# CONSERVATION PLAN

## University of New Hampshire/Durham Water Supply (#20066)

### Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) will require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

As part of the permitting of a new water supply source, the University of New Hampshire/Durham Water System (UDWS) prepared a draft Water Conservation Plan (September 2012), which was reviewed by DES Drinking Water and Groundwater Bureau and is under revision by UDWS, but has not yet been approved.

UDWS is a public water system supplying the Town of Durham and the University of New Hampshire campus. UDWS includes three water supply sources: the Oyster River Reservoir (owned by UNH), in the Town of Durham; the Lee Well (owned by the Town of Durham), in the Town of Lee; and a diversion (owned by UNH) from an impoundment in the Lamprey River above Wiswall Dam in the Town of Durham. The water system is operated by UNH Water Supply personnel and receives guidance from the Water, Wastewater, Stormwater Committee, which is staffed by representatives from both the University and the Town of Durham. The maintenance of the system is shared by UNH and the Town of Durham based on the location of the distribution lines. The water use patterns will only be described for the Lamprey River withdrawal, which is the only UDWS source in the Lamprey Water Management Planning Area. This Conservation Plan applies to the entire UDWS service area.

### Water Source and Uses

UDWS has three water sources. Two sources are outside the Lamprey River drainage basin—the Lee Wells (20066-S0x) and the Oyster River withdrawal (20066-S01). The UDWS withdrawal from the Lamprey River is registered with DES as Water User ID #20066-S02. The pumping station and intake, which were constructed in 1970, are located approximately 2,700 feet upstream of Wiswall Dam. The withdrawal is taken from the impounded river segment behind the dam.

The UDWS withdrawal from the Lamprey River is registered as Water User ID #20066-S02. Figure 1 depicts the location of the pumping station approximately 2,700 feet upstream of Wiswall Dam. The withdrawal is located on the Designated River and the drainage area at the location of this diversion is approximately 183.9 square miles.

Prior to 2002, withdrawals from the Lamprey River were used to supplement the Oyster River in times of drought. Water was withdrawn from the Lamprey River on an irregular basis when demand was high and the available supply from the two other water sources was limited. In 2002 a direct connection between the Lamprey River and the Arthur Rollins Water Treatment Plant was completed. Episodes of high water usage for trials and experimentation of the new system configuration occurred from 2002

**Figure 1. Location of the University of New Hampshire Water Works Lamprey River Pump Station (20066-S02).**

until 2004. From 2004 through 2008 the use of the Lamprey River diversion reverted to the historical practice. In the fall of 2008, the Lamprey became the principal year round source of water for the UDWS. Prior to this, the Oyster River was the system's primary source. The water from the Lamprey and Oyster Rivers is treated at the water treatment plant and then distributed to the water system, while the Lee Well, which represents 25 percent of the total supply, supplies the system directly.

**Water Use Patterns**

Water use data for were obtained from DES Water Use Registration database. Annual water use was converted from thousands of gallons to cubic feet per second (cfs) and cubic feet per square mile of drainage area (cfsm) to make comparisons with stream flow values in the Lamprey Designated River. UDWS's water withdrawals were first registered with the Department of Environmental Services (DES) in October 1987 and water use data for the Lamprey River withdrawal are available beginning October 1988. UDWS's withdrawals are metered and withdrawal volumes are recorded daily and totaled monthly with the monthly and daily water use data being reported quarterly to DES.

Figure 2 and Table 1 show system-wide water use, although data gaps resulted in some year's data being presented as partial records. Date presented are for full-year records unless identified otherwise. Water use declined 106.1 million gallons over the 1993 to 2012 period. This is a 27.2 % reduction from the 1993 water use over the 20 years of record or an average annual decline of 1.36%.

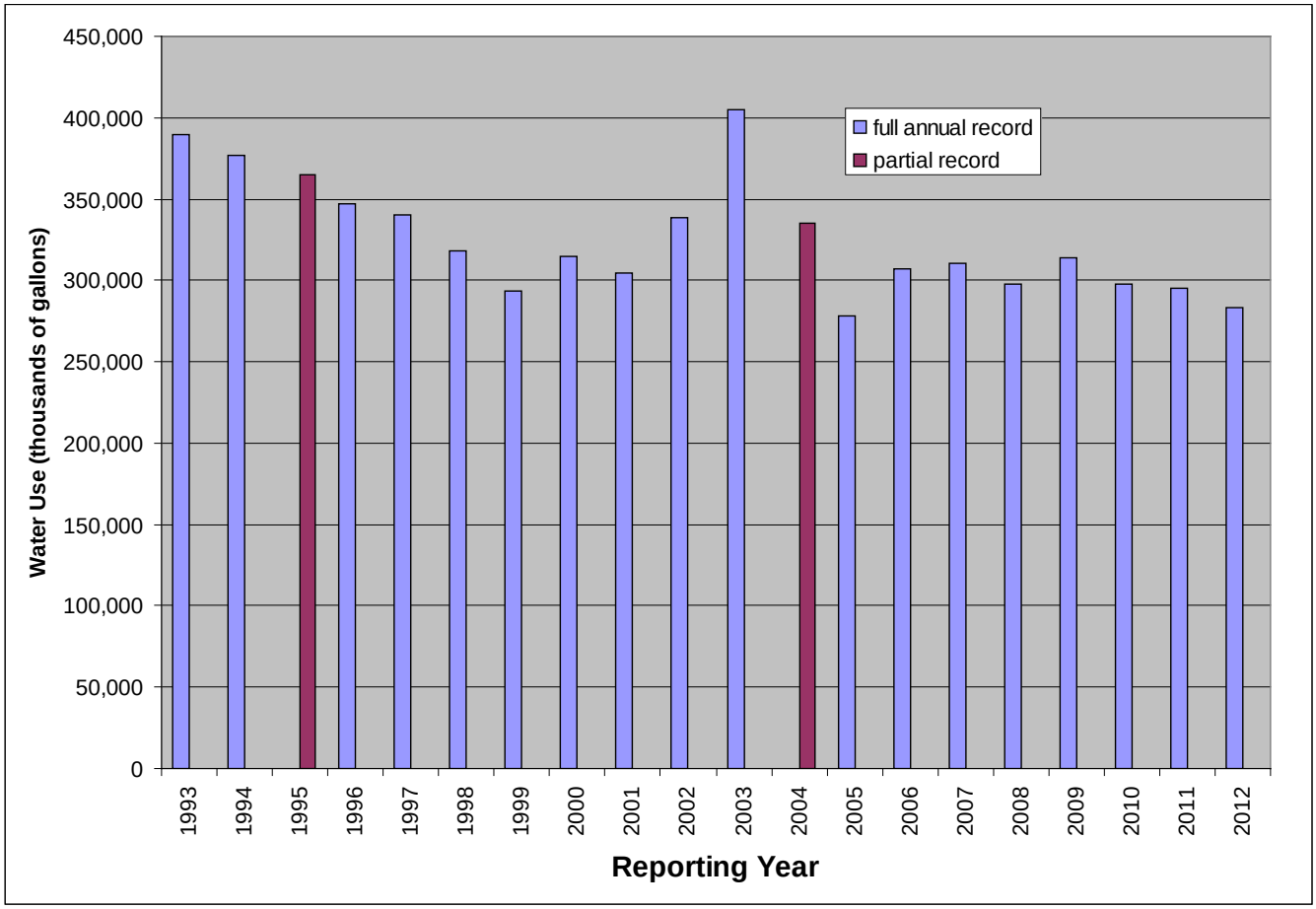


**Figure 2 – UDWS (20066) – Annual Water Use**

**Table 1 – UDWS - Annual Water Use Statistics (1993-2012, except 1995 and 2004)**

| | Low | High | Average |
|---|---|---|---|
| Thousands of Gallons | 277,936 | 404,831 | 313,596 |
| cfs | 1.1782 | 1.7162 | 1.3294 |
| cfsm at Packers Falls Gage | 0.00644 | 0.00938 | 0.00726 |

In 1999, UDWS increased its use of water from the Lee 5 Corners Well ((20066-S03) and used less water from the Oyster River diversion (20066-S01). In late 2008, UDWS began using the Lamprey River diversion (20066-S02) as its primary water source and use of the Oyster River diversion was further reduced. Annual withdrawals from the UDWS's Oyster River, Lamprey River and Lee well sources are summarized in the figures and tables below.

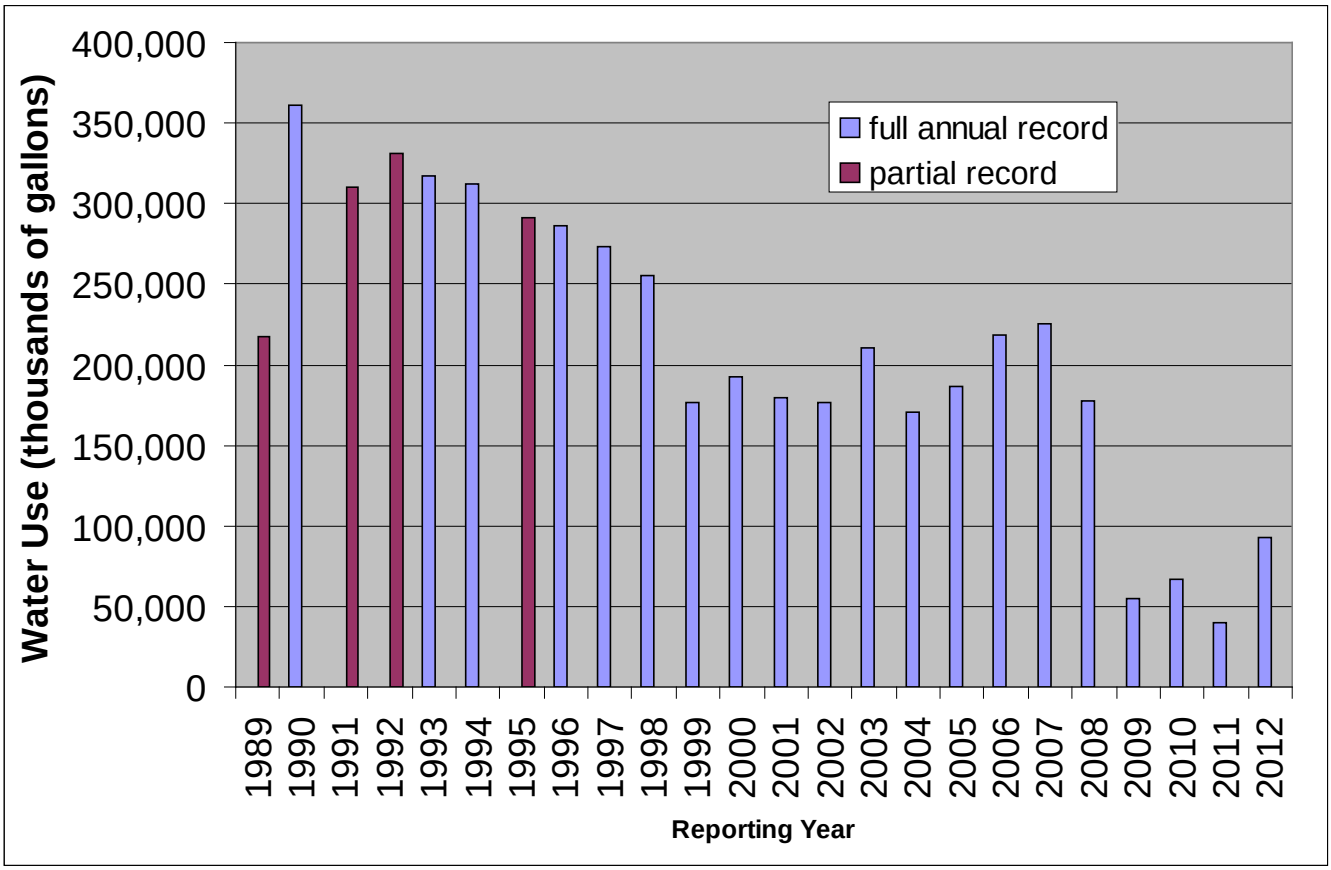


**Figure 3 – UDWS – OYSTER RIVER DIVERSION (20066-S01) – Annual Water Use**

**Table 2 – Oyster River Diversion – Annual Water Use Statistics (1990-2012, except 1991, 1992, 1995)**

| | Low | High | Average |
|---|---|---|---|
| Thousands of Gallons | 40,310 | 361,442 | 198,720 |
| cfs | 0.1709 | 1.5323 | 0.8424 |
| cfsm at Packers Falls Gage | 0.00093 | 0.00837 | 0.00460 |

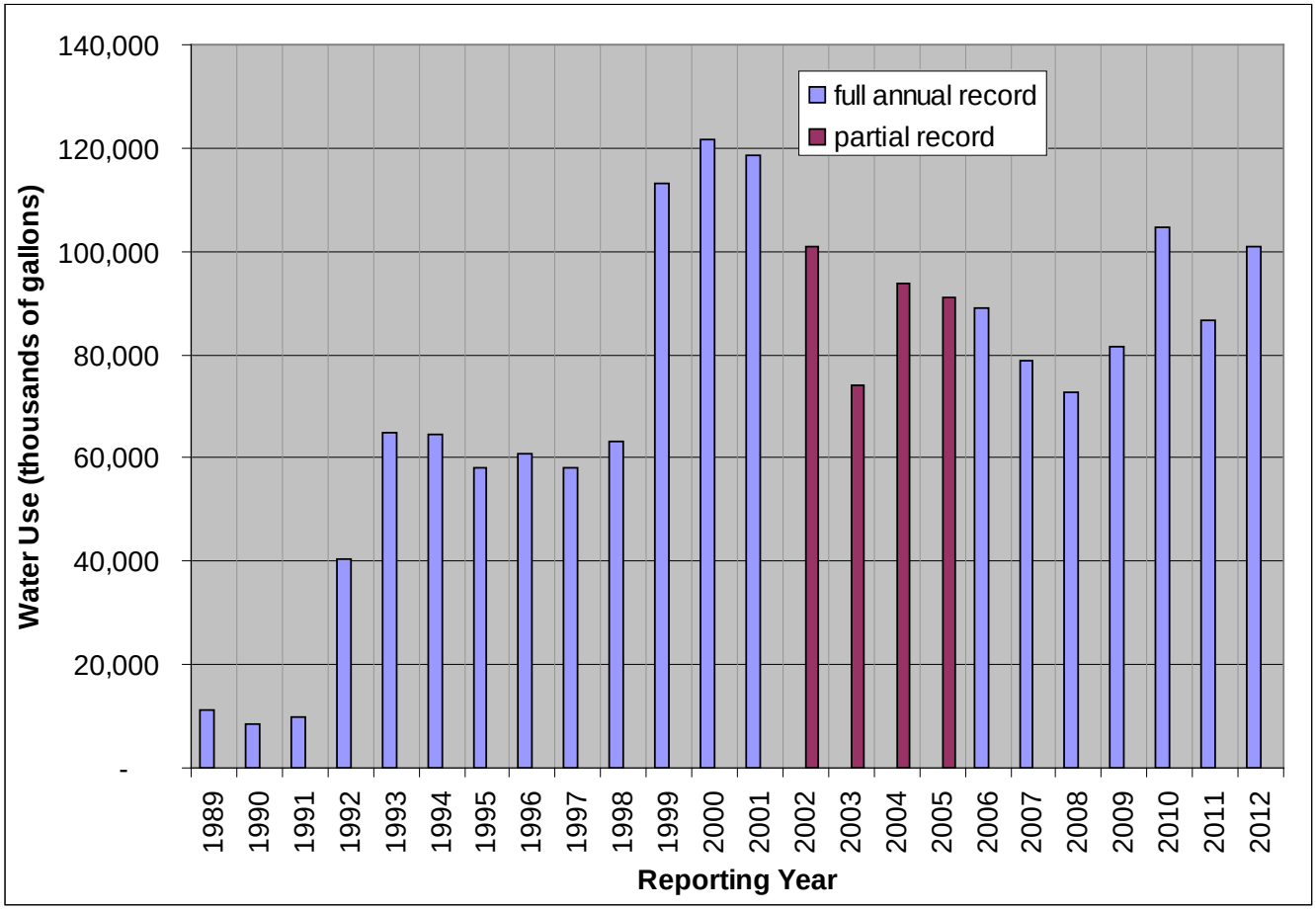


**Figure 4 - UDWS – LEE WELL (20066-S03) – Annual Water Use**

**Table 3 – UDWS – Lee Well – Annual Water Use Statistics (**

| | Low | High | Average |
|---|---|---|---|
| Thousands of Gallons | 8,409 | 121,668 | 70,392 |
| cfs | 0.0356 | 0.5158 | 0.2984 |
| cfsm at Packers Falls Gage | 0.00019 | 0.00282 | 0.00163 |

Prior to 2009, most supply needs were met with withdrawals from the Oyster River and the Lee Well. Withdrawals from the Lamprey River were made based on increased demand, the combined available supply from the Lee Well and Oyster River Reservoir, and sometimes by water quality considerations. Withdrawals from the Lamprey River typically occurred during August and September, when demand increases in response to the return of UNH students to Durham and decreased in the spring with higher stream flow available on the Oyster and the decline in the UNH student population. These withdrawals took advantage of the higher quality of the Lamprey River water to reduce the requirements of water quality treatment.

Between 1993 and 2008 water withdrawals from the Lamprey River were sporadic and irregular. Withdrawals from the Lamprey River were significantly greater from 2002 through 2004 than during all other years until 2009 (Figure 5.) According to UDWS staff this was a result of trials and experimentation as the Lamprey River withdrawal was transitioned from a source of recharge to the Oyster River Reservoir to a direct connection with the water treatment plant. This period also coincided with several summers of below normal discharge on the Lamprey and Oyster Rivers due to regional

drought conditions. Starting in late 2008, the Lamprey River became the principal source of water for the UDWS. Annual water use beginning in 2009 clearly reflects this change in priority of use . Water use statistics show the shift in emphasis put on the use of the Lamprey River before and after the beginning of 2009.

Annual withdrawals during the period 1993 through 2008 increased by 39.8 million gallons or 515 percent. This represents an average increase of 2.487 million gallons per year or 32 percent per year over this 16 year period of record. In comparison, annual water use by the entire UDWS between 1993 and 2008 decreased by 91.4 million gallons or 23.5 percent. Annual water use from the Lamprey River from 1993 through 2008 ranged from a high of 120.905 million gallons (2003) to a low of 0 gallons (multiple years) with an average annual use of 21.963 million gallons (Table 4A). From 2009 through 2012, water use ranged from a high of 178.760 million gallons (2009) to a low of 89.630 million gallons (2012) with an average annual use of 140.948 million gallons (Table 4b).

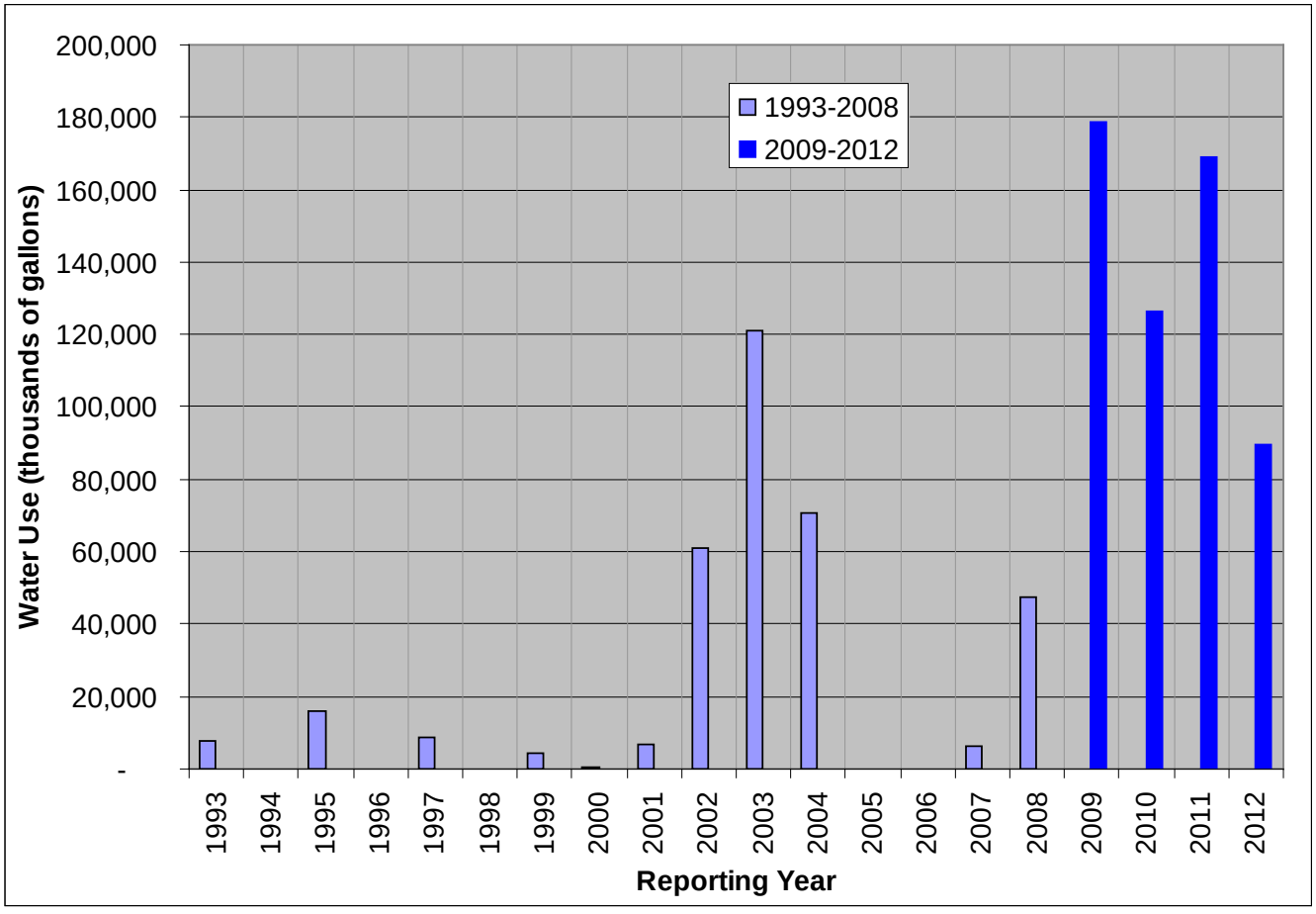


**Figure 5 – UDWS - LAMPREY RIVER DIVERSION (20045-S02) - Annual Water Use (1993 through 2012).**

**Table 4A – UDWS – Lamprey River – Annual Water Use Statistics (1993-2008)**

| | Low | High | Average |
|---|---|---|---|
| Thousands of Gallons | - | 120,905 | 21,963 |
| cfs | - | 0.5125 | 0.0931 |
| cfsm at Packers Falls Gage | 0.00000 | 0.00280 | 0.00051 |

**Table 4B – UDWS – Lamprey River – Annual Water Use Statistics (2009-2012)**

| | Low | High | Average |
|---|---|---|---|
| Thousands of Gallons | 89,631 | 178,760 | 140,948 |
| cfs | 0.3800 | 0.7578 | 0.5975 |
| cfsm at Packers Falls Gage | 0.00208 | 0.00414 | 0.00327 |

UDWS's monthly water use is variable due largely to shifts in seasonal demand, particularly related to start of the university year. The monthly usage pattern is different from that of other public water supplies because the highest usage is not during the summer. The average monthly water usage is greatest during the fall and spring, and lowest during the winter and summer (Figure 6). This seasonal pattern reflects higher water usage as the university prepares for the return of students to UNH in the fall and the increased population upon their return.

The highest monthly usage for UDWS was 51.310 million gallons (October 2003). The lowest monthly usage was 13.272 million gallons (Table 5). The average monthly usage was 27.077 million gallons for 1993 through 2012.

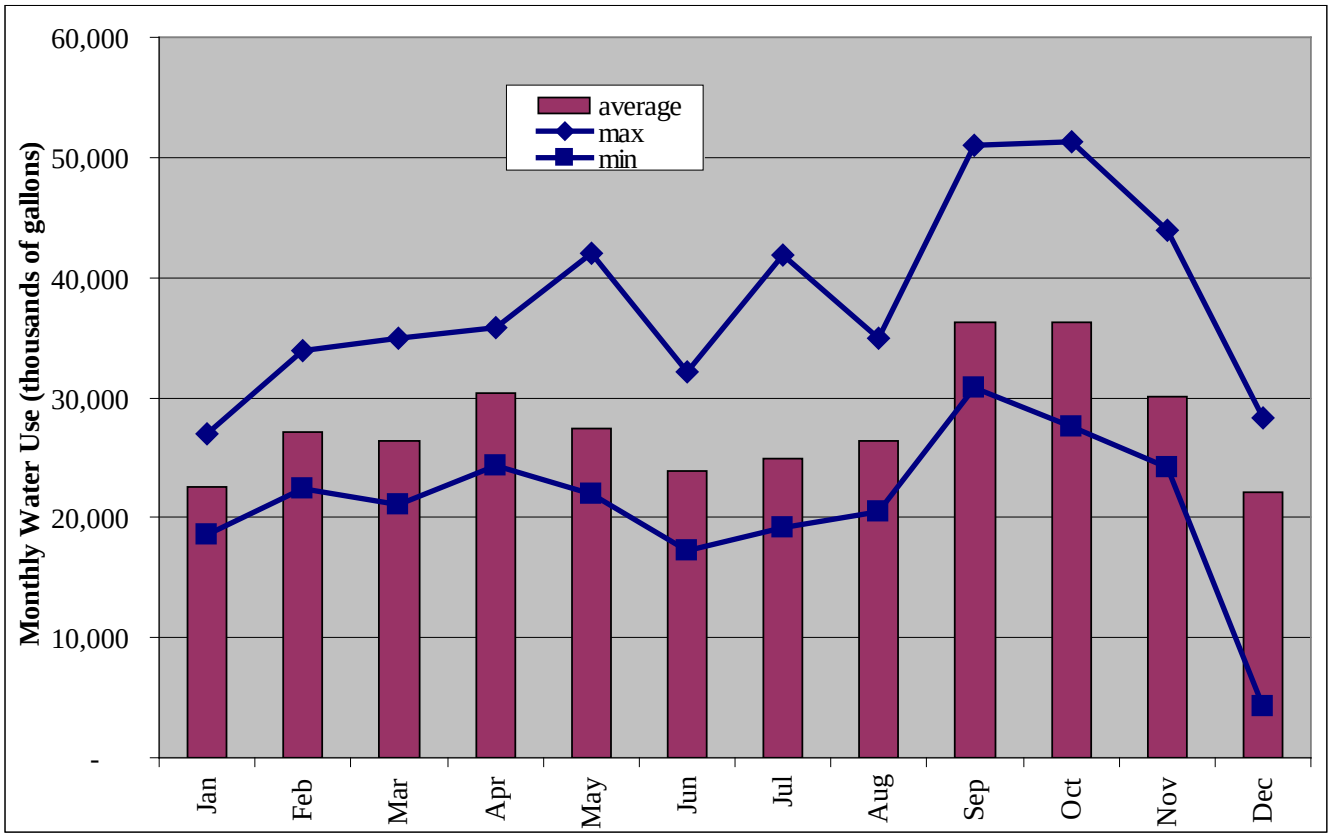


**Figure 6 – UDWS – Monthly Water Use Statistics (1993-2012, except Dec 1995 and Sept 2004)**

**Table 5 – UDWS - Monthly Water Use Statistics (1993-2012, except Dec 1995 and Sept 2004)**

| | Low | High | Average |
|---|---|---|---|
| Thousands of Gallons | 13,272 | 51,310 | 27,077 |
| cfs | 0.6752 | 2.6102 | 1.3774 |

Monthly water use data for the Lamprey River withdrawal have been assessed separately for the period before and after the beginning of 2009. The monthly water use data in Figure 7 and Table 6 show that the average monthly water use of the Lamprey River from 1993 through 2008 ranged from a minimum of 0 cfs (multiple occurrences), to a maximum of 1.093 cfs (0.767 million gallons per day) (during October 2003) with a mean monthly water use of 0.0929 cfs (65,188 gallons per day).

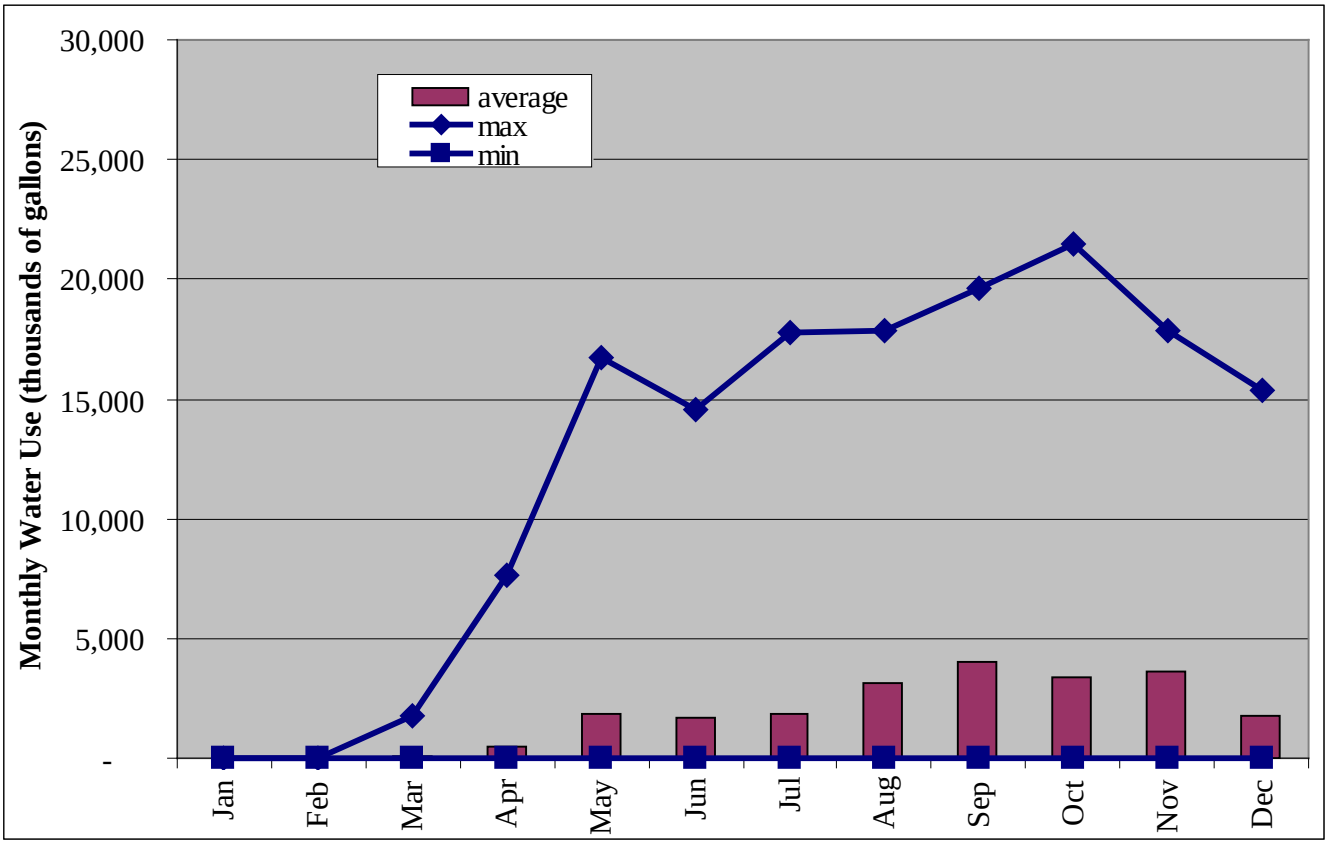


**Figure 7 – UDWS – Lamprey River Diversion – Monthly Water Use (1993-2008)**

**Table 6 – UDWS – Lamprey River Diversion – Monthly Water Use Statistics (1993-2008)**

| | Low | High | Average |
|---|---|---|---|
| Thousands of Gallons | - | 21,480 | 1,825 |
| cfs | - | 1.0927 | 0.0929 |
| cfsm at Packers Falls Gage | 0.00000 | 0.00597 | 0.00051 |

The average monthly water use of the Lamprey River beginning in 2009 through 2012, shown in Figure 7 and Table 6, ranged from a minimum of 0 cfs (multiple occurrences), to a maximum of 1.22 cfs (0.856 million gallons per day) (February 2009) with a mean monthly water use of 0.596 cfs (0.385 million gallons per day) over the period 2009-2012 (Table 7).

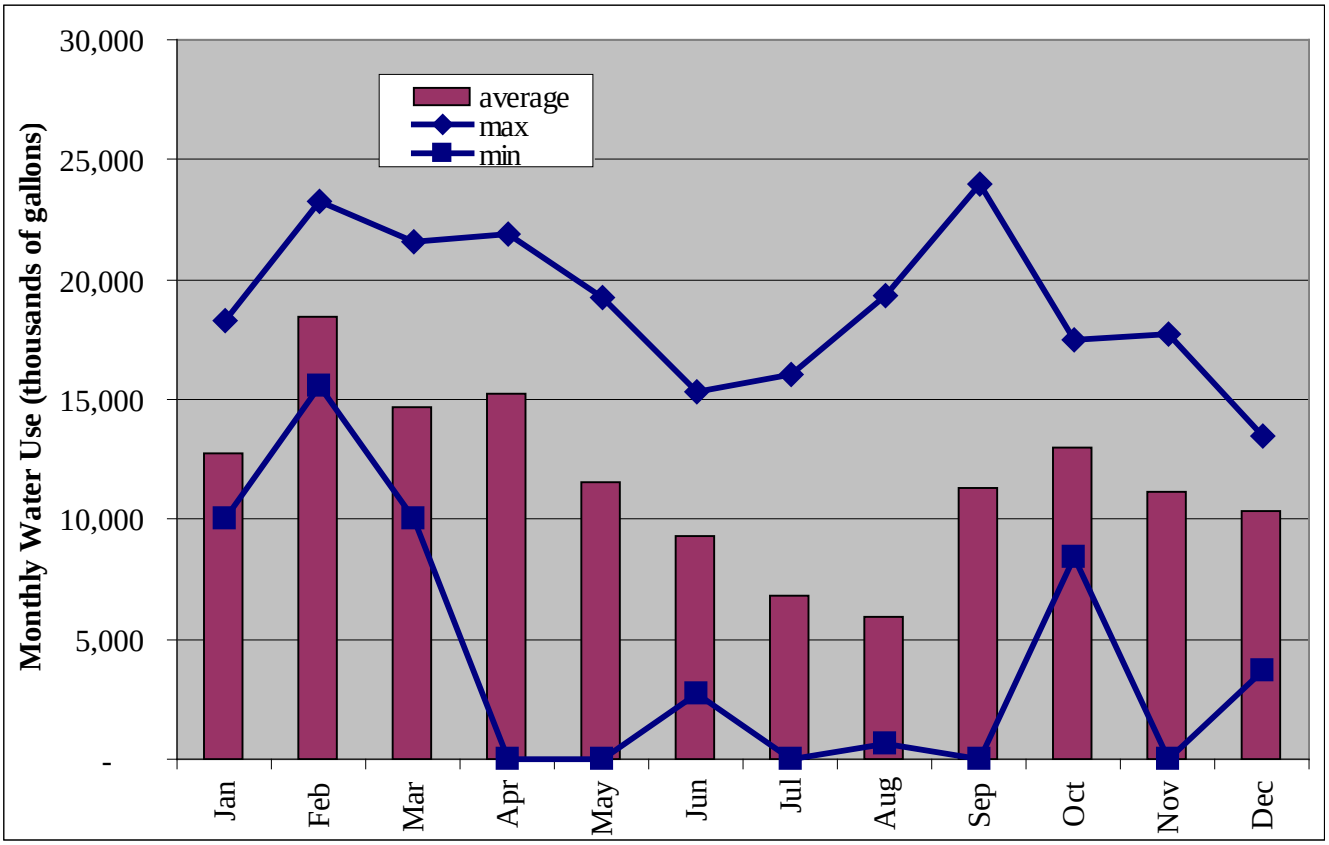


**Figure 8 – UDWS – Lamprey River Diversion – Monthly Water Use (2009-2012)**

**Table 7 – UDWS – Lamprey River Diversion – Monthly Water Use Statistics (2009-2012)**

| | Low | High | Average |
|---|---|---|---|
| Thousands of Gallons | - | 23,955 | 11,714 |
| cfs | - | 1.2186 | 0.5959 |
| cfsm at Packers Falls Gage | 0.00000 | 0.00666 | 0.00326 |

**Env-Wq 2101 Requirements for Water Conservation Plan**

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will meet the Conservation Plan requirements under the Instream Flow Rules. The Water Conservation Rules require different activities depending on the type of water use. Conservation plans for public water supplies require inclusion of the following components:

- Installation, maintenance, and use of appropriately selected meters
- Maintaining low levels of unaccounted-for water,
- Performing water audits to assess losses,
- A comprehensive plan for leak detection surveys of the distribution system,
- System pressure reduction where necessary,
- A water conservation educational outreach initiative,
- Adopting a rate structure that promotes water conservation, and
- On-going water conservation compliance reporting.

UDWS will be in compliance with the water conservation plan requirements of the Instream Flow Program by completing and getting approval for their Water Conservation Plan through DES Groundwater and Drinking Water Bureau.

**Existing Water Conservation Measures**

The Town of Durham and the University of New Hampshire (aka UDWS) submitted a proposed Water Conservation Plan (September 2012) to DES's Drinking Water and Groundwater Bureau in support of their permit application for the development of a new water supply source near Spruce Hole Bog in Durham. The proposed Water Conservation Plan documents the water conservation measures employed by both UNH and the Town of Durham and how its operations meet the water conservation requirements for existing Large Community Water Systems pursuant to Env-Wq 2101.

The 2012 draft Water Conservation Plan describes the existing and planned actions that UNH has implemented as part of its campus sustainability initiative, parts of which are described at UNH's sustainability web site (www.sustainableunh.unh.edu/biodiversity-education-initiative-bei-current-projects#water). The draft plan includes testing and calibration schedules for meters. The master meters at the water treatment facility are tested and calibrated twice a year. The meter at the Lee Well is tested annually. UNH requires all new buildings and renovations to use low flow water fixtures including urinals, toilets, showers and any dishwashers or cooling systems. UNH is also installing waterless urinals and dual flush toilets in two of its most recently renovated buildings. Students at UNH are educated on the water conservation techniques through an annual or biannual outreach effort which includes informational postings and fliers. They are instructed to report leak and drips in sinks, showers and toilets. They are also encouraged only to wash full loads of laundry, to turn the water off while brushing their teeth and to take shorter showers.

As noted in the water conservation section of UNH's Sustainability website (www.sustainableunh.unh.edu/biodiversity-education-initiative-bei-current-projectsl#water), all the water meters on campus buildings are checked via monthly readings. If a meter is 15 percent above or below a running average it is investigated. Meters 2 inches and under are calibrated on an as needed basis or replaced due to unexplained variances. Meters over 2 inches are repaired as needed and calibrated on a rotating basis. Automatic meter reading is being phased in to all meters on campus.

A comprehensive leak detection study was performed on the UDWS system two years ago. The results of the study identified 8 percent unaccounted losses, which is lower than the 15 percent limit in the Water Conservation Rules (Env-Wq 2101). To minimize unaccounted-for water, water use is actively monitoring and reported leaks are responded to immediately.

The 2012 draft Water Conservation Plan also describes the Town of Durham's current conservation activities. The Town has metered all of its customers and reads its meters twice a year. The Town's water customers pay for their water based on a unit price and the rate structure is the same for all customer classes. The Town periodically sends out water conservation outreach materials with its bi-annual water bills and includes water conservation tips in the weekly Town newsletter that is emailed to Town residents. The Town's engineering department staff present updates to Town committees on water and water conservation issues.

**Water Conservation Alternatives and Costs**

As required by Env-Wq 2101 for the development of a new water supply source, UDWS has submitted a proposed Water Conservation Plan (September 2012) to DES for the proposed Large Groundwater Withdrawal identified as Durham/UNH Production Well #2 (DGD-PW2). Completion of this plan by UDWS and approval by DES Drinking Water and Groundwater Bureau will meet the Instream Flow Program's Conservation Plan requirements. The Water Conservation Plan will be administered by the Drinking Water and Groundwater Bureau under their existing authority or the authority of the Instream Flow Program.

The costs for the water conservation plan are not considered part of the Instream Flow Program. Completion and approval of the existing draft Water Conservation Plan is a requirement of developing the new water supply source. As such, there are no costs associated the Instream Flow Program unless the UDWS abandons its plan to develop the new source.

**Conservation Implementation Schedule**

Prior to obtaining approval for the proposed new source, but no later than June 1, 2014, UDWS will finalize its proposed Water Conservation Plan in accordance with Env-Wq 2101.

**Water User Contact Information**

**Water User:** University of New Hampshire/Town of Durham Water System

**Address:** Town of Durham Department of Public Works
100 Stone Quarry Drive, Durham, NH 03824
**Contact:** David Cedarholm, Town Engineer
**Phone:** 868-5578
**Email:** dcedarholm@ci.durham.nh.us

**Address:** UNH Energy and Utilities
17 Leavitt Lane, Durham, NH 03824
**Contact:** Jim Dombrosk, Director Energy and Utilities
**Phone:** 862-2345
**Email:** jim.dombrosk@unh.edu

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Department of Environmental Services (DES) 2009. Final Lamprey Protected Instream Flow Report. Prepared by Normandeau Associates, Inc., Rushing Rivers Institute and the University of New Hampshire. NHDES-R-WD-08-26.

Personal communication with Wesley East. UNH/Durham Water System.

Personal communication with David Cedarholm, P.E., Town of Durham.

Survey of Lamprey River Affected Water Users performed by Normandeau Associates, Inc. completed by Wesley East. UNH/Durham Water System.

Weston & Sampson 2012. Town of Durham University of New Hampshire Water Conservation Plan (draft). Dated September 2012.

Water use reports on file with the Department of Environmental Services (DES).