



The

NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES

hereby issues

LARGE GROUNDWATER WITHDRAWAL PERMIT

NO. LGWP-2020-0003

to the permittee

HAMPSTEAD AREA WATER COMPANY
54 SAWYER AVENUE
ATKINSON, NH 03811
(603-362-4299)

for the withdrawal of the following volume of groundwater from the following wells for the purpose of community water supply:

Angle Pond Well 1 (APW1):	10,700 gallons over any 24-hour period
Angle Pond Well 2 (APW2):	20,160 gallons over any 24-hour period
Angle Pond Well 3 (APW3):	164,160 gallons over any 24-hour period

Date of Issuance: February 13, 2020

Date of Expiration: February 13, 2030

Pursuant to authority in N.H. RSA 485-C:21, the New Hampshire Department of Environmental Services (NHDES), hereby grants this permit to withdraw groundwater from the Angle Pond Wells subject to the following conditions:

1. The permittee shall comply with the requirements of this permit, Env-Wq 403 and RSA 485-C at all times.
2. Water Conservation: The permittee shall implement the approved Water Conservation Plan, dated May 8, 2008, in accordance with Env-Wq 2101 and NHDES' approval dated June 5, 2008.
3. Metering Requirements: Withdrawals from the sources must be metered at all times. All meters must be selected, installed, tested, and maintained in accordance with Env-Wq 2101. The permittee shall read the source water meter to adequately report the following volumes to the reporting program referenced in condition No. 6 of this permit:
 - a) The 24-hour peak day volume withdrawn from each well during each month and the date the water use occurred; and
 - b) The cumulative volume withdrawn from each well during each month.
4. Monitoring and Reporting Requirements: The permittee shall establish and maintain the monitoring and reporting program as described below:
 - a) Groundwater Monitoring
 - i. Off-site Private Bedrock Wells:
 - 1) The permittee shall install a pressure transducer and data logger and measure water levels at a frequency of at least once every four hours in the private bedrock wells serving the properties below, starting at least 30 days before initiating the withdrawal from APW3.

Property Identification Number	Station ID:
[REDACTED]	20200003DW01
[REDACTED]	20200003DW02
[REDACTED]	20200003DW03

*or another nearby private well if this location is not available

- 2) Water level monitoring shall commence at least one month prior to initiating a withdrawal from APW3 and shall continue indefinitely as a condition of this permit.
- 3) The private wells above shall be sampled for bacteria in accordance with Env-Wq 403.16(e)(5) and Env-Wq 403.16(g) prior to and after the installation of any monitoring equipment
- 4) Before installing the monitoring equipment, the private wells above shall be sampled for the following water quality parameters: arsenic, chloride, hardness, iron, manganese, nitrate, pH, and sodium. Copies of the water quality reports shall be provided in the first annual report.
- 5) If a well owner denies permission to monitor water levels, then the permittee shall propose an alternative monitoring location to NHDES for approval.
- 6) Monitoring locations and frequencies may be added or changed if the data obtained contradict the information provided in the permittee's application, or if additional data points are required to assess the potential for adverse impacts to occur.

- ii. On-site Production Wells: The permittee shall install pressure transducers and data loggers and measure water levels at a frequency of at least once every four hours in all three Angle Pond production wells. Water level monitoring shall commence upon initiating a withdrawal from APW3 and shall continue indefinitely as a condition of this permit.

Station IDs: 20200003PWAPW1, 20200003PWAPW2, 20200003PWAPW3

- b) All groundwater monitoring data shall be submitted to NHDES on a quarterly basis, by January 31, April 30, July 31, and October 31 of each year. All groundwater monitoring data collected under condition No. 4a shall be submitted in an electronic format established by NHDES.
- c) An annual monitoring report shall be submitted to NHDES annually by January 31 of each year in an electronic format. The annual monitoring report shall summarize the groundwater monitoring data, note any relevant observations that may affect the measurements and include all field notes documenting the monitoring activities for the preceding year.
- d) All monitoring shall be completed by a person who can demonstrate, by education or experience, competency in collecting and reporting hydrogeologic measurements.

5. Mitigation Requirements

- a) Prior to initiating the large groundwater withdrawal, the permittee shall notify in writing via certified mail the owners of all properties served by private wells or public wells not owned by the permittee within the 180-day potential zone of influence of the Angle Pond Wells, as illustrated on Figure 18A, titled "Angle Pond Well Field and Parcels within Revised Wellhead Protection Area" in the Supplemental Information Final Well Siting Report prepared by Emery & Garrett Groundwater Investigations, a Division of GZA, dated November 13, 2019. The permittee shall provide a copy of the notification letter and copies of the return receipts to NHDES. The permittee shall explain to property owners with wells in the identified areas that their well may be influenced by the withdrawal at the Angle Pond Wellfield and provide the property owners with clear instructions and contact information for both the permittee and NHDES in the event they believe they may be adversely impacted by the withdrawal.
- b) The permittee shall maintain an emergency well service agreement with a company capable of providing pump- and well-related services, including the drilling of new wells, so that in the event of an adverse impact to a public or private well, mitigation steps can be undertaken expeditiously.
- c) Where the status of an unanticipated impact is not clear, the permittee shall gather information needed to quantify the impact and determine its status relative to the adverse impact criteria defined under RSA 485-C:21, V-c and provide this information to NHDES within 48 hours of being notified by NHDES. A verified adverse impact shall be mitigated in accordance with Env-Wq 403.
- d) In the event that an adverse impact occurs, the permittee shall comply with the impact mitigation and source replacement requirements of Env-Wq 403 and implement the stage 2 management procedures below.

- e) NHDES will routinely review the results of all monitoring data, and if water level monitoring data indicate that groundwater is being extracted at a rate that exceeds natural recharge on average, then NHDES will modify the permit in accordance with Env-Wq 403 in order to prevent adverse impacts from occurring.
- f) In addition, the permittee shall operate the Angle Pond Wells 3 in accordance with the management procedures described below.

STAGE 1 MANAGEMENT PROCEDURES:

In the event that the following trigger occurs, output from APW3 production well shall be reduced to 75% of the permitted withdrawal volume such that output from the well does not exceed 123,120 gpd:

Trigger: A 15-foot drawdown below the 180-day no-recharge projections (at locations and associated values listed in Table 1), unless it is determined by NHDES that the drop in water levels in a specific monitoring point is erroneous.

As part of Stage 1 Management Procedures, the permittee shall increase the frequency of reporting of all on-site and off-site water level measurements to NHDES, and submit all measurements electronically to NHDES by the last day of each calendar month.

STAGE 2 MANAGEMENT PROCEDURES

In the event that the following trigger occurs, the combined production from APW3 shall be reduced to less than 57,600 gallons over any 24-hour period:

Trigger: A thirty-foot drawdown below the 180-day no-recharge projections (at locations and associated values listed in Table 1), unless it is determined by NHDES that the drop in water levels in a specific monitoring point is erroneous.

As part of Stage 2 Management Procedures, the permittee shall continue reporting all on-site and off-site water level measurements to NHDES electronically by the 15th and last day of each calendar month.

- 6. The permittee shall register APW3 with the NHDES Water Use Registration and Reporting Program and maintain the water use reporting requirements of the Angle Pond Wellfield established by RSA 488, Env-Wq 2102 and this permit.
- 7. The permittee shall apply for renewal of this permit no more than 6 months prior to its expiration date in accordance with Env-Wq 403. The permittee shall continue to comply with all conditions in this permit until the permit is renewed or the facility is closed in accordance with all applicable requirements, regardless of whether a renewal application is filed.

Any person aggrieved by any terms or conditions of this permit may appeal in accordance with RSA 21-O:7, IV within 30 days.



11 Feb '20

Thomas O'Donovan, P.E.,
Director Water Division

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Table 1. Trigger Water Level Elevations for Angle Pond well field Large Groundwater Withdrawal Permit 2020-0003

Town Map / Lot Number	Address	Top of Casing Elevation (feet MSL)	Static Water level (feet below top of casing)	180-day Projected Water Level (feet below top of casing)	Stage 1 Trigger Level (75% of PPV) (feet below top of casing)	Stage 2 Trigger Level (<57,600 gpd) (feet below top of casing)
Station ID: 20200003DW01	██████████	238.2	14.98	22.3	37.3	52.3
20200003DW02	██████████	235.1	5.07	25.4	40.4	55.4
20200003DW03	██████████	TBD	TBD	Note 1	Note 1	Note 1

NOTES:

1. Static water level for this well shall be determined at the time monitoring begins. Stage 1 and 2 trigger levels shall be established based on static water levels and observations following start of monitoring.
2. If an alternative monitoring location is used, the trigger levels shall be established as specified in Note 1 above.
3. The stage 1 and 2 water level triggers are for a resting or non-pumping water level measurement that does not include the additional effects of domestic water use.

NHDES PROJECT NARRATIVE AND DECISION STATEMENT

**Large Community Well Siting Approval/Large Groundwater Withdrawal Permit LGWP-2020-0003
Hampstead Area Water Company, PWS ID 1031010
Angle Pond Well Field
Hampstead, New Hampshire**

February 13, 2020

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1 INTRODUCTION

Below is the Project Narrative and Decision Statement prepared by the New Hampshire Department of Environmental Services (NHDES) for the approval of Large Groundwater Withdrawal Permit No. LGWP-2020-0003 issued to the Hampstead Area Water Company (HAWC) for the Angle Pond well field in Hampstead for the following groundwater withdrawals:

Angle Pond Well 1: 10,700 gallons per day (gpd)

Angle Pond Well 2: 20,160 gpd

Angle Pond Well 3: 164,160 gpd

The approval of this large groundwater withdrawal permit is based on the following:

- Preliminary application report titled “Preliminary Hydrogeologic Investigation, Groundwater Development, Angle Pond Production Well 3” (Preliminary Application) prepared for HAWC by EGGI, dated August 13, 2018;
- A supplemental submittal titled “Response to New Hampshire Department of Environmental Services Comments on the Preliminary Large Well/Large Groundwater Withdrawal Permitting Application” prepared for HAWC by EGGI, dated January 22, 2019;
- Final report titled “Final Hydrogeologic Investigation, Groundwater Development, Angle Pond Production Well 3” (Final Report) prepared for HAWC by EGGI, dated May 15, 2019;

- A supplemental submittal titled “Response to New Hampshire Department of Environmental Services Comments Regarding the Final Report for Large Well Siting/Large Groundwater Withdrawal Permitting Application” prepared for HAWC by EGGI, dated November 13, 2019;
- Public comments on the final report submitted by the Towns of Sandown and Hampstead, and from members of the public.

This decision provides specific findings made by NHDES on issues relevant to the legal and technical requirements of a large groundwater withdrawal permit that were contrary to comments or recommendations made by municipalities, HAWC, and the general public. Overall, NHDES finds through review and analysis of the data and observations collected as part of the application process required under Env-Wq 403, and issuance of this permit, that the use of the large groundwater withdrawal will not infringe on the public’s use of groundwater in accordance with RSA 485-C:21,VIII. Accordingly, this decision statement addresses relevant technical comments provided by the public as required by RSA 485-C:21, V.

Angle Pond Well 3 (APW3) is proposed as a new large community water supply well to be used at a production rate above the threshold for a large groundwater withdrawal well, therefore the administrative rules Env-Dw 302 and Env-Wq 403 jointly apply to the application. Some of the community well siting rules are not applicable to the large groundwater withdrawal regulations, like the wellhead protection program and sanitary protective area and are not addressed in this large groundwater withdrawal permit decision statement, but are addressed through the large community well siting approval.

2 BACKGROUND

Emery & Garrett Groundwater Investigations, a Division of GZA (EGGI) on behalf of HAWC performed the required monitoring and reporting activities for the large groundwater withdrawal permitting. EGGI submitted the application to NHDES requesting approval for a large community production well and issuance of a large groundwater withdrawal permit for the Angle Pond Wells in Hampstead.

HAWC currently operates two wells, designated Angle Pond Well 1 (APW1) and Angle Pond Well 2 (APW2), and is requesting to permit an additional well, Angle Pond Well 3 (APW3) that is located approximately 500 feet east of APW2 on the property of the Angle Pond Woods Condominium Association in Hampstead. The wellfield is located approximately 2,000 ft southeast of Angle Pond and water produced from the wellfield is sent through its water treatment building before entering HAWC’s core water system in Hampstead and Atkinson (PWS ID 1031010).

The Angle Pond wells are located near a small shallow pond in the northeastern part of Hampstead, near the border with Danville and Sandown. The pond was created as a result of the mining of sand and gravel for construction purposes during the construction of the surrounding community. The outlet of the pond drains to the east, connecting with Bartlett Brook downstream and to the east of Angle Pond.

In 2003, APW1 and APW2 were drilled to depths of 1,000 feet and 340 feet and pump tested at 30 and 40 gallons per minute, respectively. These withdrawal rates were approved by NHDES, although the combined withdrawal from both wells was limited to 57,600 gallons per day under the small community well siting rules, and below the large groundwater withdrawal permit threshold. The overall capacity of

two wells in the last ten years has diminished significantly, necessitating additional source development for the system.

APW3 was installed in December 2017 in accordance with New Hampshire Water Well Board construction standards. The well has 40 feet of 8-inch casing and a total depth of 600 feet. The driller reported an air lift yield of 275 gallons per minute with water bearing fracture zones at depths of 75 feet (20 gpm), 320 feet (70 gpm), 460 feet (50 gpm), and 580 feet (100 gpm). Bedrock was encountered at approximately 18 feet below ground surface. The overburden in the area likely consists of glacial till that's common throughout the region although there are some deposits of sand and gravel located nearby. The bedrock unit mapped at the well site is the Berwick Formation, a moderately fractured/foliated iron rich granofels to calcareous schist common in southeastern New Hampshire.

3 WITHDRAWAL TESTING PROGRAM OVERVIEW

The Angle Pond well withdrawal testing program was conducted by EGGI from February 20 to March 13, 2019. The purpose of withdrawal testing was to:

- Provide data to estimate the long-term sustainable water quantity and quality of Angle Pond well field;
- Observe the response of the surrounding water users and water resources to pumping;
- Evaluate the degree of hydraulic connection between Angle Pond wells, the overlying deposits, and surrounding private wells; and
- Assess the potential for adverse impacts to water resources and users that may result from the proposed withdrawal.

The withdrawal testing program began on February 20 with an antecedent monitoring period (non-pumping) where groundwater levels were measured in Angle Pond wells and the surrounding monitoring network for approximately five days. Next, the startup of each well was staggered to allow for the monitoring of potential influence between the wells. APW1 began pumping on February 25 at approximately 7.4 gpm and the following day APW2 began pumping at approximately 19 gpm. On February 27, APW3 began pumping with a flow rate of 160 gpm, which was maintained for the duration of the test. Pumping of APW3 in combination with APW1 and APW2 lasted seven days and ended on March 6, 2019. This was followed by a seven-day period of monitoring the groundwater level recovery at all monitoring locations. The groundwater produced from APW3 was discharged over 600 feet away from the production well to an area draining away from the site. Because APW1 and APW2 were already active community water supply wells, the groundwater pumped during the test was sent to HAWC's core water system.

During the testing program, groundwater levels were recorded in:

- the Angle Pond production wells APW1, APW2 and APW3;
- A production well at the Cotton Farm MHP located northeast of APW3;
- fifteen domestic private water supply wells, including thirteen bedrock wells and two dug wells;
- three shallow piezometers;
- three surface water stations; and,
- one background bedrock monitoring well.

Groundwater levels at these locations were measured continuously for approximately 21 days total, including all three phases of the withdrawal test (antecedent, pumping, and recovery periods) in order to observe the hydraulic effects of pumping on the surrounding groundwater and surface water resources. For APW3, the groundwater level dropped to 86(+) feet below the top of casing during the test, with the majority of the drawdown occurring over the first two days, after which the groundwater levels nearly stabilized over the duration of the test. The groundwater level recovery in APW3 was quick, with groundwater levels returning to near static conditions within two days. Groundwater levels in APW1 and APW2 stabilized at depths of approximately 250 ft and 220 ft below the top of casing, respectively. Groundwater levels in these wells did not fully recover as pumping from them continued during the APW3 recovery period in order to supply the system with water.

Five of the fifteen private water supply wells that were monitored had a measurable amount of hydraulic response to APW3. The greatest amount of response was observed in two private bedrock wells, the Moore and Doherty wells, located to the northeast of APW3. Groundwater levels in the Moore well, which is 980 feet from APW3, were lowered by approximately 19 ft in response to the pumping of APW3. Groundwater Levels in the Doherty well, which is slightly further away and to the north of the Moore well were lowered by approximately 4.4 ft in response to pumping of APW3. Additional drawdown of groundwater levels in three other private wells around 1,100 feet from APW3 also had around 1 foot of drawdown in response to pumping APW3. Based on an analysis of graphical projections of drawdown assuming 180 days of continuous pumping of APW3, drawdown may extend predominantly to the northeast of the wellfield on the order of 5,300 feet from APW3, and up to 2,300 feet from the well in areas that did not respond as much to pumping.

During the pumping test, groundwater quality samples were collected on the first day, the third day and at the end of pumping period (day 7) to characterize the quality of the groundwater derived from the well. Results of the groundwater quality sampling conducted during the withdrawal testing program indicate that each parameter was below the applicable Maximum Contaminant Level (MCL) or Secondary Maximum Contaminant Level (SMCL) in water derived from APW3 except for iron, manganese and arsenic. These compounds are naturally occurring in the bedrock and will be addressed through treatment. Per- and polyfluoroalkyl substances (PFAS) were not detected above the laboratory reporting limits. The microscopic particulate analysis performed on the well water due to the it's proximity to surface water indicates the well is at low risk of being influenced by surface water.

4 PUBLIC NOTIFICATION AND INVOLVEMENT

Pursuant to RSA 485-C:21, II through V-a, materials submitted in support of the large groundwater withdrawal permit (the preliminary application, final report, and supplemental materials) are required to be sent via certified mail to municipalities and public water suppliers in the potential impact area of the withdrawal. In this case, applications were sent to the towns of Hampstead, Danville and Sandown and the Cotton Farm MHP community water system. No public hearing was requested after the submittal of the preliminary application in September 2018 and NHDES did not receive any written comments during the 45-day comment period following submission of the preliminary report that ended on October 19, 2018.

After the submittal of the Final Report in May 2019, the town of Hampstead requested a public hearing to review and comment on the report. NHDES scheduled the public hearing on the Final Report at the Hampstead Middle School for June 26, 2019. Due to a last minute staffing issue with HAWC's consultant,

the hearing was postponed until July 25, 2019. At the hearing, a summary of the regulations governing large groundwater withdrawals was presented by NHDES, a withdrawal testing program summary was presented by EGGI, a question and answer session was held, and oral testimony was recorded. After the public hearing, the 45-day written comment period on the application commenced, and subsequently closed on September 8, 2019. Thirty-eight written public comments were received by NHDES during this period and responses to those comments relevant to the withdrawal testing program, large groundwater withdrawal permit process, ongoing monitoring program, and/or administrative rules are discussed in section 6 below.

5 LARGE GROUNDWATER WITHDRAWAL PERMIT MONITORING, REPORTING AND WITHDRAWAL REQUIREMENTS

In accordance with Env-Wq 403.21, NHDES finds sufficient information is available to issue HAWC a large groundwater withdrawal permit with individual permitted production volumes (PPV) for each of the Angle Pond wells:

- Angle Pond Well 1: 10,700 gpd
- Angle Pond Well 2: 20,160 gpd
- Angle Pond Well 3: 164,160 gpd

NHDES reduced the PPV for APW1 and APW2 from the combined maximum of 57,600 gallons per day from the original well siting approval in 2003, by roughly 46%, to the rates established during the withdrawal testing program for this application.

APW3 was tested at a production rate of 160 gallons per minute and therefore HAWC requested a PPV of 230,400 gallons per day. NHDES did not approve this volume, but has approved a reduced PPV of 164,160 gpd or 114 gpm based on the requirements of administrative rule Env-Dw 302.30(d)(4). Specifically, Env-Dw 302.30(d)(4) establishes that water level drawdown in a proposed new large community water supply well shall not exceed 90% of available drawdown in the well, assuming a condition of 180-days of continuous pumping at the maximum rate with no recharge. Env-Dw 301.04 defines available drawdown as the distance between the static water level and the uppermost productive water bearing zone.

The basis of the reduction in the PPV is that EGGI, HAWC's consultant, concluded that the uppermost water bearing fracture observed in APW3 at a depth of 75 feet was not productive enough to warrant adjustment of the tested production rate. NHDES did not concur with that conclusion and used the drawdown observed in the production well at 160 gpm to proportionally reduce the PPV for APW3 to 114 gpm, a rate estimated to maintain drawdown above the fracture at 75 feet and comply with Env-Dw 302.30(d)(4). If NHDES determines that the withdrawal exceeds the rate of natural recharge based on a review of the monitoring data (described below), Condition 5e of the large groundwater withdrawal permit allows NHDES to require HAWC to further reduce the withdrawal from APW3.

Impact Monitoring and Reporting Program

The large groundwater withdrawal permit requires HAWC to conduct an impact monitoring and reporting program in accordance with Env-Wq 403.26, Env-Wq 403.28 and Env-Wq 403.30 that includes monitoring of all three Angle Pond production wells and three off-site private bedrock water supply wells. A complete description of monitoring and reporting requirements is established under condition No. 4 in the large groundwater withdrawal permit and is summarized as follows:

- On-site wells – The permit requires that groundwater levels in APW1, APW2, and APW3 be monitored so that groundwater level fluctuations in off-site monitored wells can be compared to the operation of the production well. The groundwater levels in the production wells will be compared to the levels recorded during the withdrawal test, the available drawdown, and the projected 180-day drawdown level estimated by HAWC.
- Off-site wells – The permit requires that groundwater level monitoring in three private bedrock water supply wells, two of which responded to pumping APW3 and one new well that has potential to be impacted by the withdrawal. For each private well, a groundwater quality sample will be collected and tested for the standard analysis before the withdrawal begins. This sampling will provide baseline groundwater quality results should there be changes in the groundwater quality associated with the withdrawal such that follow up sampling is necessary in accordance with Env-Wq 403.28(e).

As stipulated in condition 4b of the permit, HAWC is required to submit all groundwater monitoring information to NHDES on a quarterly basis by the end of January, April, July, and October of each year, with an annual report summarizing the monitoring due by January 31. All water levels associated with this monitoring will be available to the public for review.

Additionally, HAWC will continue to maintain compliance with their approved water conservation plan in accordance with Env-Wq 2101 as a condition of this permit. HAWC is required to meter all withdrawals and record monthly and 24-hour max production volumes from all three Angle Pond and report the values to NHDES' Water Use, Registration and Reporting Program.

Mitigation Requirements

Condition 5 of the large groundwater withdrawal permit establishes the notification, adverse impact investigation/response process, and mitigation criteria established for the wellfield in accordance with Env-Wq 403.31. In the event of an unanticipated adverse impact, steps outlined under this condition shall be followed by HAWC to mitigate the impact.

To provide a means for notification in the event of an unforeseen impact, the large groundwater withdrawal permit condition 5a. requires HAWC to notify any property owner with a private or public well within the estimated zone of influence (ZOI) of the Angle Pond wellfield prior to initiating a large groundwater withdrawal from the well. As part of the notification, HAWC must explain to each property owner that their well may be influenced by the withdrawal at the production wells and provide them with instructions and contact information for HAWC and NHDES in the event they believe their well may be impacted by the withdrawal.

Condition 5b. requires HAWC to have emergency well services contractors available that can provide both pump- and well-related services in the event they are needed to evaluate a potential adverse impact or mitigate a known adverse impact as defined in the large groundwater withdrawal statute RSA-485- C:21, V-c.

Condition 5c. requires HAWC to investigate the status of an unanticipated adverse impact. In the event that an adverse impact is reported and verified, an impact mitigation program would be implemented in

accordance with conditions of the large groundwater withdrawal permit and Env-Wq 403.31. The program would implement actions necessary to mitigate the impact including reducing the withdrawal volume or ceasing the withdrawal from the production well(s), establishing water use restrictions for customers of the water system, modifying or replacing an impacted source at no initial capital cost to the user, and expanding (or establishing) a monitoring network to assess the effectiveness of the mitigation program.

In addition, under condition 5f, NHDES has established a set of groundwater level ‘triggers’ that, if encountered, require HAWC to implement management procedures to incrementally reduce withdrawal volumes from the wellfield to rates that minimize the potential for any adverse impacts to occur. These management procedures can be modified by NHDES if needed to ensure that adverse impacts do not occur.

6 NHDES RESPONSE TO PUBLIC INPUT

NHDES received only one verbal comment during the oral testimony phase of the public hearing held in July 2019, whereas during the 45-day written comment period that followed the public hearing, NHDES received thirty-eight letters; one from the Town of Hampstead’s Water Resources Committee, one from the Sandown Board of Selectmen, and thirty-six from residents of Hampstead, Sandown and Danville. NHDES has reviewed all of the comments received and has addressed them through this permit decision or its response letter to the applicant dated October 7, 2019.

In accordance with RSA 485-C:21, V, this decision statement addresses relevant legal and technical comments about the Angle Pond well field large groundwater withdrawal permit application as submitted by the public that are either contrary to the NHDES’ findings or not previously addressed. In its responses below, NHDES has addressed comments that pertain to the process, observations or data collected during the large groundwater withdrawal permit application and testing program that was conducted by the applicant to meet the pertinent rule and statute requirement in order to obtain a permit. Comments that relate to other matters, such as water system operations, current/future water service areas, NHPUC requirements, propriety of water uses, etc., are not addressed in this permit decision.

Due to the fact that many of the comments received contained similar content, responses are generally grouped into the following common topics and include excerpts from specific comments for clarity:

- Private well owner mailing performed before the withdrawal test
- Private wells selected for monitoring during the withdrawal test
- Timing of the withdrawal test and seasonal water use
- Potential impact to water levels in nearby private wells
- Potential impacts to Angle Pond
- Mitigation Plan Development
- Water Conservation Management Plan
- Water Quality Monitoring

Private well owner mailing performed before the withdrawal test

Comments submitted to NHDES raised concerns about the mailing that was performed as part of the application process that requires an applicant to contact private well owners within 1,000 feet of the potential influence area of the wellfield for information about their well and, for a subset of locations, to ask permission to monitor their well during the pumping test program. Specifically, the concern expressed largely focused on how the private lot owners were sent the mailing through first class mail and not certified mail, and asserts that HAWC was non-compliant with the large community well siting administrative rule Env-Dw 302.14 (h)(1)b. related to the mailing method, which reads:

Env-Dw 302.14 (h):

(1) At least 14 days prior to the start of the pumping test program, the applicant shall send a written request for permission to monitor a well via certified mail, return receipt requested, or by another method that provides documentation that the notice has been delivered, to:

a. The owner of each private well and each public well located within 1,000 feet of the proposed new source; and

b. The owners of representative wells within 1,000 feet of the estimated cone of depression, determined based on the conceptual hydrogeologic model developed as required by Env-Dw 302.08(e);

The Hampstead Water Resources Committee (HWRC) provided a comment about the mailing method and related issues, as follows:

In correspondence to NH DES dated January 22, 2019, EGGI stated:

"Monitoring request letters were mailed to a total of 411 potential domestic well owners within 1,000 feet of estimated Preliminary Zone of Influence on January 2, 2019 (Figure 1 and Appendix C). Nine of those letters were sent via Certified Mail to those properties within 1,000 feet of Production Well #3. The remaining 402 letters were sent via US Postal Service, First Class Mail."

Based upon this correspondence, 98% of the potential candidates for monitoring were not notified by a method that provided documentation that the notice was delivered, as required by Env-Dw 302.14 (h)(1). The Final Report does not provide an explanation or technical justification for why most of the potential monitoring candidates were not notified in accordance with the regulations. According to EGGI's January letter to NH DES, only nine property owners were notified in accordance with Env-Dw 302.14 (h)(1).

Regardless of the basis for not adhering to this regulation, the impacts of that decision include:

- 1. A number of land owners were not notified of the test in accordance with the rules,*
- 2. The quality of pumping test monitoring was significantly impacted because key potential monitoring locations were not included in final monitoring network. One such example is the 19 White's Lane monitoring location (MacDonald). This well, which is located in a particularly important geographic location (along the general trend of drawdown to the southwest of AP BRW #3), is reported to be only 120' deep, 18' higher than AP BRW #3, and is relatively low-yielding (5 gpm). The well on the abutting property (17 White's Lane) would have been a superior monitoring location in that it is much deeper (420 feet) and higher yielding (25 gpm), as these characteristics are more consistent with those of BRW #3. However, since no response was received from the owner of 17 White's Lane, it is unknown if the query was received and considered by the well owner.*

3. In correspondence to NH DES dated January 22, 2019, EGGI stated: "A search was performed for properties that lie within 1,000 feet of Angle Pond Wells #1 and #2, but the search did not uncover any additional lots where monitoring would be mandatory (all pertinent lots were on public water or vacant). Therefore, the list provided in the Preliminary Report was complete." This statement does not appear to be correct; the 1,000 foot radius around Angle Pond Well #1 intersects several properties on Shannon Road, including the home at #20 Shannon Road, which according to the NH DES well inventory database has a 300' bedrock well and the home at #16 Shannon Road (unknown depth). The NH DES database has well completion reports for 4 other properties on Shannon Road, however the street numbers were not recorded.

Does NH DES believe that well owners were properly notified for possible inclusion in the pump test monitoring network?

The large groundwater withdrawal permitting process requires an applicant to assess for impacts the withdrawal may cause on other water users by evaluating the effects of pumping the proposed new well on private wells that are monitored before/during/after a pumping test (Env-Wq 403.19). The applicant develops a monitoring network for the pumping test in a two-step process, whereby the first step is completing an inventory of available private wells and associated well construction information within the potential zone of influence of the proposed new well (Env-Wq 403.11). The applicant compiles this inventory by both conducting a review of publically available records pertaining to private well construction data, and directly contacting each private lot owner within the potential zone of influence of the proposed production well by mailing them a water well questionnaire. In the second step, the applicant uses the information collected from the water well inventory to develop a targeted monitoring well network of 'representative' private wells that will receive an offer to monitor groundwater levels in their wells; these locations are selected to both represent the range of typical well construction observed in the area, and spatially represent the distribution of private wells around the proposed new withdrawal well (Env-Dw 302.14).

In reference to the information above, the mailing done for the water well questionnaire used to compile the water well inventory under Env-Wq 403.11, notifies private well owners about the upcoming pumping test and asks for any construction information that lot owners may have about their wells. The mailing method for the inventory questionnaire is not specified in rule. For the lots with wells that are offered to be monitored during the test, Env-Dw 302.14 and Env-Wq 403.13 establish that all well owners that have wells within 1,000 feet of the production well, and representative wells located within 1,000 of it's estimated cone of depression, be sent an offer-to-monitor letter via certified mail. The basis for sending offer-to-monitor letters via certified mail is to confirm, via the returned mail receipts, that a recipient has, or has not, received the letter.

It is significant to note that certified mail requires the postal service to obtain a signature at the delivery address and then return the signed receipt to the sender. If a homeowner is not present at the time of delivery, the postal service attempts to deliver the letter two additional times, after which a homeowner is notified that a letter is available for pick up at the post office. If the letter is not claimed, it is returned to the sender. In the department's experience, there is sometimes marginal success with certified mailings to private homes during typical weekday working hours due to the fact that many homeowners are not commonly at their residence during the day.

Mailings to Properties within 1,000 feet of the Angle Pond Wells

For nine properties with private wells within 1,000 feet of APW3, HAWC performed the mailing of monitoring offer letters to the property owners with private wells in accordance with Env-Dw 302.14(h) by sending them a letter via certified mail in December 2018. The HRWC comment asserts that there are additional private wells within 1,000 feet of APW1, specifically at 16 and 20 Shannon Road, that should also have been sent offer letters. NHDES reviewed the location of these properties and found that while a small percentage of the undeveloped wooded portion of the properties are within the 1,000 ft radius of Angle Pond wellfield, the private wells serving the homes are beyond 1,000 feet. In reference to Env-Dw 302.14 (h) and Env-Wq 403.13(i), NHDES finds that the rule requirement is based on the distance to the well and not the property boundary, therefore the applicant met the rule requirement.

The initial response from the homeowners within 1,000 ft of the wellfield who were sent certified mail was low; in fact, no responses were received from the nine properties that were sent an offer to monitor groundwater levels in their wells, and only four of the nine letters that were sent the mailing were signed for. Because of this, HAWC followed up with a second mailing to those properties via priority mail, but again did not receive responses from any of the well owners by the time targeted for selecting private well monitoring locations (end of January). Due to the importance of monitoring wells that are close to the withdrawal, NHDES performed an additional mailing and outreach to the homeowners in early February that requested that the owners consider participating in the monitoring program; as a result of that effort, two additional wells, the Moore and Barosky wells, were added to the private well monitoring network. NHDES finds that HAWC's mailing and follow up to owners of wells within 1,000 feet of APW3 met the requirements of Env-Dw 302.14 and Env-Wq 403.16.

Mailings to Properties beyond 1,000 feet from the Angle Pond Wells

For private lots within 1,000 feet from the potential cone of depression of the Angle Pond well field, HAWC included in the water well questionnaire a 'consent to monitor' question that would identify lot owners who were willing to allow their private well to be monitored during the test if requested (section V.C – September 2018 preliminary application). Additionally, HAWC requested to waive the requirement for certified mail due to the fact that the questionnaire would be sent to all lots within the potential zone of influence for the well and provide for direct follow up to a potentially longer list of respondents who were 'pre-identified' as willing to be monitored. NHDES approved the questionnaire/request letter and the waiver request and required submission of a list of respondents and the proposed monitoring locations at least 30-days prior to the start of the pumping test (October and December 2018 NHDES responses to preliminary application).

In December 2018 and January 2019, HAWC mailed the questionnaire/request form to 402 private lot owners identified within a 1,000 foot buffer of the potential zone of influence of APW3 (figure 9, appendix F – September 2018 preliminary application). The results of the mailing were as follows:

- 57 lot owners returned responses to the questionnaire that include well construction information;
- 36 lot owners consented to be monitored if requested;
- 105 of the letters mailed were returned as non-deliverable; and,
- the remaining letters were not responded to (appendix C, part 2 - January 2019, EGGI preliminary application addendum; section V.A, figure 7, appendix C – May 2019, EGGI final report) .

The description of the mailing methods and record of responses noted above demonstrates that the effort to obtain water well information and gain approval from private well owners out to a buffer of 1,000 feet from the potential zone of influence of the wellfield was both sufficient and conservative relative to rule requirements, and NHDES finds that it met the requirements of Env-Dw 302.14 with NHDES' waiver. In contrast to the assertion made in the comment above that 98% of lot owners were not notified in a manner that provided documentation of mailing, both the number of owners who responded to receiving a letter (57 or ~14% of those mailed), and the number of letters that were not returned as non-deliverable (240 or ~60% of those mailed), directly implies that up to 297 letters (74%) were received by lot owners within the potential ZOI of the wellfield prior to the testing program.

With reference to the property at 342 Sandown Road, NHDES does acknowledge that the property was not notified of the withdrawal test and was not included in the mailing because HAWC incorrectly identified the property as being served water by HAWC when it is actually served by a private well. Observations from the pumping test, however, do not indicate that the groundwater level in the well on this property would have responded to pumping. Besides this one instance, NHDES does not have information that any other properties served by private wells within the potential zone of influence of the wellfield were not notified.

NHDES does not concur with HWRC's comment above regarding the interpretation of Env-Dw 302.14(h) or the assertion that monitoring the well at 17 White's Lane would have been superior to monitoring the Macdonald well. The idea that the extent of drawdown at any specific location is known with enough certainty before a pumping test to discriminate the relative degree of response between abutting/neighborly shallow or deep open hole bedrock wells is flawed. The observed range of well characteristics in the area does substantiate monitoring some shallow and/or lower yielding wells in addition to deeper wells for potential adverse impacts. Additional discussion of the private wells selected for inclusion in the pumping test is provided below.

Private well monitoring network selected for the withdrawal test

Many public comments were received related to the adequacy of the monitoring network of private wells that were selected for the pumping test. Comments generally included one or more of following statements:

- Not enough wells were included in the monitoring program;
- Many of the wells included in the monitoring program did not appear to respond to pumping of APW3;
- The monitoring network did not account for the complexities of the bedrock aquifer and the preferential directions of groundwater flow;
- The types and depths of private wells included were not appropriate or take into account the water bearing zones in APW3;
- A second pumping test with additional monitoring points should be performed; and
- Another party, as opposed to HAWC's consultant or HAWC should complete the withdrawal test to avoid potential conflicts of interest.

The following comments provided by HWRC are emblematic of many comments related to these issues:

EGGI used thirteen (13) bedrock domestic wells as the bedrock groundwater monitoring network. In addition, EGGI used a “sentinel well” strategy for the design of the monitoring network. A sentinel well strategy can be effective in overburden water supply aquifers, which are generally uniform in nature, consist of porous, permeable media, and lacking confining layers. Such aquifers are consistent and not complex, with hydraulic responses being communicated in relatively predictable ways. Conversely, bedrock groundwater aquifers tend to be complex and non-uniform. As was seen during the Angle Pond well field 2019 pumping test, conditions encountered in one bedrock well varied significantly from another well a short distance away, and wells within one fracture zone showed markedly different impacts than those in a different fracture zone. The complexity of the well field’s bedrock is three-dimensional in nature, due to the non-uniformity of lateral fractures, and the varying attributes of horizontal water bearing zones. In addition, significant vertical discontinuities typically exist, resulting in only specific zones being capable of providing meaningful sources of water. For Angle Pond BRW #3, four (4) such zones were identified; 75’, 320’ 460’, and 580’. A sound monitoring network design would include added consideration of these likely preferential groundwater pathways.

The proposed bedrock monitoring network did not account for the complexities of the Angle Pond area bedrock aquifer, and in particular, increased consideration of preferential groundwater pathways. As an example, no affected wells southwest of the Angle Pond well field were monitored.

How will NH DES address the limited pump test data describing well withdrawal impacts in their assessment of the nature and extent of effects associated with operation of the Angle Pond BRW #3?

The proposed monitoring network also did not appear to give consideration to assessment of the different vertical water bearing zones. For example, there was not a discussion of residential well depths in the EGGI report, and how wells screened in different vertical zones responded to the pump test. This is a significant aspect, noting the age of most of the homes in the potential zone of impact (ZOI), and typical (i.e., shallower) depths of wells for these homes. A more appropriate approach to monitoring would have been to include wells of varying depths which could then be assessed to determine the occurrence of well field adverse impacts.

In accordance with Env-403.13(i), an applicant for a large groundwater withdrawal permit shall establish a monitoring network of representative water users in the area of the withdrawal. The supposition that the private well monitoring network for the pumping test was not adequate is not correct nor reflective of the information collected and provided in the preliminary application and final report. Information related to the network includes the following:

- Fifteen private wells were included in the monitoring network, including 13 bedrock wells and two dug wells (table 1.- Final Report). Well depths were provided for seven of the bedrock wells and no construction information was available for the remaining six bedrock wells. For the seven bedrock wells with construction information, total depths range from 120 to 450 feet, which is consistent with the depth and production zone(s) observed in APW3 (appendix C, part 2 – Final Report).
- The depth range of the bedrock wells included in the monitoring network are also generally consistent with regional information available from nearby private well construction logs. Well

construction records available from the NH Water Well program database shows that within a 0.5 mile radius of the Angle Pond wellfield, the range of total well depths for 63 private wells is from 160 to 560 feet, with only a few exceptions.

- In reference to the spatial distribution of private wells monitored during the pumping test, the wells monitored circumscribe the wellfield inclusive of all of the areas around the field that are primarily served by private wells. The only areas where there was no monitoring include a small area to the northwest and immediate south of the wellfield, these areas were not included largely due to the fact that these areas are served water by the water system and not private wells (section V, figure 7 – Final Report).

Although not a well network issue, it is also significant to note that the monitoring network did resolve the ZOI of APW3 as an area of preferential drawdown oriented to the north-northeast of the wellfield, which is consistent with structural geologic features mapped in the region and the hydrogeologic conceptual model for the site (section VII.C. – Final Report). The statement presented above that implies that if no response to pumping is observed at a monitoring well (to the southwest of the wellfield) then it is not an adequate monitoring location is technically flawed. Env-Wq 403 does not require that only wells that respond to pumping are to be monitored during the pumping test, nor is it reasonable to assume that an applicant would know which wells respond to pumping before conducting a pumping test. A more reasonable conclusion to the lack of response in wells located to the southwest of the wellfield is that the ZOI may not extend into that area, therefore the lack of response aids in the ZOI refinement under Env-Wq 403.17. This information, in turn, is also useful in focusing the long term monitoring program developed in accordance with Env-Wq 403.26 to those areas that are effected by the wellfield.

NHDES finds that HAWC met the requirements to develop a monitoring well network using representative water user locations in accordance with Env-Wq 403.13, and the observations from the network were adequately used to refine the conceptual model for the site under Env-Wq 403.17 and complete the impact description of withdrawal effects under Env-Wq 403.19.

Another HWRC comment is as follows:

Noting that the drawdown observed in BRW #3 exceeded the first water-bearing fracture zone at 75 feet, how will NH DES assess potential long-term impacts to residential bedrock wells which may rely on this fracture zone?

NHDES does concur that consideration of the water bearing zone observed at 75 feet in depth in APW3 is pertinent to the long-term performance of the well and potential impacts, and has therefore reduced the approved withdrawal volume for the well in the permit to a rate that is projected to maintain groundwater levels above this fracture zone (see attached permit and community well approval).

Another HWRC comment is as follows:

During the July 25, 2019 hearing/meeting held at the Hampstead Public School, Mr. Tinkham commented that EGGI did not have depth or productivity information regarding the majority of the wells in the study area.

Without such data, how can an assessment of the significance of the upper water bearing horizontal fracture zone(s) be completed?

Depth/fracture specific information for private water supply wells are not required to be recorded during well construction and are rarely available (for purposes of monitoring well selection) as part of large groundwater withdrawal tests or any other tests. Assessment of the likely influence area(s) of a pumping well is thereby reliant on establishing a representative (lateral and vertical) monitoring network. See the response above for NHDES response to the issue of monitoring well network adequacy.

Another HWRC comment is as follows:

The use of a conservative monitoring network reflective of the complexity of the bedrock aquifer was warranted for the 2019 well field pump test. The process and criteria set forth under Env-Wq 403 (e.g., sections 403.06, 403.12 and 403.13) and Env-Dw 302 (e.g., sections 302.14 and 302.30), as well as the requirements set forth in RSA 485-C:21 V-c (e.g., disallowance of a new production well will occur if it results in “reducing the withdrawal capacity of a private water supply well or a single residence as a result of the reduction of available water that is directly associated with the withdrawal”) provided the framework for design and adoption of an effective network.

Will NH DES consider requiring the conduct of an additional pump test involving a more extensive and reflective bedrock well network to more accurately assess well field operational impacts?

See NHDES’ response above for reference to the adequacy of the pumping test monitoring network. Env-Wq 403 does not require performance of multiple pumping tests nor is a second test substantiated for this project due to the fact that the groundwater level response data collected as part of the test has adequately resolved the potential ZOI such that:

- a preferentially north-northeast oriented influence area has been established,
- a long term monitoring network has been established within the potential influence area to track trends over time (condition No. 4 in permit) and enable any necessary responses, and
- notification is required to parties within a 180-day projected drawdown area outside of the observed influence to area to enable NHDES to respond to uncertainty in predicting the extent of drawdown effects (condition 5a in the permit).

Additionally, a Hampstead resident noted:

I am concerned also with the inadequacy of the monitoring network for the pump test because the people doing the monitoring were the company (HAWC) itself, or a vendor that HAWC was paying. There should have been a third party neutral company to monitor the test.

In order to ensure that established standards of professional practice are used to develop technically sound geologic models, conduct testing, and evaluate data; Env-Wq 403.06 and Env-Dw 302.05 require that applications for large community water supply wells and large groundwater withdrawals be prepared and submitted by either a NH-licensed Professional Geologist or Professional Engineer. NHDES, like other agencies that oversee work submitted by other licensed parties, is reliant on the licensure requirement as it establishes the standards for professional experience and acumen of those that developed the project application, and is the basis for the integrity of the data collected and its independent analysis. As noted on the cover letters for all of the materials submitted as part for this project, the professional license information for the individual preparing the material was provided, therefore NHDES determines that the requirements for Env-Wq 403.06 and Env-Dw 302.05 are met, NHDES additionally determines that the data collected as part of this project and the analysis performed does follow the standard of professional practice that is typical of similar projects with similar testing results.

A resident of Sandown also commented:

Private wells that were tested seemed to be selectively chosen so as to possibly steer the results towards a desirable outcome for the permit applicant. Homeowners who live in the likely area of impact, and were willing to offer their wells for monitoring, were passed over in favor of those who were on the outskirts of the area and/or seemingly less likely to be affected. The well of my neighbor, Richard Hillard (43 Trues Parkway), was one chosen for monitoring. Not only is his property at one of the farthest points from the site, he also has a shallow (dug) well that is not more than a dozen feet deep and seems unlikely to be affected.

As noted previously, a range of wells, in terms of well type, direction and distance from the withdrawal was selected in order to represent the varying well construction in the general area of the wellfield. In reference to the Hillard well, it was necessary to verify through monitoring the assumption that pumping at APW3 will not influence the water levels in Angle Pond and nearby dug wells, the value of monitoring the Hillard well was that it was a dug well adjacent to Angle Pond. The lack of response in the Hillard well implies the proposed withdrawal will have no substantive effect on the pond or shallow groundwater wells near it, without such a monitoring location, uncertainty related to the effects of the withdrawal on Angle Pond, would remain.

Additionally, HWRC commented on performing well assessments on the private wells that were monitored in the withdrawal test:

RSA 485-C: 21 V-c (a) states that to preserve the public trust, an assessment of impacts must be made to private wells based upon their withdrawal capacity (e.g., > 4 gpm for 4 hours). A review of the EGGI Final Report did not indicate the inclusion of the withdrawal capacities of affected wells in the impact area, nor an assessment of this impact criteria. To add significance to this observation, during the July 25, 2019 hearing/meeting at the Hampstead Middle School, in response to a question asked about pumping test impacts to the Moore well, Mr. Tinkham stated that EGGI did not have well depth or productivity information for most wells monitored during the pump test.

Will NH DES require this assessment be performed prior to reaching their decision regarding the PPV for this well field?

Individual private well assessments are not required as part of the testing and application process for a large groundwater withdrawal permit. A well assessment would be part of a response-verification process if a potential adverse impact to a private well was reported to NHDES in accordance with Env-Wq 403.25(e), and evaluated per condition No. 5 of the permit. Additionally, based on projected drawdowns of approximately 20 feet or less in wells effected by pumping, NHDES anticipates that any impacts to the capacity of the Moore well or other area private wells would be negligible, particularly given the fact that well construction records in the area indicate that shallow bedrock wells are on the order of 160 feet deep. Conducting a pumping assessment or any 'invasive' work within a private water supply well would otherwise be unnecessary unless there is a valid reason to do so. In general, NHDES uses groundwater level monitoring established as part of a long term monitoring network as the primary indication of impacts to wells (see condition 4 of the permit).

Timing of the withdrawal test and seasonal water use

Comments received by NHDES referred to issues related to the timing of the pumping test conducted from late February to early March. Those comments included:

- Seasonal variation in water levels: water levels are generally lower in the summer than late winter, so the withdrawal test results are not conservative enough.
- Seasonal Water use: Surrounding water users (including both public and private wells) use more water in the summer and therefore this test in the late winter is not representative of the conditions observed in the summer when more water is being used.
- School Vacation Week: the test was completed during the February school vacation week when homeowners were not around and therefore private well water levels may not be representative of typical condition

The HWRC comments are emblematic of multiple comments and are included below:

The February- March 2019 Angle Pond well field pump test was performed at a time when stresses on the aquifer were less than typical and well below peak stress periods. For example:

1. The test was performed in the absence of high demand uses (e.g., no irrigation, watering, exterior washing), and following the winter months of lower demand use when the aquifer is recovering. A review of the past five years of water withdrawal rates for the HAWC Hampstead-Atkinson network in the NH DES Onestop database show substantially higher withdrawals during summer months.

2. The test was begun during a school vacation week, when domestic well use for some homes was absent or reduced over a portion of the test (see Final Report Appendix D plots of domestic well drawdown over time for Villella and Belliveau wells). The number of homes absent during all or a portion of the pump test is not discussed in the report.

3. Some partial year residents with homes on or near Angle Pond were absent from their homes, and thus not using their wells, during this (winter) time of the year. This aspect of reduced use was not discussed in the report.

4. According to data in the NH DES Onestop data base, Angle Pond well BRW 14 (a.k.a. AP BRW #2) was not operated during the month of February, allowing the aquifer to recharge and recover from operations in advance of the pump test.

Recognizing that the pump test was not performed during a period of typical or high demand on the aquifer, and that pump test impacts would have been greater if it had been performed during the summer months, how will NH DES calibrate or adjust the impact assessment to account for impacts likely to occur during higher aquifer use periods?

NHDES concurs that water use in the summer season is generally higher than other seasons and that recharge to groundwater during the summer months minimally occurs relative to other times of year. Based on long term observations in a bedrock monitoring well in Atkinson, regional groundwater levels did increase due to recharge during the fall of 2018, however, throughout the winter months (December 2018 to March 2019), groundwater levels steadily declined due to frozen ground conditions limiting recharge in the area.

Neither Env-Dw 302, nor Env-Wq 403 stipulate that pumping tests for new large groundwater withdrawal wells be conducted at a specific time of year. Rather, the rules require that an applicant use a worst case projected drawdown condition at locations that responded to pumping to assess for adverse impacts. Specifically, Env-Dw 302.29(e)(4) requires that drawdown observed in wells that responded to pumping be projected out to 180-days assuming continuous pumping from APW3 at maximum rates with no recharge from precipitation or snowmelt. Effectively this approach assumes that the production well must pump at maximum rates during a six-month drought. This approach to projecting potential drawdown under worst case conditions, in NHDES' experience with other withdrawal sites, is adequately conservative to address the variability in groundwater levels throughout the year. HAWC included such an assessment in the final report (section VIII.C., table III, appendix F) and used the projected values to assess for adverse impacts (section XIII.A.). NHDES finds that HAWC met the requirements to project drawdowns in accordance with Env-Dw 302.29(e)(4) and use those projections to assess impacts in accordance with Env-Dw 403.19.

NHDES acknowledges that there is additional water use in the summer from surrounding domestic water wells and seasonal residences. As noted previously, the conservative approach to projecting drawdown observed in wells using worst case pumping conditions, coupled with the ongoing monitoring program established in the permit (condition No. 4), will track groundwater levels within the projected ZOI of the wellfield throughout the year. This will enable NHDES to compare groundwater levels to the results of the withdrawal testing program to determine the impact of summer water use on water levels in the bedrock aquifer. Additionally, as established in condition No. 5 of the permit, NDHES can limit the withdrawal from the wellfield in the event that groundwater levels drop to non-predicted low levels in the wells that are monitored.

In response to the comment regarding the withdrawal test occurring over the school vacation week (February 25- March 1, 2019), the withdrawal test did start during the vacation week, but extended until March 6 into the middle of the following week. In review of the groundwater levels observed at all of the private wells monitored during the withdrawal test, short-duration downward 'spikes' in groundwater levels observed in the response curves at all locations indicate that residents were actively using water from wells during the test (appendix D – final report). As referred to by HWRC, it does appear that in two of the fifteen private wells, the owners may not have been using water for two to three days at the start of the test, but this did not affect the outcome of the water level monitoring at these locations. Based on the observations noted above, NHDES finds that the withdrawal test partially overlapping the school vacation week did not substantially affect the results of the test nor the impact assessment on wells that responded to pumping.

In response to APW2 being off-line for the month prior to the withdrawal test, Env-Dw 302.14(d) requires that the production wells are off for at least a week prior to starting the pumping test to allow groundwater levels to reach static conditions. The purpose of achieving static conditions prior to the test is to observe the actual effects of the proposed pumping well on the formation rather than residual effects of other nearby sources. NHDES finds that HAWC met the requirement to cease withdrawals from APW2 prior to the test in accordance with Env-Dw302.14 and that reaching static conditions in the bedrock formation was beneficial for the analysis of effects of the proposed well APW3.

Potential Impacts to Groundwater Levels

Comment letters provided by residents of Hampstead, Danville and Sandown expressed concern about the effects of pumping of APW3 on the surrounding private water supply wells. A number of these letters included similar comments related to the following:

- The potential for reductions in static groundwater levels and dewatering of private wells due to pumping of APW3, similar to what happened at a separate wellfield in Hampstead.
- Concerns about two new developments in the area of the Angle Pond wellfield.
- Concern about lowering of the water table in Hampstead, citing that the average depth of bedrock wells constructed in Hampstead has increased from around 200 ft in the 1980s to over 600 ft in recent years.
- The potential financial costs to homeowners caused by impacts to private wells.

NHDES is aware of issues related to a separate wellfield in Hampstead that did not go through the large groundwater withdrawal siting and permitting process, that system is not directly related to this permit however, and therefore is not addressed in this permit decision. In a similar manner, NHDES is aware of a small water system project proposed in the area of the Angle Pond wellfield and is involved in the review of that proposal. Under Env-Wq 403.33(i) NHDES can, if necessary, modify a large groundwater withdrawal permit based on new withdrawals, however; there is currently no information available for the proposed project that is pertinent to this permit application or the impacts observed as part of testing, and therefore the matter is not addressed in this permit decision.

As noted previously, results from the pumping test indicated that pumping from APW3 will influence groundwater levels in private wells in a relatively small area to the north and northeast of the wellfield, and do not appear to affect groundwater levels in wells at a larger scale. NHDES finds that groundwater level impacts in these limited number of private water supply wells are not irreversible or immediate, and do not meet the definition of adverse impact in RSA 485-C:21, V-c. Moreover, NHDES finds that data collected during the pumping test and impact assessment required by Env-Wq 403 for the withdrawal does not indicate that impacts will occur at a regional or town-wide scale.

In order to track for trends in groundwater levels over time and monitor for potential adverse impacts, two of the wells that were influenced by pumping, along with a third new well in a recently constructed development, will be monitored as part of a long-term monitoring program developed in accordance with Env-Wq 403.26 under condition No. 4 of the large groundwater withdrawal permit. Results of the long-term monitoring will be reported to NHDES on a quarterly basis for review, and summarized in an annual report. In the event that an adverse impact is either observed, or reported and confirmed, HAWC is required to implement the mitigation requirements under condition No. 5 of the withdrawal permit. In addition to other measures, mitigation of impacts to private wells can include a source replacement program conducted in accordance with Env-403.32, if necessary, whereby the permittee is required to replace the adversely impacted source at no capital cost to the private well owner.

In the comments received by NHDES, several Hampstead residents requested that their private well be included in the long-term monitoring program, including the Doherty well which is included. NHDES finds

that the inclusion of additional private wells in the long-term monitoring network that are outside of the zone of influence of the wellfield is not warranted due to the relatively limited extent of drawdown observed in private wells. It should be noted however, that NHDES has the ability to modify the long-term monitoring program in the future if needed.

Additionally, the HWRC commented on EGGI's interpretation of groundwater elevation data presented in the final report. An excerpt from their comment follows:

A significant aspect of hydrogeologic investigation for permitting an LGW involves adequately understanding and characterizing groundwater flow patterns in the study area, both under pumping and non-pumping conditions. These characterizations affect the determination of the well head protection area (WHPA), an appropriate sanitary protective area (SPA) reflective of the nature of a bedrock aquifer (as compared to a circular area appropriate for an overburden supply well), and the zone of influence (ZOI). Standard accepted engineering practice would call for a minimum of three data points to delineate potentiometric contours and groundwater flow lines; groundwater contours cannot be reliably developed for an area with less than three data points. However, a review of Figure 8 (and other later figures) in EGGI's Final Report indicates that the basis for characterizing groundwater flow patterns in the study area is not adequate.

...

In summary, it does not appear that groundwater flow patterns are well understood in the study area, which would impact the ability to reliably determine the PIA, ZOI and WHPA.

How will NH DES assess and determine groundwater flow patterns in study areas with such limited data, and will this limitation of groundwater flow patterns affect the magnitude of the PPV for the Angle Pond well field?

This statement that Figure 8 of the final report shows that development of groundwater flow patterns are not adequate is incorrect. Figure 8, and other associated figures of EGGI's final report, depicts fifteen private wells and three onsite production wells were used as data points to develop groundwater contours that served as the basis for estimates of the potential ZOI, the projected ZOI, and the WHPA. Figure 15 and 17 (and table III) in the final report show that of those eighteen locations, five private wells and one of the other wellfield production wells responded to pumping of APW3, and groundwater level responses [drawdown] in the private wells ranged from 0.94 to about 19 feet. The remaining monitoring points (inclusive of site piezometers and surface water stations) did not respond to pumping and were used to bound the influence area of the withdrawal, which further aided in groundwater flow pattern development. NHDES acknowledges that this project, like other withdrawal projects, used a finite number of groundwater measurements to establish the groundwater flow contours presented in the figures and created estimates of the ZOI and WHPA based on professional judgment and interpretation of groundwater level elevation measurements. As noted previously, lack of hydraulic response to pumping at a given monitoring point does not mean, by rule or professional practice, that the location is not an acceptable monitoring point.

As established previously, NHDES finds that the monitoring well network established for the pumping test complied with the rule requirements, further, NHDES finds that the conceptual hydrogeologic model for the site and the estimate of the ZOI for the wellfield were refined in accordance with Env-Dw 302.21 and Env-Wq 403.17. NHDES additionally finds that the WHPA for the wellfield was developed and refined in accordance with Env-Dw 302.22 as it was developed based on an appropriate and reasonable estimate of

groundwater contours developed for the site from the pumping test observations. In reference to the comment above about the development of the sanitary protective area (SPA) around the well, it is significant to note that the SPA is a fixed radius circle with a radius that varies based on the permitted production volume (PPV) for the new well as established in the large community well siting rules Env-Dw 302.10. As noted in the attached community well approval, the SPA radius for APW3 is 400 feet.

Potential for Impacts to Angle Pond

Several comments were received from residents surrounding Angle Pond in Sandown, Hampstead and the Angle Pond Association concerning the withdrawal causing a reduction in the water level in the pond. The comment below is emblematic of the comments received:

I have a concern with Angle Pond and how Well #3 may change the level of water. In one information meeting we were told that 10% of the water about 2" would come from Angle Pond. In another meeting no water would be taken from the pond. Angle Pond is a shallow, on average only about 10-12' deep pond. Well#3 is taking a substantial amount of water from underground and our pond is "spring fed". I don't see how anyone can predict the exact flow of water through underground layers of the earth. Residents in and around Angle Pond are concerned about the value of their properties without drinking water or a pond to use.

Env-Wq 403.11 and 403.12 require that the applicant inventory water resources within the estimated impact area of the withdrawal and estimate the effect on water resources that may result from the withdrawal. In addition to other shallow monitoring points, the monitoring network developed for the APW3 pumping test program included three surface water level staff gauges, one of which was installed in Angle Pond, and a dug well located on a lakefront property on the pond (section VII.B. – preliminary application; figure 2-final report). Based on observations made before/during/after the pumping test, no influence on water levels in the surface water station nor the dug well was observed due to pumping from APW3 (section VII.C.2. and 3., figure 15. – final report). The water level fluctuations in the surface water stations that did occur appeared to be associated with a short duration snowmelt event, not the pumping from APW3. Additionally, APW3 is located about 2,000 feet south and east of Angle Pond and pumping at the well was observed to preferentially influence groundwater levels in bedrock monitoring wells that were located to the northeast of the wellfield. Groundwater level impacts of pumping of APW3 in bedrock wells to the north and west of the wellfield (towards Angle Pond) were less than the influence observed in other wells and were not observed in some locations, further indicating limited hydraulic effects near or around Angle Pond. NHDES finds that observations of groundwater level and surface water levels indicate that impacts to the nearby surface water features adjacent to the APW3 well site do not trigger the adverse impact criteria established in RSA 485-C:21 and that water levels in Angle Pond are not likely to respond to pumping from the wellfield.

Mitigation Plan Development

A Hampstead resident commented about the development of a mitigation plan for private wells potentially impacted by the wellfield. The following comment is emblematic of others received on this topic:

Is there a documented mitigation plan? I would like to see the mitigation plan as a condition of the permit. I assumed a mitigation plan would include that the well #3 withdrawals would be reduced or stopped if any well is compromised. I expect that the plan would also reimburse homeowners for the cost

of damages or their homes depreciation if water issues result in a market price drop for their home or if the home becomes temporarily unsalable...

Additionally, the town of Sandown submitted the following comment related to a mitigation plan:

In the event of adverse impacts as a result of the operation of the well field, it would be our request that a mitigation plan be put in place and finalized prior to the issuance of the permit for the well.

As noted previously, NHDES finds that groundwater level impacts observed and estimated from the pumping test data do not meet the definition of adverse impact in RSA 485-C:21, V-c. therefore development and implementation of a mitigation plan before issuance of the permit or use of the withdrawal per the requirements of Env-Wq 403.31 is not warranted. However, condition No. 5 of the permit establishes the mitigation plan requirement in the event of a non-foreseen and confirmed adverse impact to a water user that includes:

- The requirement to notify NHDES of any reported adverse impact within 48-hours.
- A requirement for HAWC to maintain an emergency service agreement with a company that provides well and pump-related services, to include well drilling services.
- The requirement to replace the source of an impacted water user in accordance with the large groundwater withdrawal rules at no capital cost to the well owner.
- The requirement to reduce its withdrawals to below large groundwater withdrawal levels in the event of a validated adverse impact and increase data reporting frequency to NHDES.

In reference to financial obligations associated with adverse impacts, under Env-Wq 403.32, the permittee is required to provide to the user of an adversely impacted source an equivalent quantity of water that was available before the withdrawal that meets water quality standards at no capital cost to the user. The rules do not extend the requirements to cover the costs for anything other than the capital costs for source replacement.

A Sandown resident's comment on the idea of a 'phase-in' or stepped withdrawal permit is representative of a number of comments submitted that also referenced a 'ramping up' of the withdrawal of the permit, or application of some type of safety factor to the withdrawal:

...will DES consider a long-term phased in approach to how much water is drawdown from Well #3 to protect the integrity of the residential wells? This phased in approach would also take into consideration other developments currently under construction in the potential PIA and future developments.

As referenced above, the influence on groundwater levels observed (or projected) in private wells are generally less than 20 feet at the pumping rate tested and do not meet the criteria as an adverse impact. Per Section 5 above, NHDES approved a permitted production volume for APW3 that is approximately 29% lower than the rate tested in order to keep drawdown in the production well above the observed uppermost water bearing zone; which will also result in less influence on area private wells. This reduction, coupled with the conservative approach for assessing impacts by projecting drawdown in private wells assuming constant pumping during a six-month drought, while monitoring for effects in nearby groundwater wells under typical operating conditions, adequately addresses any estimation uncertainty such that a phased-in approach to production from the well is not necessary.

Water Conservation Management Plan

A number of comments from residents refer to the need for the permitting process for APW3 to include submission of a conservation management plan per the statutory requirements of RSA 485-C:21,V-b.(b). Env-Wq 403.14 and Env-Dw 302.18 addresses this requirement by referencing the need to submit and obtain approval for a Water Conservation Plan that developed in accordance with administrative rule Env-Wq 2101. In 2008, HAWC submitted and obtained approval for a Water Conservation plan related to a previous community well approval, HAWC continues to implement and report required material to the Water Conservation program in accordance with their approved plan, therefore NHDES finds that the conservation management plan requirement under RSA 485-C:21,V-b.(b) is met.

Water Quality Monitoring

A Hampstead resident, commented concerning water quality monitoring of private wells:

Will DES implement any continued water QUALITY monitoring in off-site private wells in the PIA of Well #3? If so, how does DES intend to implement testing and monitoring for water quality?

Per condition No. 4.a. of the large groundwater withdrawal permit, NHDES has required HAWC to sample for the water quality in three private wells before initiating the withdrawal. In the event that water quality concerns arise after activation of the APW3, NHDES shall require HAWC to collect additional water quality samples as appropriate, in accordance with Env-Wq 403.28(e), and compare results to the pre-activation water quality sample results. Drinking water treatment equipment shall be installed in accordance with Env-Wq 403.32(e) and (f) in the event that water quality results indicate primary or secondary drinking water standard exceedances have occurred as a result of the withdrawal from APW3.