GeoInsight®
Environmental Strategy & Engineering

May 11, 2020 GeoInsight Project 9787-000

Jeff Paradis
United Mechanical, Inc.
41 Poor Farm Road
Nottingham, NH 03290

RE: Hydrogeologic Study
41 Poor Farm Road Subdivision
Nottingham, New Hampshire

Dear Mr. Paradis:

As requested, GeoInsight, Inc. (GeoInsight) prepared this hydrogeologic report for a proposed subdivision at 41 Poor Farm Road (the Property). It is our understanding that the planned subdivision involves creation of four lots on the Property with an existing residential parcel remaining on the north side of the Property (Lot 7-1) with three new subdivided parcels created to the south (Lots 7-1-1, 7-1-2, and 7-1-3) of this parcel. Plans for the subdivision have been provided to us by Franklin Associates, LLC (Franklin) and it is our understanding that these plans have been provided to the Nottingham Planning Board (the Board). It is further our understanding that you have been notified by the Board that the planned subdivision is located within the Town of Nottingham's (the Town's) Aquifer Protection Overlay District and a hydrogeologic study is required as part of the application. This letter addresses requirements specified by the Board for planned projects in the Aquifer Protection Overlay District as specified in Article III A of the Town's Zoning Ordinance (the Ordinance).

Services completed as part of this study included:

- review of subdivision plans prepared by Franklin;
- review of test pit logs compiled by Franklin;
- review geologic mapping accessible through on-line sources; and
- review the Town's Aquifer Protection Overlay District requirements and evaluation of compliance status with these requirements.

AQUIFER MAPPING

The boundaries of the aquifer, as delineated on the aquifer overlay map, are shown on Attachment A along with the approximate location of the Property. The map notes indicate that the aquifer delineation is taken from the NH GRANIT mapping database as compiled by Strafford Regional Planning Commission. GeoInsight compiled a geographic information

system (GIS) map from the New Hampshire Department of Environmental Services (NHDES) GIS system to show Property locations relative to the mapped aquifer boundaries (see Attachment B). This Attachment shows that only the southeastern half of the Property is located within the Aquifer Protection Overlay District.

The aquifer boundaries shown on GIS sources was delineated by U.S. Geologic Survey (USGS) (Moore, 1990[1]) as part of a cooperative effort with the NHDES to map stratified drift aquifer resources throughout the State of New Hampshire. Moore maps areas of stratified drift (sorted sand deposits associated with meltwater from the recession of continental ice sheets 10,000 years ago) in the Exeter, Lamprey, and Oyster River basins. Where stratified drift deposits are coarse and are saturated with groundwater, these deposits can form stratified drift aquifers that can represent important water resources. Mapping, as described by Moore, involved compiling soil maps, surficial geology maps, and plotting drilling data from a variety of sources including geotechnical borings, monitoring wells, municipal supply well reconnaissance, and other sources.

The mapping in the vicinity of the Property shows a small discrete aquifer defined independent of actual drilling data (see Figure 1 below).

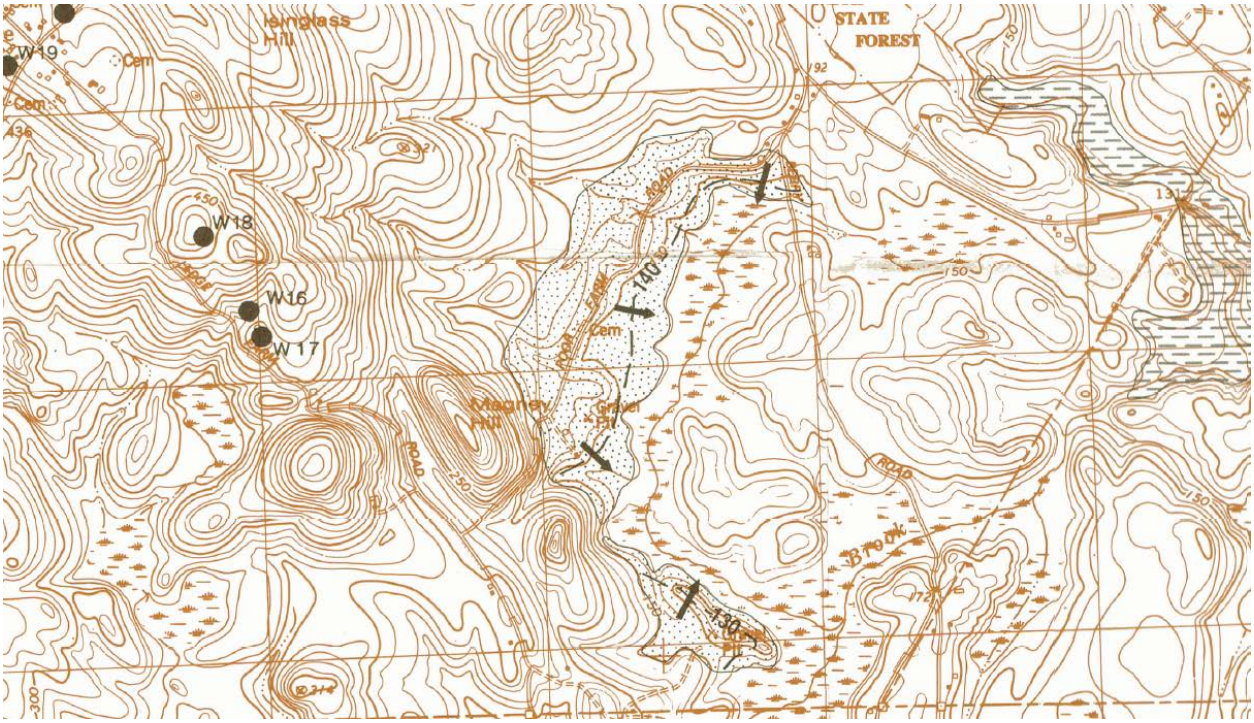


Figure 1: Water Resources Investigation 88-4128 Plate 2- Altitude of Water Table, Data Collection Locations and Surficial Geology for Stratified Drift Aquifers in the Exeter, Lamprey and Oyster River Basins, Southeastern New Hampshire.

[1] Moore, Richard B., 1990, Geohydrology and Water Quality of Stratified Drift Aquifers in the Exeter, Lamprey, and Oyster River Basins, Southeastern New Hampshire. U.S. Geological Survey Water Resources Investigation Report 88-4128.

Notice that delineation of the Poor Farm Road aquifer is not based upon mapped borings or wells (shown as labelled black dots outside the aquifer). Presumably, the aquifer in the Poor Farm Road area was delineated based upon soils maps, surficial geology maps, and possibly spot checked by field mapping. Two gravel pits are shown on the USGS south of the Property. Although not supported by actual groundwater measurements, groundwater contours were plotted by the USGS with groundwater flow directed to the east to a marshy tributary of Rollins Brook.

Based upon this mapping, the USGS estimated that the aquifer in the vicinity of Poor Farm Road is thin with a saturated thickness less than 20 feet and the transmissivity low, less than 500 feet squared per day. Aquifer thickness and transmissivity as mapped by Moore is shown on Figure 2.

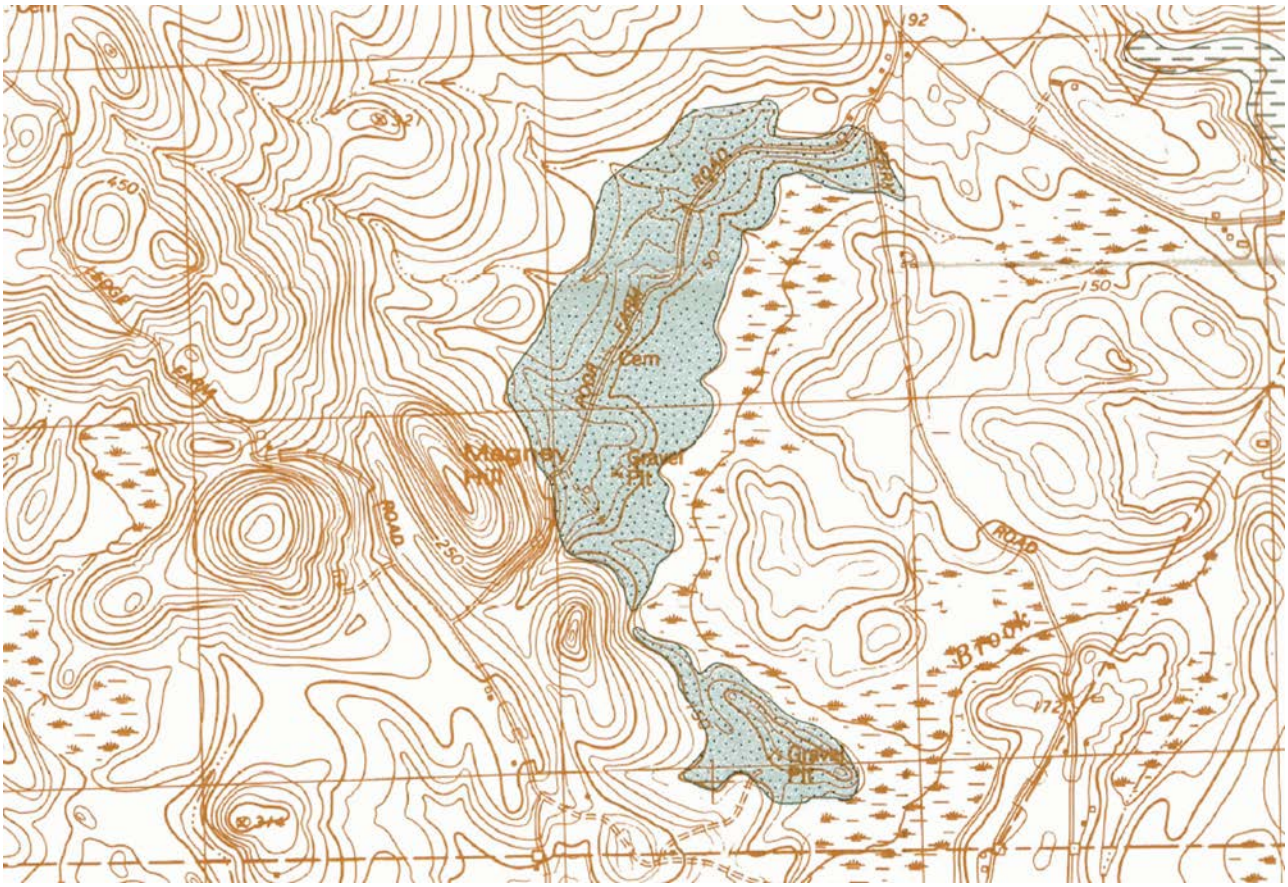


Figure 2: Water Resources Investigation 88-4128 Plate 6 Saturated Thickness and Transmissivity of Stratified Drift in the Exeter, Lamprey, and Oyster River Basins, Southeastern New Hampshire.

Transmissivity is the hydraulic conductivity of an aquifer multiplied by its thickness. Generally, transmissivities of greater than 1,000 feet per day are needed to support development of a community water supply.

TEST PIT LOGS

The three individual lots to the south of Parcel 7-1 are planned as residential parcels and test pits were conducted in areas reserved for individual septic systems. Two test pits were conducted for each reserve area: TP-1 and TP-2 for lot 7-1-1, TP-3 and TP-4 for Lot 7-1-2, and TP-5 and TP-6 for Lot 7-1-3. The septic reserve area for 7-1-1 appears to be on the northwest side of the Property outside the mapped aquifer boundary while septic reserve areas for Lots 7-1-2 and 7-1-3 appear to be within the mapped aquifer. Test pits and reserve areas relative to the approximate aquifer boundary are shown on Attachment C, which is an annotation of Sheet 2 of the subdivision plans prepared by Franklin. The approximate aquifer boundary is taken from Attachment B.

Soils described in test pit logs show highly variable sandy material consistent with glacial drift found in stratified drift aquifers. Test pit logs for TP-1 and TP-2 (Lot 7-1-1 outside the mapped aquifer) describe fine sandy loam and loamy coarse sand to a depth of 60 inches (5 feet). Test pit logs for TP-3 and TP-4 (for Lot 7-1-2) within the mapped aquifer) show fine sandy loam to coarse sand (TP-3) and fine sandy loam to very fine sandy loam (TP-4). Depths of these test pits ranged from 6 to 7.5 feet. Test pit logs for TP-5 and TP-6 (Lot 7-1-3 within the mapped aquifer) show fine sandy loam to coarse sand to 6 feet (TP-5) and fine sandy loam to coarse sandy loam to 7 feet (TP-6). Groundwater was not observed in the test pits; estimated seasonal high water level depths, presumably estimated from soil oxidation, ranged from 32 feet to 72 feet. Test pit logs are included at Attachment D.

ORDINANCE REQUIREMENTS

Mapping completed by the USGS shows that approximately half of the Property is included in the Aquifer Protection Overlay District. Mapping by the USGS was not based upon actual data but test pit data documents soils that could be consistent with stratified drift found in aquifers. The materials described in the test pits are highly variable and USGS mapping suggests that the aquifer is thin and not suitable for a community supply.

Accordingly, requirements specified in the Town Zoning Ordinance Aquifer Protection Overlay District appear to apply to the proposed development, which includes development of new three residential lots south of the existing lot (Lot 7-1). The status of aquifer district requirements (Article III A) is summarized as follows.

1. Lot sizes are greater than minimum requirements of three acres (see Franklin plans, Attachment C).
2. Residential development will be unlikely to involve rendering more than 10 percent of the lots as impermeable. Commercial development, which would involve paved parking areas, are not considered and potential impervious areas would be likely limited to residential roofs and driveways. Test pit logs suggests that sandy materials on site would allow for adequate infiltration.
3. Based upon discussions with you, prohibited site uses listed under Section 4 (c) are not considered.

4. Residential development is consistent with permitted uses described under Section 4 (d).
5. Septic systems, if designed in accordance with New Hampshire Code of Administrative rules Chapter WS 1000, should adequately preclude nitrate impacts greater than 5 milligrams per liter at Property boundaries. Community septic systems that would concentrate waste water discharges for multiple lots are not considered (see Attachment C). Furthermore, groundwater flow to the east suggests septic system discharges from the individual lots will not likely overlap and contribute to one another. Groundwater flow directions inferred by the USGS (Moore 1990) are shown on Figure 1.
6. Septic system design requirements are further specified in Section 6 (f) of the Ordinance. As noted earlier, the septic reserve area for Lot 7-1-1 is located outside the mapped aquifer area. It may be possible to move septic systems for the other two lots to the west outside the mapped aquifer area (see Attachment C). However, these areas are upgradient of the aquifer area and domestic waste water would likely flow east and into the aquifer district. Further, the actual location of the aquifer boundary is uncertain and not based upon actual field data (see Figure 1). Also, all test pit data showed sandy material suggesting of glacial drift. Accordingly, relocation of the septic reserve areas to the north and west outside the mapped boundary may not be justified considering the acceptable soil conditions for septic design as documented in the test pits. Compliance with septic system design standards further specified in Section 6 can be evaluated during system installation.
7. As the lots are specified for residential use, significant hazardous materials usage discharge or dry usage is not anticipated.

CONCLUSIONS

Data compiled from USGS sources, test pitting, and proposed sub-division design was used to document compliance with Aquifer Protection Overlay District Ordinance requirements. Data shows that the Property is partially located within an aquifer area and that the aquifer is not thick or laterally extensive. The aquifer could not likely support the development of a community drinking water source. Residential development of the Property, as shown on plans provided by Franklin, should not significantly limit aquifer recharge. Waste water discharges being considered are limited to three single residence septic systems and these systems should not significantly endanger groundwater provided that they are properly designed and installed in accordance with New Hampshire standards and design standards specified in the Aquifer Protection Overlay District Ordinance.

Methods used to develop these conclusions are similar to those used on similar projects where hydrogeologic reports are required. Accuracy of these conclusions is dependent upon the accuracy of the data including professional references and planning/engineering documents provided to GeoInsight.

If you have questions regarding the findings or conclusions of this document, please contact me a (603) 314-0820.

Sincerely,
GEOINSIGHT, INC.

David A. Maclean, M.S., P.G.
Senior Associate/Senior Hydrogeologist

\\Geonho\NHO_Projects\9787 Nottingham Poorfarm Road Hydro Study\Report\Letter Report-Text.Docx

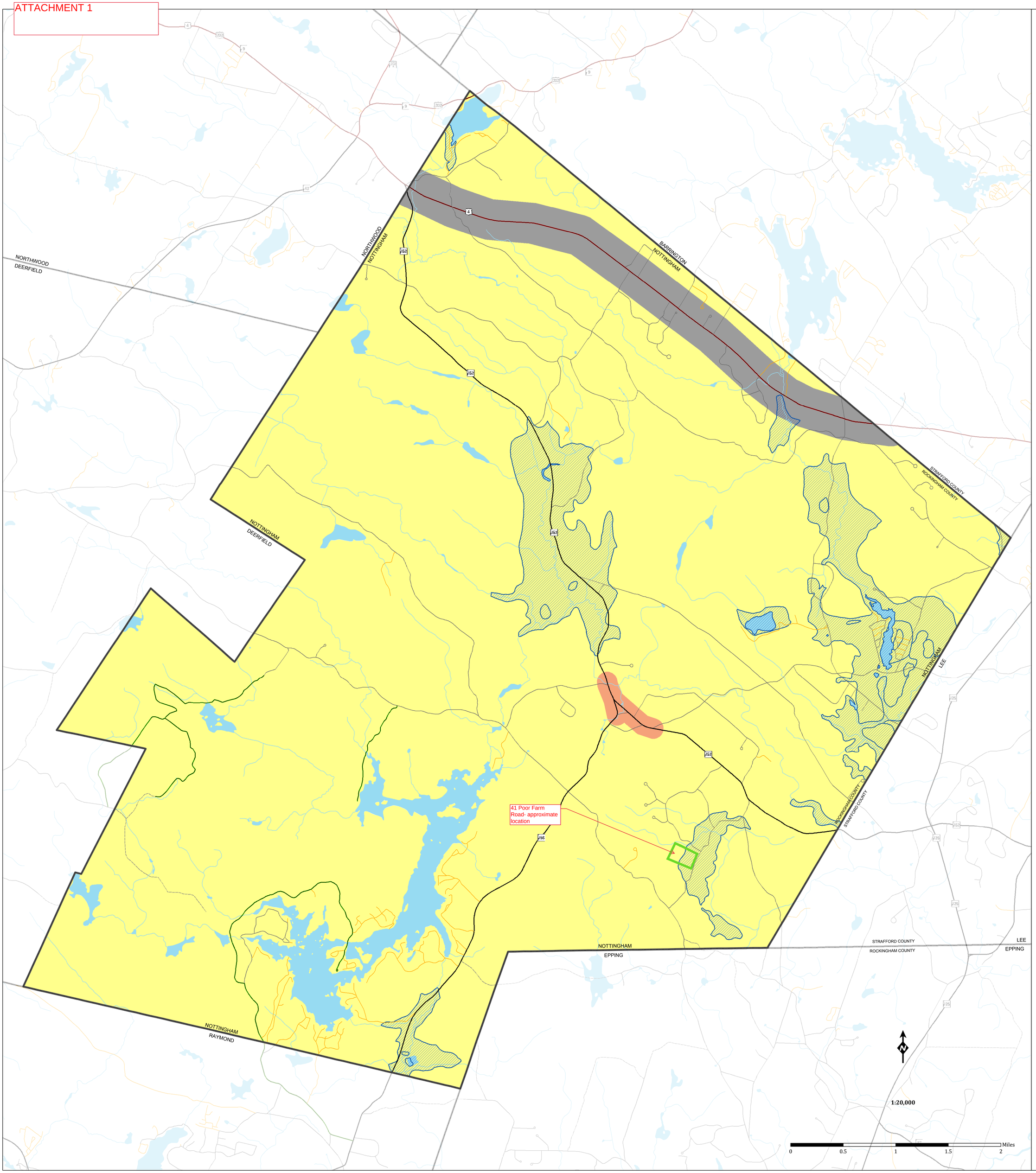
ATTACHMENT A

AQUIFER OVERLAY MAP

ATTACHMENT 1

Aquifer Protection Overlay District

Town of Nottingham
New Hampshire



Legend

- Aquifer Protection Overlay District

Zoning District

- Commercial Indistrial
- Residential Agricultural
- Town Center

Base Features

- Municipal Boundary
- Stream, River
- Lake, Pond

Roads

- Class I Primary Highway
- Class II Secondary Highway
- Class III Recreational Road
- Class V Local Road
- Class VI Not Maintained
- Private

For provisions of this overlay district see Article III Section A of the Town of Nottingham, New Hampshire Zoning Ordinance amended 16 March 2017.

Map Adopted: May 23, 2018

MAP IS FOR PLANNING PURPOSES ONLY.

Prepared by the Strafford Regional Planning Commission
150 Wakefield St. Suite 12 Rochester, NH 03867
T: (603) 994-3500 E: srpc@strafford.org

Date: 5/14/2018 Author: RM
Path: M:\Towns\not\MapRequests\AquiferOD.mxd

Data Sources

Base features from NH GRANIT database. Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Earth Systems Research Center (ESRC), under contract to the Office of Energy and Planning (OEP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OEP nor ESRC make any claim as to the validity or reliability or to any implied uses of these data.

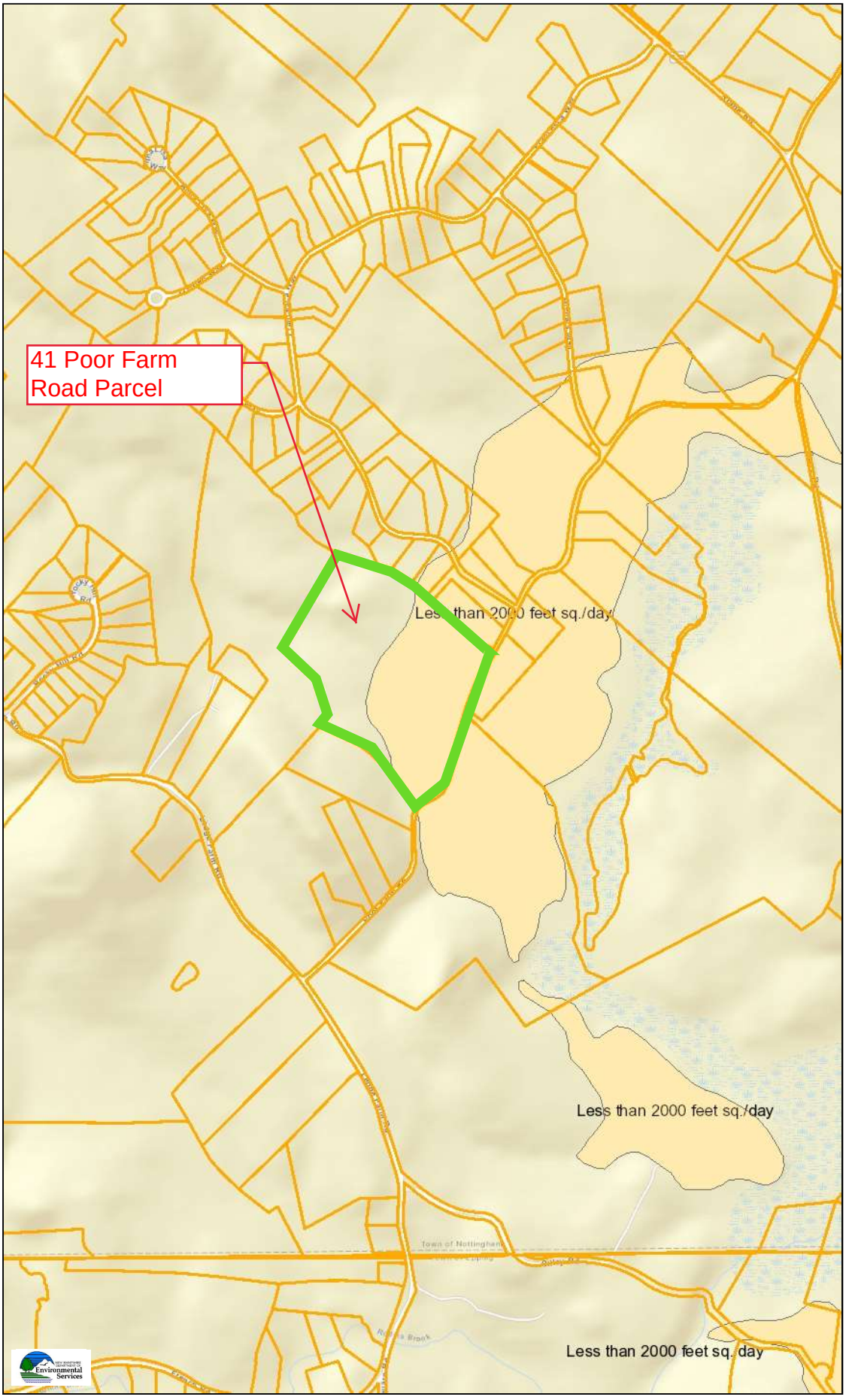
Digital tax parcels taken from SRPC database. Data should be used for planning purposes only. Data were derived from various sources and were updated at different timeframes, with varying levels of accuracy. Please notify SRPC of any errors or omissions.

ATTACHMENT B

GIS MAP

Attachment 2 Parcel and Aquifer Map

Poor Farm Road Aquifer



Legend

- Parcels - polygons
- Aquifer Transmissivity
  - Less than 2000 feet sq./day
  - 2000 - 4000 feet sq./day
  - Greater than 4000 feet sq./day

Map Scale

1: 12,988

Map Generated: 5/7/2020

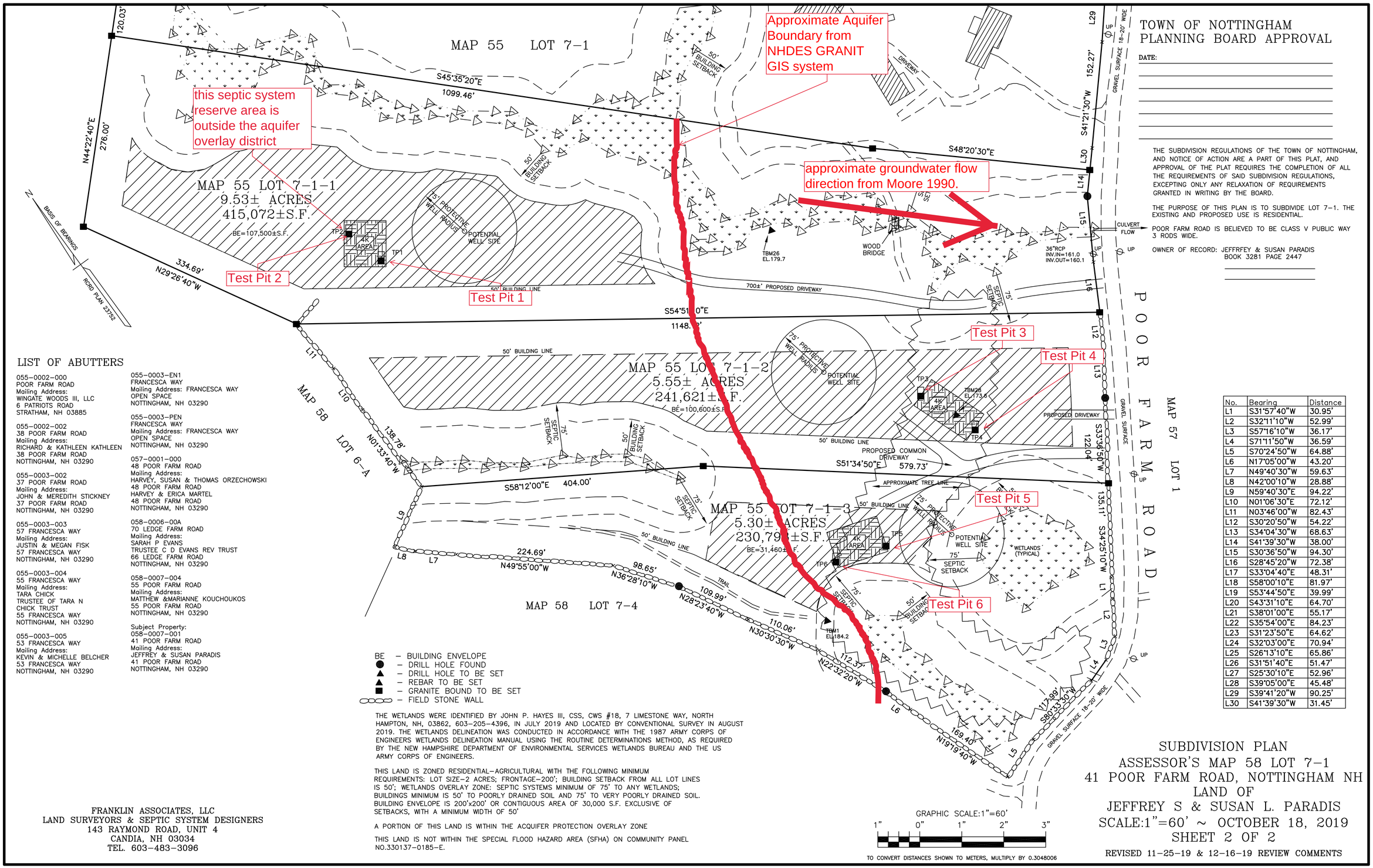
Notes

compiled by DAM

ATTACHMENT C

FRANKLIN SUBDIVISION PLANS

Attachment 3- Test Pit Locations



LIST OF ABUTTERS

055–0002–000
POOR FARM ROAD
Mailing Address:
WINGATE WOODS III, LLC
6 PATRIOTS ROAD
STRATHAM, NH 03885

055–0002–002
38 POOR FARM ROAD
Mailing Address:
RICHARD & KATHLEEN KATHLEEN
38 POOR FARM ROAD
NOTTINGHAM, NH 03290

055–0003–002
37 POOR FARM ROAD
Mailing Address:
JOHN & MEREDITH STICKNEY
37 POOR FARM ROAD
NOTTINGHAM, NH 03290

055–0003–003
57 FRANCESCA WAY
Mailing Address:
JUSTIN & MEGAN FISK
57 FRANCESCA WAY
NOTTINGHAM, NH 03290

055–0003–004
55 FRANCESCA WAY
Mailing Address:
TARA CHICK
TRUSTEE OF TARA N
CHICK TRUST
55 FRANCESCA WAY
NOTTINGHAM, NH 03290

055–0003–005
53 FRANCESCA WAY
Mailing Address:
KEVIN & MICHELLE BELCHER
53 FRANCESCA WAY
NOTTINGHAM, NH 03290

055–0003–EN1
FRANCESCA WAY
Mailing Address: FRANCESCA WAY
OPEN SPACE
NOTTINGHAM, NH 03290

055–0003–PEN
FRANCESCA WAY
Mailing Address: FRANCESCA WAY
OPEN SPACE
NOTTINGHAM, NH 03290

057–0001–000
48 POOR FARM ROAD
Mailing Address:
HARVEY, SUSAN & THOMAS ORZECHOWSKI
48 POOR FARM ROAD
HARVEY & ERICA MARTEL
48 POOR FARM ROAD
NOTTINGHAM, NH 03290

058–0006–00A
70 LEDGE FARM ROAD
Mailing Address:
SARAH P EVANS
TRUSTEE C D EVANS REV TRUST
66 LEDGE FARM ROAD
NOTTINGHAM, NH 03290

058–0007–004
55 POOR FARM ROAD
Mailing Address:
MATTHEW &MARIANNE KOUCHOUKOS
55 POOR FARM ROAD
NOTTINGHAM, NH 03290

Subject Property:
058–0007–001
41 POOR FARM ROAD
Mailing Address:
JEFFREY & SUSAN PARADIS
41 POOR FARM ROAD
NOTTINGHAM, NH 03290

BE – BUILDING ENVELOPE
● – DRILL HOLE FOUND
▲ – DRILL HOLE TO BE SET
▲ – REBAR TO BE SET
■ – GRANITE BOUND TO BE SET
⬭ – FIELD STONE WALL

THE WETLANDS WERE IDENTIFIED BY JOHN P. HAYES III, CSS, CWS #18, 7 LIMESTONE WAY, NORTH HAMPTON, NH, 03862, 603–205–4396, IN JULY 2019 AND LOCATED BY CONVENTIONAL SURVEY IN AUGUST 2019. THE WETLANDS DELINEATION WAS CONDUCTED IN ACCORDANCE WITH THE 1987 ARMY CORPS OF ENGINEERS WETLANDS DELINEATION MANUAL USING THE ROUTINE DETERMINATIONS METHOD, AS REQUIRED BY THE NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES WETLANDS BUREAU AND THE US ARMY CORPS OF ENGINEERS.

THIS LAND IS ZONED RESIDENTIAL–AGRICULTURAL WITH THE FOLLOWING MINIMUM REQUIREMENTS: LOT SIZE–2 ACRES; FRONTAGE–200'; BUILDING SETBACK FROM ALL LOT LINES IS 50'; WETLANDS OVERLAY ZONE: SEPTIC SYSTEMS MINIMUM OF 75' TO ANY WETLANDS; BUILDINGS MINIMUM IS 50' TO POORLY DRAINED SOIL AND 75' TO VERY POORLY DRAINED SOIL. BUILDING ENVELOPE IS 200'x200' OR CONTIGUOUS AREA OF 30,000 S.F. EXCLUSIVE OF SETBACKS, WITH A MINIMUM WIDTH OF 50'

A PORTION OF THIS LAND IS WITHIN THE ACQUIFER PROTECTION OVERLAY ZONE

THIS LAND IS NOT WITHIN THE SPECIAL FLOOD HAZARD AREA (SFHA) ON COMMUNITY PANEL NO.330137–0185–E.

GRAPHIC SCALE:1"=60'
1" 0" 1" 2" 3"

TO CONVERT DISTANCES SHOWN TO METERS, MULTIPLY BY 0.3048006

TOWN OF NOTTINGHAM PLANNING BOARD APPROVAL

DATE: _____

THE SUBDIVISION REGULATIONS OF THE TOWN OF NOTTINGHAM, AND NOTICE OF ACTION ARE A PART OF THIS PLAT, AND APPROVAL OF THE PLAT REQUIRES THE COMPLETION OF ALL THE REQUIREMENTS OF SAID SUBDIVISION REGULATIONS, EXCEPTING ONLY ANY RELAXATION OF REQUIREMENTS GRANTED IN WRITING BY THE BOARD.

THE PURPOSE OF THIS PLAN IS TO SUBDIVIDE LOT 7–1. THE EXISTING AND PROPOSED USE IS RESIDENTIAL.

POOR FARM ROAD IS BELIEVED TO BE CLASS V PUBLIC WAY 3 RODS WIDE.

OWNER OF RECORD: JEFFRFEY & SUSAN PARADIS
BOOK 3281 PAGE 2447

No.	Bearing	Distance
L1	S31°57'40"W	30.95'
L2	S32°11'10"W	52.99'
L3	S57°16'10"W	36.17'
L4	S71°11'50"W	36.59'
L5	S70°24'50"W	64.88'
L6	N17°05'00"W	43.20'
L7	N49°40'30"W	59.63'
L8	N42°00'10"W	28.88'
L9	N59°40'30"E	94.22'
L10	N01°06'30"E	72.12'
L11	N03°46'00"W	82.43'
L12	S30°20'50"W	54.22'
L13	S34°04'30"W	68.63'
L14	S41°39'30"W	38.00'
L15	S30°36'50"W	94.30'
L16	S28°45'20"W	72.38'
L17	S33°04'40"E	48.31'
L18	S58°00'10"E	81.97'
L19	S53°44'50"E	39.99'
L20	S43°31'10"E	64.70'
L21	S38°01'00"E	55.17'
L22	S35°54'00"E	84.23'
L23	S31°23'50"E	64.62'
L24	S32°03'00"E	70.94'
L25	S26°13'10"E	65.86'
L26	S31°51'40"E	51.47'
L27	S25°30'10"E	52.96'
L28	S39°05'00"E	45.48'
L29	S39°41'20"W	90.25'
L30	S41°39'30"W	31.45'

FRANKLIN ASSOCIATES, LLC
LAND SURVEYORS & SEPTIC SYSTEM DESIGNERS
143 RAYMOND ROAD, UNIT 4
CANDIA, NH 03034
TEL. 603–483–3096

SUBDIVISION PLAN
ASSESSOR'S MAP 58 LOT 7–1
41 POOR FARM ROAD, NOTTINGHAM NH
LAND OF
JEFFREY S & SUSAN L. PARADIS
SCALE:1"=60' ~ OCTOBER 18, 2019
SHEET 2 OF 2

REVISED 11–25–19 & 12–16–19 REVIEW COMMENTS

ATTACHMENT D

TEST PIT LOGS

TEST PIT LOG

Inspected by: Jason Franklin
NH Septic Designer #1803

Lot Owner: Jeffery Paradis
Location: 41 Poor Farm Rd
Nottingham, NH 03290
Tax Map 58 Lot 7

Test pits inspected November 21, 2019

SOIL TYPE: 140C- Chatfield- Hollis-Canton Complex
Source: www.websoilsurvey.com

Test Pit 1

0-12"	10YR4/6	Fine Sandy Loam	Massive	Very Friable
12-18"	10YR5/8	Fine Sandy Loam	Massive	Very Friable
18-32"	10YR6/8	Loamy Coarse Sand	Massive	Friable- Compact in place
32-60"	7.5Y5/6	Fine Sandy Loam	Platy	Friable

Notes: No Obs. water; No Refusal
Common, fine roots to 12"
Gravelly 12-32"; Few Cobbles 36-48"
ESHWT at 32"
Estimated Perc Rate- 12min/1"

Test Pit 2

0-4"	10YR2/2	Fine Sandy Loam	Massive	Very Friable
4-36"	7.5Y4/6	Fine Sandy Loam	Massive	Very Friable
36-50"	2.5Y5/6	Loamy Coarse Sand	Massive	Friable
50-60"	2.5Y5/6	Fine Sandy Loam	Platy	Friable-Compact in place

Notes: No Obs. water; No Refusal
Common roots to 24", few fine roots to 36"
Gravelly 36-50"
ESHWT at 36"
Estimated Perc Rate- 12min/1"

TEST PIT LOG

Inspected by: Jason Franklin
NH Septic Designer #1803

Lot Owner: Jeffrey Paradis
Location: 41 Poor Farm Rd
Nottingham, NH 03290
Tax Map 58 Lot 7

Test pits inspected November 21, 2019

SOIL TYPE: 140C- Chatfield- Hollis-Canton Complex
Source: www.websoilsurvey.com

Test Pit 3

0-2"	10YR3/4	Fine Sandy Loam	Massive	Very Friable
2-30"	10YR3/3	Fine Sandy Loam	Massive	Very Friable
30-40"	10YR4/6	Fine Sandy Loam	Massive	Very Friable
40-52"	2.5Y6/6	Sand	Massive	Friable-Compact in place
52-90"	5Y5/4	Coarse Sand	Massive	Friable-Compact in place

Notes: No Obs. water; No Refusal
ESHWT at 50"
Estimated Perc Rate- 12min/1"

Test Pit 4

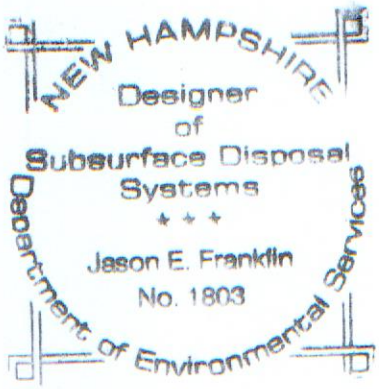
0-2"	10YR3/4	Fine Sandy Loam	Massive	Very Friable
2-12"	10YR3/3	Fine Sandy Loam	Massive	Very Friable
12-24"	2.5Y5/4	Fine Sandy Loam	Massive	Friable
24-36"	2.5Y5/4	Fine Sandy Loam	Massive	Friable-Compact in place
36-48"	5Y5/6	Very Fine Sandy Loam	Massive	Friable
48-56"	5Y5/6	Very Fine Sandy Loam	Massive	Friable
56-72"	5Y4/4	Very Fine Sandy Loam	Massive	Friable-Compact in place

Notes: No Obs. water; No Refusal
Gravelly 24-36"
ESHWT at 36"
Estimated Perc Rate- 12min/1"

TEST PIT LOG

Inspected by: Jason Franklin
NH Septic Designer #1803

Lot Owner: Jeffrey Paradis
Location: 41 Poor Farm Rd
Nottingham, NH 03290
Tax Map 58 Lot 7



Test pits inspected November 21, 2019

SOIL TYPE: 314A- Pipestone Sand
Source: www.websoilsurvey.com

Test Pit 5

0-4"	10YR3/3	Fine Sandy Loam	Massive	Very Friable
4-24"	10YR5/6	Sand	Granular	Loose
24-72"	2.5Y5/6	Gravelly, Coarse Sand	Granular	Loose

Notes: No Obs. water; No Refusal
No Roots
Many Stones and Cobbles 24-72"
ESHWT at 6'
Estimated Perc Rate- 6min/1"

Test Pit 6

0-2"	10YR3/3	Fine Sandy Loam	Massive	Very Friable
2-12"	10YR3/6	Fine Sandy Loam	Massive	Friable
12-24"	2.5Y5/6	Fine Sandy Loam	Massive	Friable
24-60"	5Y5/4	Fine Sandy Loam	Massive	Friable
60-72"	5Y5/4	Coarse Sandy Loam	Massive	Very Friable
72-84"	5Y5/4	Fine Sandy Loam	Massive	Friable-Compact in place

Notes: No Obs. water; No Refusal
No Roots
ESHWT at 48"
Estimated Perc Rate- 12min/1"