

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES



Thomas S. Burack, Commissioner

August 3, 2012

John Brooks
 Emery & Garrett Groundwater, Inc.
 P.O. Box 1578
 Meredith, NH 03253

**RE: Final Report -- Large Well Siting/Large Groundwater Withdrawal Permit Application
 Durham/UNH Water System, PWS ID 0691010
 Well #2 (DGD-PW2)
 Lee, New Hampshire**

Dear Mr. Brooks:

The New Hampshire Department of Environmental Services (DES) has conducted a review of the final report submitted in support of a community well siting and large groundwater withdrawal permit application (Final Report) titled "Final Hydrogeologic Investigation Town of Durham-University of New Hampshire Groundwater Development UNH/Durham Production Well DGD-PW2" prepared by Emery & Garrett Groundwater, Inc. (EGGI) on behalf of the Durham/UNH water system (Durham/UNH), dated March 28, 2012. In summary, Durham/UNH is seeking large well siting approval and a large groundwater withdrawal permit for one new overburden production well, designated well DGD-PW2, located in the town of Lee just west of the Durham-Lee town line, east of Packers Falls Road and west of Spruce Hole Bog. The total proposed permitted production volume is 1,044,000 gallons per day (gpd), or 725 gallons per minute (gpm) over a 24-hour period, with a maximum annual withdrawal volume limitation of 63 million gallons. Durham/UNH is pursuing the proposed groundwater withdrawal in conjunction with an artificial recharge project in which natural recharge to the overburden aquifer from which DGD-PW2 withdraws groundwater (herein referred to as the Spruce Hole Aquifer) will be artificially supplemented with surface water withdrawn from the Lamprey River [DES Groundwater Discharge Permit No. GWP-201111101-L-001].

This letter contains DES' comments on the Final Report in accordance with: RSA 485-C:21, *Approval for Large Groundwater Withdrawals*; New Hampshire Administrative Rules Env-Wq 403, *Large Groundwater Withdrawals*; and New Hampshire Administrative Rules Env-Dw 302, *Large Production Wells for Community Water Systems*. The following are DES' comments:

I. General Comments

- a) DES acknowledges that Durham/UNH is requesting an increase of the proposed permitted production volume of DGD-PW2 from 1,008,000 gpd (700 gpm) [proposed in the Preliminary Application] to 1,044,000 gpd (725 gpm) based on the constant rate pumping test performed on the well. Given EGGI's conservative assumptions in developing the potential impact area, DES does not require any modification of the potential impact area due to the revised production volume of DGD-PW2.
- b) In keeping with DES' prior correspondence, although comments on the Final Report for DGD-PW2 are provided below, final approval for the well can not be issued until a water conservation plan, completed in accordance with Env-Wq 2101, has been submitted and approved by DES' Water Conservation Program. Based on recent communication with EGGI, DES understands that Durham/UNH anticipates

submitting a water conservation plan by the end of August 2012. If EGGI or Durham/UNH have any questions regarding the water conservation rule requirements, or need further assistance compiling the plan, please contact Stacey Herbold at (603) 271-0659 or stacey.herbold@des.nh.gov.

- c) Provide copies of the Well Completion Reports (or State Well ID numbers if available) for the test and monitoring wells installed as part of this investigation and filed with the NH Water Well Board by the NH-licensed water well contractor that constructed the wells.

II. Community Well Siting Requirements

- a) With reference to the 400-foot radius sanitary protective area (SPA) of DGD-PW2 and the properties depicted in Figure 6, DES approves a waiver of the requirements of Env-Dw 302.06(d) for the portion of Durham Tax Map 13, Tax Lot 13-2 contained within the SPA. DES' decision to grant a waiver is based on a review of the information included in section III of the Final Report. This waiver is approved based on the fact that the property is currently undeveloped, and access to the portion of the property within the SPA is limited. This approval is conditional upon the current undeveloped status of the portion of the property within the SPA being maintained.
- b) With reference to the refined Wellhead Protection Area (WHPA) of DGD-PW2 and the updated potential contamination source (PCS) inventory depicted in Figure 23, and comment No. 5 of DES' letter dated October 2, 2008, the Packers Falls Village mobile home park shall be added to the PCS inventory and included in any future Wellhead Protection Program (WHPP) established by Durham/UNH, as necessary.

III. Large Groundwater Withdrawal Permitting Requirements

- a) Impact Description (Env-Wq 403.17)
 - i. *Surface Water and Wetland Resources:* The conceptual hydrologic model of the withdrawal presented by EGGI in the Final Report identifies spring discharge to Chesley Brook as a significant sink for groundwater flow in the Spruce Hole Aquifer. Under non-pumping conditions, the dominant groundwater flow direction within the aquifer is northward toward the springs which discharge to Chesley Brook along its south side, just west of where the brook crosses under Packers Falls Road, approximately 2,200 feet north of DGD-PW2. Based on the conceptual model and a water budget analysis, the Final Report states that groundwater discharge to Chesley Brook will be reduced under any pumping scenario of DGD-PW2, as the total volume of groundwater draining from the aquifer is reduced. EGGI estimates that the withdrawal from DGD-PW2 will reduce annual groundwater discharge to the springs by between 50 and 69% (52-73 million gallons per year, or 100-138 gpm). DES acknowledges that these estimates do not take into consideration using artificial recharge to supplement the total amount of groundwater available in the aquifer; and that artificial recharge will likely serve to lessen reductions in spring flow to some degree.

Based on the above-cited estimates, DES concurs with EGGI in that there is the potential for the withdrawal from DGD-PW2 to impact flow in Chesley Brook, particularly during times of the year when spring discharge and groundwater baseflow comprise a greater proportion of stream flow. DES also concurs that spring flow/surface water flow reductions could potentially impact riparian wetlands that occur at and downstream of the springs. The potential for these impacts to occur is further supported by the reduction in stream flow observed at surface water station DGD-SW4 during the recovery period of the withdrawal testing program; although, DES acknowledges that quantifying the reduction is confounded by the influence of a rainfall event near the end of the pumping period and subsequent stream flow recession during the recovery period.

Relevant to this issue [and referenced on page 34 of the Final Report] is the fact that within the reach of Chesley Brook that includes the springs, the New Hampshire Fish and Game Department (NHFGD) has identified a 'dense' population of American brook lamprey (*Lampetra appendix*; herein referred to as ABL), which is listed as a state endangered species. Based on information provided by the NHFGD staff that conducted fish surveys of Chesley Brook, the health and abundance of this population is attributed to the habitat provided by Chesley Brook and the influx of groundwater from the springs. By reducing the amount of groundwater discharging from the springs, and subsequently reducing stream flow in the brook, water quality parameters could be shifted outside of preferred ranges; or different stream habitats used by the ABL during its various life stages could be reduced to unsuitable conditions or dewatered. These scenarios could pose an immediate risk to individual members of the species, and consequently the species as a whole given its rarity (M. Carpenter, NHFGD; personal communication, July 12, 2012; letter, July 30, 2012).

In consideration of the above comments, DES believes there may be the potential for the withdrawal from DGD-PW2 to cause a violation of the adverse impact criteria of RSA 485-C:21, V-c.(f) and (g), specifically by reducing surface water levels or flows in Chesley Brook that will, or do, cause a violation of the State's surface water quality standards specified in Env-Wq 1700; or by causing a net loss of values for submerged lands and wetlands as set forth in RSA 482-A. Given the documented presence of a state endangered species within the reach of Chesley Brook most likely to be affected by the withdrawal from DGD-PW2, Durham/UNH shall conduct a site-specific instream flow study of Chesley Brook to determine the flow conditions that must be maintained to provide suitable habitat conditions for the ABL during its various life stages (see comment No. III.b)i. below).

Per the position presented on page 32 of the Final Report, DES concurs that the withdrawal from DGD-PW2, as proposed, is not likely to significantly impact flow in the Oyster River.

ii. *Private Water Supply Wells*

1. For private wells that were monitored during the withdrawal testing program, provide copies of the plots depicting the monitoring results to the respective property owners. The monitoring results shall be accompanied by a cover letter that provides a contact name and telephone number for both Durham/UNH and DES for any questions regarding the water level plots.
2. Given the water level influence observed in the private overburden (dug) well serving the Tsukrov property (Lee Tax Map 15, Tax Lot 2-4) during the withdrawal testing program, and the amount of water level drawdown estimated to occur during the continuous operation of DGD-PW2 [as described on page 30 of the Final Report], DES concurs that the use of DGD-PW2 could disrupt the use of the Tsukrov well, and cause a violation of the adverse impact criterion of RSA 485-C:21, V-c.(a), specifically by reducing the withdrawal capacity of the Tsukrov well as a result of the reduction of available water that is directly associated with the withdrawal. As such, provide a plan to mitigate adverse impacts to the Tsukrov well, in accordance with Env-Wq 403.30, *Replacement of Sources Adversely Impacted by Withdrawal*. Implementation of the mitigation plan prior to initiating a withdrawal from DGD-PW2 shall be a condition of any large groundwater withdrawal permit issued.
3. Given the water level influence observed in some of the private wells monitored, provide a draft plan for providing an alternative water supply (i.e., a draft "Source Replacement Plan") that would be implemented by Durham/UNH in the event of an adverse impact to a private water

supply source, in accordance with the criteria and procedures in Env-Wq 403.30, *Replacement of Sources Adversely Impacted by Withdrawal*. The plan should propose a mechanism for meeting short-term water supply needs in situations where a long-term solution may be necessary. At a minimum, the plan shall need to establish a protocol that Durham/UNH intends to follow to replace the water supply of a private well user in the event of an adverse impact, to include a statement that any work on a private well, if deemed necessary, will be conducted by a NH-licensed water well contractor/pump installer.

4. Provide a figure depicting the following information overlain on a current tax map: 1) wells that were monitored during the withdrawal testing program and their associated 180-day water level drawdown estimates; 2) estimated 180-day drawdown contours; and 3) 180-day zone of influence. Where information is available (e.g., from completed private well survey forms, windshield surveys, etc.) the map should differentiate between properties that are served by bedrock wells and those that are served by overburden (dug) wells, and properties should be labeled with their tax map and lot number. Also, provide a table to accompany the map that contains the ownership information for each property within the estimated 180-day zone of influence that is served by a private well.

Note that as a condition of any large groundwater withdrawal permit issued, Durham/UNH shall send a letter to the owners of all properties served by private wells or public wells not owned by Durham/UNH within the estimated 180-day zone of influence of the withdrawal, notifying them that their well may be influenced by the withdrawal and that a source replacement plan is available if they would like a copy, and providing them with contact information for Durham/UNH and DES in the event they believe they may be adversely impacted by the withdrawal.

- iii. *Aquifer Recharge*: Based on the conceptual model and water budget analysis presented in the Final Report and groundwater level recovery trends observed during the withdrawal testing program, DES believes that the use of DGD-PW2 at the proposed permitted production volume could potentially result in groundwater being withdrawn from the aquifer faster than it is recharged by natural processes causing water levels in the aquifer to decline over time, and cause a violation of the adverse impact criterion of RSA 485-C:21, V-c.(k), specifically by causing the long-term predictable rate of replenishment of the Spruce Hole Aquifer to be exceeded. This stated, however, DES also believes that the proposed groundwater withdrawal from DGD-PW2 can not be viewed separately from Durham/UNH's artificial recharge project, and that artificial recharge will serve to mitigate any potential adverse impacts related to the rate of aquifer recharge. As such, implementation of the artificial recharge project shall be a condition of any large groundwater withdrawal permit issued. To ensure an adverse impact does not occur, Durham/UNH shall implement a water level monitoring program to monitor the trend of groundwater levels in the aquifer over time (see comment No. III.b)ii. below).
- b) *Impact Monitoring and Reporting Program (Env-Wq 403.24)*: An impact monitoring and reporting program shall be conducted when available information is not sufficient to verify that adverse impacts from a large groundwater withdrawal will not occur, provided the available information does not suggest that an impact is irreversible or will occur immediately. The following is a summary of the components DES anticipates would be included as part of a proposed program and associated upfront studies.
 - i. *Instream Flow Study of Chesley Brook*: Propose a site-specific instream flow study of Chesley Brook, focusing on the stream reach extending from Packers Falls Road upstream to the confluence with the unnamed tributary stemming from the southeast. Any study proposed shall be prepared by a qualified

professional and address such items as the following (to the extent they are suitable for the site) and any other technically appropriate issues determined to be relevant:

- A literature review to compile information on the ABL, and the species' environmental requirements (e.g., physical habitat, water quality preferences, etc.) during its various life stages;
- A plan to conduct the following over a minimum baseline (pre-withdrawal) period of three consecutive years:
 - Instream habitat surveys of the study reach, including field mapping of physical habitats, channel morphology, instream cover, substrate composition and distribution, and stream profile transects, etc.;
 - Fish surveys, in consideration of input from NHFGD;
 - Stream flow and stream stage monitoring to characterize the baseline (pre-withdrawal) flow regime of the study reach, including quantifying contributions to the study reach from the main stem of Chesley Brook, the unnamed tributary, and the springs;
 - Instream water quality monitoring within the study reach to characterize baseline (pre-withdrawal) ranges of parameters such as temperature, pH, dissolved oxygen, etc. at locations both upstream, at, and downstream of the springs;
 - Riparian wetland surveys at and downstream of the springs during the growing season, including field mapping of wetland boundaries, plant community inventorying, hydrologic monitoring (e.g., assessing connectivity with Chesley Brook and the springs, surface water and groundwater level monitoring, quantifying the degree and timing of inundation/saturation), functions and values assessments, etc.; and
- Identification of a reference site or sites that can serve as "controls" within the context of a long-term impact monitoring and reporting program to document natural trends and variations in conditions not influenced by the proposed groundwater withdrawal.

DES anticipates that the goals of any study proposed will be to: 1) determine the flow conditions that must be maintained in Chesley Brook to provide suitable habitat conditions for the ABL during its various life stages; and 2) define the components of a long-term impact monitoring and reporting program, and potentially a mitigation plan, to ensure that adverse impacts do not occur to Chesley Brook, its riparian wetlands, and their users, specifically the ABL. Implementation of the instream flow study and impact monitoring and reporting program shall be a condition of any large groundwater withdrawal permit issued.

- ii. *Groundwater level monitoring:* DES anticipates that the groundwater level monitoring plan included as a condition of any large groundwater withdrawal permit issued shall adopt the monitoring plan that is already approved as part of Durham/UNH's artificial recharge project, with the addition of monitoring well MW-104 as a background well.

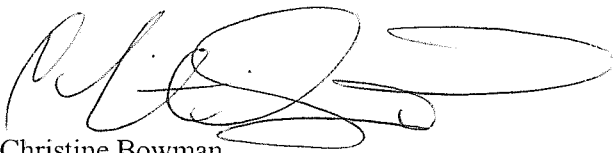
Note that although not proposed in the Final Report, as a condition of any large groundwater withdrawal permit issued, Durham/UNH shall monitor water levels in DGD-PW2. These measurements will serve as a comparative benchmark for water level fluctuations at other monitoring

locations, and, in the context of sustainable use, enable Durham/UNH to track water levels in their production well over time.

The above-requested information and materials shall be submitted to DES within 180 days of the date of this letter. In accordance with Env-Wq 403.19(c)(2), if the specified information and materials are not provided to DES by January 30, 2013, the application will be deemed to have been withdrawn, unless an extension is requested and granted pursuant to Env-Wq 403.36.

If you have any questions about this letter or any other groundwater permitting issues, please contact me at (603) 271-8866 or christine.bowman@des.nh.gov.

Sincerely,



Christine Bowman
Hydrogeologist
Drinking Water and Groundwater Bureau

cc: David Cedarholm, Durham/UNH Water System
Brandon Kernen, Stephen Roy, Richard Skarinka, Cynthia Klevens, Derek Bennett, Stacey Herbold, Ted Diers, Philip Trowbridge, Owen David, Wayne Ives; DES (email)
Matthew Carpenter, Benjamin Nugent, Carol Henderson; NHFGD (email)
Town Council, Town of Durham
Board of Selectmen, Town of Lee
Emeritus at Spruce Wood
Oyster River Condominium Association
Packers Falls Village