SANBORN HEAD

*6 Bedford Farms Drive, Suite 201*
*Bedford, NH 03110*

Mr. R. Carter Scott
TransFarmations, Inc.
149 Captain Clark Highway
Wilton, NH 03086

July 24, 2023
File No. 5902.00

Re: Hydrogeologic Study
Jacobson Farm
Christian Hill Road
Amherst, NH

Dear Mr. Scott:

On behalf of TransFarmations, Inc. (TransFarmations), Sanborn Head & Associates, Inc. (Sanborn Head) has prepared this Hydrogeologic Study for the Jacobson Farm development (Site) on Christian Hill Road in Amherst, New Hampshire (Tax Map 5 Lots 100 and 148). We understand that TransFarmations is currently proposing to develop the Site to include one 60-unit or one 33 single-family units plus one 4-unit barn development to be serviced by on-Site supply wells and septic systems. In addition, a Groundwater Resource Assessment dated February 12, 2020 prepared by Weston & Sampson, Inc. (Weston & Sampson) on behalf of TransFarmations[1] concluded that local groundwater resources can support the proposed development.

The objective of this work was to perform a desktop Hydrogeologic Study to respond to nine items previously requested by the Planning Board for a different proposed development site in Amherst, NH (Clearview Development Group – Prew Purchase Site). The work has been performed in accordance with Sanborn Head's proposal dated July 12, 2023.

This Hydrogeologic Study has been developed based on the Town of Amherst Planning Board's request for a Hydrogeologic Study for a similar residential development project. Each item previously requested by the Planning Board is copied below in bold text, followed by Sanborn Head's response in plain text.

**STRATIFIED DRIFT AQUIFERS AND POTENTIAL IMPACTS**

The locations of the stratified drift (overburden) aquifers are shown on Figure 1. Based on the New Hampshire Department of Environmental Services (NHDES) One Stop Data Mapper which depicts stratified drift aquifers from Toppin, 1986[2], a zone of stratified drift is located in the eastern portion of the Site on Map 5 Lot 148, generally coinciding with a topographic

[1] "Re: Jacobson Farm Agrihood, Amherst, New Hampshire – Groundwater Resource Assessment", by Weston & Sampson, and dated February 12, 2020.

[2] Toppin, K.W., 1986, Hydrogeology of Stratified-Drift Aquifers and Water Quality in the Nashua Regional Planning Commission Area, South-Central New Hampshire, Water Resources Investigation Report 86-4358

depression, and Ceasar's Brook/Beaver Brook and associated wetland areas. The stratified drift extends to Christian Hill Road and was not mapped on Map 5 Lot 100, except for a small (<1 acre) portion in the eastern corner of Lot 100. The 2020 Groundwater Resource Assessment by Weston & Sampson discusses that sand and gravel encountered in test pits is consistent with the presence of stratified drift at some locations. As depicted on Figure 1, transmissivity categories[3] for the stratified drift on Map 5 Lot 148 ranges from less than 2,000 square feet per day ($ft^2$/day) to greater than 4,000 $ft^2$/day, with transmissivity categories increasing to the east (towards Ceasar's Brook). Ceasar's Brook and Beaver Brook flow to the southeast as tributaries to the easterly flowing Souhegan River. Based on surface water flow directions and topography, groundwater within the mapped stratified drift likely flows to the south/southeast.

Based on information provided by TransFarmations, we understand that the majority of the area on Map 5 Lot 148 underlain by stratified drift (shown on Figure 1) is proposed to remain as open space. Based on topography, it is likely that many of the proposed wells (near buildings) will be located side-gradient or upgradient of the stratified drift. The 2020 Groundwater Resource Assessment indicated that most wells in the Site vicinity are completed in bedrock, and therefore, the domestic supply wells for the Site are similarly anticipated to be completed in bedrock with casing placed through overburden into rock. Transmissive zones based on overburden (stratified drift) materials are not directly applicable to bedrock as they do not determine water availability and yield directly in bedrock aquifers. Based on similar hydrogeologic settings, we believe that pumping from residential bedrock supply wells will not materially influence the stratified drift aquifer water levels and groundwater flow direction because of the relatively higher storage and transmissivity in the drift materials compared to bedrock and the position of the drift materials generally downgradient from proposed wells. Further, the majority of the proposed development does not overlie the mapped stratified drift aquifer and instead likely overlies till on bedrock (based on description from the 2020 Groundwater Resource Assessment). This further reduces the likelihood of material influences to water levels and groundwater flow direction within the nearby stratified drift aquifer. Depending on bedrock fracture orientations and connectivity, fractures intersected by private wells may be recharged by the stratified drift aquifer which could result in higher well yields compared to wells that intersect fractures that are connected to less permeable overburden materials.

**AQUIFER CONSERVATIONS DISTRICTS AND POTENTIAL IMPACTS**

Based on the information provided by TransFarmations, we understand that proposed development is subject to Aquifer Conservation District overlay. Based on our interpretation of the Town of Amherst Zoning Ordinance Section 4.13.D.1[4], this designation is primarily due to the presence of stratified drift mapped on Lot 5-148. As summarized on Figure 1, the Site is not located within a Wellhead Protection Area; the nearest Wellhead protection area is located

[3] Transmissivity is a parameter that provides information regarding the potential groundwater yield of the aquifer taking into account the capacity of the materials to transmit water and the thickness of the materials that contain groundwater. Higher transmissivity values correspond with higher potential sustained groundwater yield from wells screened within the aquifer material.

[4] https://www.amherstnh.gov/sites/g/files/vyhlif4116/f/uploads/sec_a_zoning_ord_2023.pdf

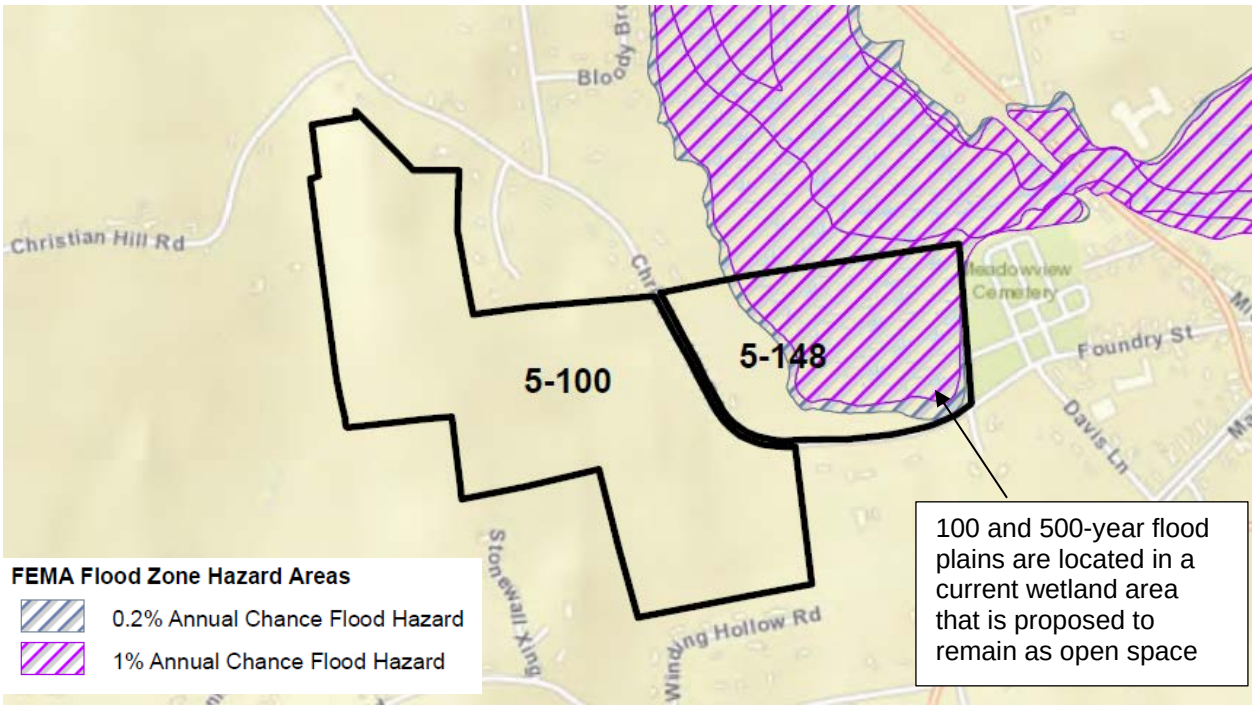
approximately ¾ mile east of the Site[5]. We understand that the proposed development intends to comply with Aquifer Conservation District requirements, and that compliance with the Aquifer Conservation District will be addressed elsewhere in the application by others. Public Water Protection Wetlands are located in the eastern portion of the Site[6]; however, this portion of the Site is currently proposed to remain as open space. The Site is located within a source water protection area for the Pennichuck Water Works, similar to most of the Town of Amherst.

**EXCAVATION RESTRICTIONS FROM FLOODING OR FLASH FLOODING**

The wetlands in the eastern portion of proposed development area within Map 5 Lot 148 are located within a 100-year and 500-year flood hazard zone associated with Ceasar's Brook/Beaver Brook as shown on plans prepared by Meridian Land Services, Inc. on behalf of TransFarmations and the exhibit below. Based on these plans, buildings and excavation activities are not currently proposed in flood zone areas. The remaining portion of the Site is not within a 100- or 500-year flood zone.

It is our opinion that potential excavation restrictions are outside the typical scope of a Hydrogeologic Study.

**Exhibit 1 – 100- and 500-Year Flood Zones**




Notes: FEMA Flood Zone Hazard Areas were accessed via NHDES OneStop on July 19, 2023. 0.2% Annual Chance of Flood Hazard = 500-year flood zone; 1% Annual Chance Flood Hazard = 100-year flood zone.

[5] Amherst Medical Center System ID = 0075060

[6] https://www.amherstnh.gov/sites/g/files/vyhlif4116/f/uploads/waterresourcesmap_bw_sm_130902.pdf

**WASTEWATER DISCHARGE IMPACTS ON GROUND & SURFACE WATER**

Based on information provided by TransFarmations, wastewater discharge will occur via individual and shared residential septic systems, and we understand that the septic systems will meet local and state design requirements. Therefore, we do not anticipate foreseeable, unallowable wastewater discharge impacts.

See NHDES Factsheets SSB-11[7], SSB-13[8], SSB-3[9], SSB-4[10], and SSB-7[11] for more information about septic system regulations in New Hampshire.

**STORMWATER DISCHARGE IMPACTS ON GROUND & SURFACE WATER**

Compliance with NHDES Alteration of Terrain (AOT) regulations, if applicable, will be addressed by others, and stormwater-related items associated with the proposed development will be addressed by TransFarmations as part of other transmittals. Based on our review of current application materials provided by TransFarmations, we note there are several current and proposed Site features that we believe will have a positive effect on stormwater impacts on groundwater and surface water, including:

- A large portion of Map 5 Lot 148 will remain as open space/wetlands, and the wetland is positioned between the proposed buildings/development and Ceasar's Brook/Beaver Brook. Because wetlands have a role in flood control, water quality, water storage and recharge[(e.g.,12)], maintaining this wetland is anticipated to retain these positive features related to stormwater discharge.
- The underlying stratified drift aquifers and sand and gravel identified during test pitting in portions of the Site are anticipated to be more favorable for groundwater recharge and infiltration (higher permeability that allows for more infiltration or precipitation and discharge septic wastewater) compared to other types of overburden materials such as less permeable silt and clay.
- Based on the CUP III application materials dated March 6, 2023, only 18% of the total land area is proposed for development, which will limit the amount of impervious surfaces and therefore not impede stormwater infiltration compared to a development with relatively more impermeable surfaces.
- The CUP II application dated March 2, 2023 indicates the TransFarmations commits to a deed restriction on the entire development to prohibit chemical fertilizers and pesticides. Restricting the use of fertilizers and pesticides is anticipated to have a beneficial effect on water quality in terms of potential nutrient loading to surface water through stormwater impacts.

[7] https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/ssb-11.pdf
[8] https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/ssb-13.pdf
[9] https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/ssb-3.pdf
[10] https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/ssb-4.pdf
[11] https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/ssb-7.pdf
[12] https://www.des.nh.gov/water/wetlands

**EVALUATION OF BMPS IN MITIGATING EFFECTS OF DEVELOPMENT**

We have compiled references to available documents at the state level regarding Best Management Practices (BMPs) related to groundwater and surface water impacts of development. These BMPs have been compiled for review and discussion purposes; we are not recommending any particular BMP. In addition, in previous application materials[13], TransFarmations has indicated an emphasis on sustainability and maintaining open/green spaces in their Jacobson Farm development. In relation to groundwater resources, we believe that enhancing the amount of green space relative to impermeable surfaces may help reduce potential negative impacts from stormwater runoff and preserve land available for infiltration of precipitation to the groundwater table.

References regarding BMPs include the following:

- NHDES Fact Sheet DWGB 22-4[14]: Best Management Practices (BMPs) for Groundwater Protection
- NHDES Fact Sheet DWGB 22-6[15]: Best Management Practices for Fueling and Maintenance of Excavation and Earthmoving Equipment
- Best Management Practices Manual, Utility Maintenance in and Adjacent to Wetlands and Waterbodies in New Hampshire[16]
- Best Management Practices for Routine Roadway Maintenance Activities in New Hampshire[17]
- NHDES Model Groundwater Protection Ordinance[18]

**BLASTING IMPACT STUDIES**

Blasting Impact Studies are not typically included in a Hydrogeologic Report. NHDES provides a document describing measures that can be taken in regards blasting and groundwater quality[19]. If TransFarmations' plans for development were to include blasting, we suggest blasting impact studies be addressed elsewhere in the application by others.

**GROUNDWATER MONITORING PROGRAM**

As previously communicated to the Planning Board as part of other development projects in Amherst, we are not aware of instances where a Groundwater Monitoring Program has been required for residential development activities in New Hampshire prior to a known release (e.g., associated with a heating fuel spill or other release of a substance that could violate the Ambient Groundwater Quality Standards). Including a groundwater monitoring program in the development plans would add considerable potential cost and long-term regulatory

[13] For example, see Conditional Use Permit (CUP III) Application, 33 Single Family Lots and a 4-Unit Barn, prepared by TransFarmations, dated March 6, 2023
[14] https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/dwgb-22-4.pdf
[15] https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/dwgb-22-6.pdf
[16] https://www.nh.gov/nhdfl/documents/new_final_utility_bmp_manual_3_8_19.pdf
[17] https://www.nh.gov/dot/org/projectdevelopment/environment/units/program-management/documents/RR_V.9_FINAL_3-14-19.pdf
[18] https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/wd-06-41.pdf
[19] https://www.nhsec.nh.gov/projects/2015-04/post-certificate%20filings/2015-04_2019-04-26_bmp_rock_blasting_water_quality.pdf

requirements to the development. Based on the absence of a known release, the associated costs, and the long-term regulatory responsibilities, we do not recommend implementing a groundwater monitoring program at this time.

Should you have questions regarding the information presented herein, or wish to discuss any of our findings and conclusions, please feel free to contact the undersigned.

Very truly yours,
SANBORN, HEAD & ASSOCIATES, INC.

Lilly Corenthal, P.G.
*Project Manager*

Russell H. Abell, P.G.
*Senior Vice President*

GAP/LGC/RHA: gwb

Encl. Figure 1 - Stratified Drift and Wellhead Protection Areas

cc: Sam Foisie, P.E., Meridian Land Services, Inc.

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Figure 1

# Stratified Drift and Wellhead Protection Areas

TransFarmations, Inc.
Jacobson Farm
Amherst, New Hampshire

| | |
|---|---|
| Drawn By: | H. LaPointe |
| Designed By: | G. Bush |
| Reviewed By: | L. Corenthal |
| Project No: | 5902.00 |
| Date: | July 2023 |

## Figure Narrative

This figure depicts the location of stratified drift aquifers and wellhead protection areas in the vicinity of the proposed Jacobson Farm development.

## Notes

1. The location of stratified drift aquifers and wellhead protection areas were obtained from the New Hampshire Department of Environmental Services (NHDES) OneStop DataMapper on July 19, 2023.

2. The approximate site boundary is based on parcel layers obtained from NH GRANIT. Refer to other application materials for additional information.

3. Basemap: USGS Topo Base Map provided by ArcGIS Online.

## Legend

- Approximate Site Boundary
- Wellhead Protection Area

**Stratified Drift Transmissivity (NHDES OneStop)**

- Less than 2,000 feet sq./day
- 2,000 - 4,000 feet sq./day
- Greater than 4,000 feet sq./day

Feet
500 250 0 500 1,000

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Wellhead Protection Area for Amherst Medical Center (Public Water System ID 0075060)

Map 5 Lot 148

Map 5 Lot 100

Christian Hill

Patch Hill

AMHERST

Last Edited By: hlapointe

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