In fact, the Souhegan River itself was divided into two segments, each with its own protected flow criteria, because of the varied characteristics between its steep headwaters and the flatter, meandering reaches downstream.

Natural Flow Paradigm
When the program was established, it was expected that a single minimum flow would be calculated for each river. More recent research, however, indicates that the most flow sensitive species, fish, are best supported by flows that mimic natural flow variability. As such, minimum flows were identified for both rivers in each of six seasons based on the flow needs for spawning, rearing and overwintering of key fish species.

More Monitoring is Needed

While legislation required a two year implementation period to test the pilot program, the effects of an improved flow regime on fish communities as well as vegetative and wildlife habitat will only be apparent after many years of trend monitoring. Therefore, long-term monitoring, particularly of fish and other river species, will be required to fully determine the success of the program as well as to inform any necessary management changes in the future. While NHDES and other organizations conduct some monitoring on the Lamprey and Souhegan rivers, existing monitoring programs are insufficient to determine pilot program success.

The Pilot Project Resulted in Unexpected Benefits

- The site-specific analysis of required minimum flows actually increased the amount of water that one public water supply was able to withdraw from the Lamprey River. This was because the methods are much more precise than the generalized procedures employed by permitting processes. Furthermore, the program provides a level-playing field for all existing and new users because any new user will always have access to the same small amount of water (the *de minimis* amount) and will be subject to the same low flow limitations as existing users. This will require NHDES and the water users in the watershed to discuss the best way to share that resource, and will cause any business with consumptive water needs to ensure they have adequate other sources during droughts.

- The balancing of river and lake management concerns required by the Pilot Project resulted in increased coordination and communication between river and lake groups, both of the statewide Rivers Management Advisory Committee and Lakes Management Advisory Committee, and of local groups and associations. The statewide committee coordination effort resulted in a set of guiding principles for future watershed management.
- In the process of developing the Lamprey River Water Management Plan, and in response to concerns from property owners around Pawtuckaway Lake, NHDES conducted in-depth studies of water quality in that lake. The program determined that the lake management changes required by the program to support the survival of river life during low flows would also improve water quality and habitat for fish and other wildlife in the lake. Specifically, by maintaining higher winter water levels in the lake, water will continue to flow out of the north end of Pawtuckaway Lake where phosphorus levels are higher year-round, flushing more phosphorus from the lake than was possible when the lake level dropped below the level of the northern dam outlet. Similarly, the more consistent water level will better protect species like turtles that overwinter in the shallow areas of the lake.

The Program on the Lamprey River is Fully Implemented

The Lamprey River protected instream flow criteria have been defined and the Water Management Plan has been put into operation. Conservation and water use restrictions were implemented during the two-year evaluation period, and water users were able to fulfill their water needs even during periods of low flows by conserving water, adjusting the timing of their water use, and utilizing alternate sources. Despite several brief periods of low flow, a water release from impoundments to augment stream flow was only required once on the Lamprey River, as precipitation usually returned flows to higher levels after only a few days. This pulse release was conducted for approximately 48 hours beginning on August 17, 2015. Results from this release are not yet available, however, earlier relief flow pulse tests on the Lamprey River demonstrated the effectiveness of pulse water releases from dams to briefly increase flow above critical levels.

The Program on the Souhegan River Requires Additional Resources and Effort

The Souhegan River protected instream flow criteria have been defined, but the Water Management Plan has not yet been fully implemented. The dam management plans have been developed, but relief flow pulses cannot yet be generated from any of the four dams identified for creating supplemental flows. As of December 2015, three of the dams require retrofitting by NHDES to allow flow management, and the fourth, privately-owned, dam requires a change in its federal license to conduct the releases. In addition, a few sections the conservation and water use plans continue to be modified to better meet the needs of water users.

Potential Next Steps in the Instream Flow Program:

Ongoing Funding is Required to Implement the Pilot Program

The pilot program cost $907,500 in direct state General Funds and grant funds, plus federal and state program costs for staff, supplies, equipment and travel, but not including any capital expenses such as dam outlet retrofits. In order to fully achieve the goals of the Instream Flow Pilot Program, funding will be necessary to retrofit three NHDES-owned dam outlets to allow for pulse releases on the Souhegan River. Only by utilizing these three dams in conjunction with one privately-owned dam can the necessary volume of water be released to temporarily relieve low flow conditions without significant impact to any one reservoir. Also, the management of the

pilot program rivers requires state resources to communicate with water users and dam owners, track the status of flows, provide outreach to stakeholders, report on annual activities, and open and close dams in the event of the need for a pulse release.

Expand the Instream Flow Program to All Designated Rivers: Funding and Data Needed
The original Rivers Management and Protection Program (RSA 483) requires that the Instream Flow Program apply to all 18 designated rivers. In order to expand the pilot program, a number of changes and activities will be necessary:

- Statute and administrative rule changes are needed in three ways: 1) Modernize the language in RSA 483 to recognize the natural flow paradigm and provide enforcement for water management plans; 2) Update the Safe Drinking Water Act, Rules for Water Conservation (RSA 485.61) to authorize the administration and enforcement of water conservation plans under one program; and 3) Revise the Instream Flow Program rules, Env-Wq 1900, to support the efficient development of protected instream flows on all designated rivers.
- Prioritize the next designated rivers to incorporate under the Instream Flow Program based on a combination of the river's position in the watershed, watershed development pressure, the number of water users and dams, and the available data.
- Data on fish is needed to determine both the species and number currently living in the designated rivers and target fish communities for each river. This data would be most efficiently gathered in a state-wide effort.
- Flow data on all designated rivers. Ideally, protected instream flows would be developed based on 30 or more years of U.S. Geological Survey data. However, installation of gages now on un-gaged rivers will create data to test simulated historical flow estimates and establish a gage on which to base future management decisions. Re-establishment of historical gages will also allow staff to utilize historic data to develop protected flow numbers and connect that data to current flows.
- Funding will be required to hire consultants to conduct field work and create protected instream flows for each additional designated river (approximately $144,000 per river).
- Ongoing funding for two additional staff (approximately $212,000 per year) will be needed to develop protected flows and water management plans for the remaining designated rivers, and then to maintain the instream flow program. Maintenance tasks include tracking instream flow conditions, coordination with new and existing water users and dam owners, and monitoring to determine management success and any required adaptive management.

Changes to the Instream Flow Program Rules Can Save Money
The rules that guide the Instream Flow Program currently only apply to the Pilot Program. When the rules are updated to govern the application of the Instream Flow Program on all designated rivers, one important change will be to evaluate only those outstanding characteristics that are highly flow dependent when developing protected instream flow criteria, which will expedite the process and reduce costs.

The Instream Flow Program has been shown to protect New Hampshire's valuable natural resources while maximizing opportunities for public and private use of our state's rivers. NHDES is prepared to expand the program to the state's other designated rivers following legislative review of the pilot program and the availability of resources for that expansion.