Electronic Delivery
February 22, 2024

Sherborn Zoning Board of Appeals
Sherborn Town Hall
19 Washington Street
Sherborn, MA 01770

Re: Comments on "Final" Set of Plans
Farm Road Homes Project
55-65 Farm Road
Sherborn, MA

Chair Novak and Board Members:

Thank you for your continued attention to the matters surrounding the proposed Farm Road Homes development submitted by Fenix Partners Farm Road, LLC (Fenix). We appreciate the opportunities your Board has offered for public comment and participation. We have reviewed the plans and letters submitted by the applicant and have composed this letter to serve as a means to convey our comments and continuing concerns to your Board, as well as copying other Boards and Committees, in writing prior to your next (potentially final) meeting on February 26, 2024.

For the record, this letter may reference one or more of the previous submittals forwarded to your Board, or other Boards, Commissions, Committees of the Town during the last three (3) years of deliberations by various town boards regarding these parcels.

Summary of Concerns

Our concerns fall into five (5) categories:

1. Deed Restrictions (legal, public welfare);
2. Resource Area Delineation (public welfare, environmental);
3. Potential for Flooding (public safety, environmental);
4. Drinking Water (human health, public welfare); and
5. Waste Management (human health, public safety, public welfare, environment).

1. Deed Restrictions

Our review of the records seems to confirm that there remains no genuine dispute that deed restrictions currently prohibit the development proposed on Farm Road (refer to June 2, 2022 letter from Atty. Fenno to Select Board re PE application, August 30, 2023 letter from Moores and Atty. Haverty's response, September 13, 2023 letter from Atty. Fenno to the ZBA, October 3, 2023 letter from the Moores, and January 16, 2024 letter from Atty. Fenno).

We respectfully believe that it remains beyond the Board's jurisdictional powers to render any approval on the Farm Road Homes project without conditioning such approval on some means for properly adjudicating this matter. We also believe that it is for the applicant and proponents of this project to bear those costs since they will be the only parties to benefit from a finding which contradicts the last twenty (20) + years of protections these restrictions have offered our community.

2. Resource Area Delineation

Although the proponents for this project have performed resource area delineation work in a manner not entirely inconsistent with that which is typical for development projects in the Town of Sherborn, the Board members (and Sherborn Conservation Commission) should be reminded that as neighbors and parties potentially negatively affected by the applicant development plans, we attempted to file an appeal with the Massachusetts Department of Environmental Protection as an affected party, only to be denied based on administrative deficiencies that directly resulted from erroneous information offered by the Conservation Commission's own agent.

Our concerns about the efficacy of the resource area delineation work are predominantly driven by the fact that as neighbors, we reside in close proximity and downgradient of the proposed development – as do the resource areas. We rely solely on bedrock groundwater as our only source of potable drinking water, and we have no means to replace this resource if it becomes fouled by the development (see narrative under Item #3 and #4 below).

The "resource areas" should be re-mapped to include the area subject to flooding associated with the Pond on 65 Farm Road. We have offered several iterations of exhibits and letters concerning the flooding of the entire 65 Farm Road meadow area over the last twenty (20) years, including recent drone footage/observations of from December and January flooding event the Pond reaching an elevation of approximately 216.7 feet. Since the time of that drone footage, the Pond elevations were noted to increase even more before finally receding during the last two weeks.

The Wetlands Protection Act (WPA) includes special provisions for this type of feature in 310 CMR 10.57, including the following specific statement of presumption at 310 CMR 10.57(3):

> *"Where a project involves removing, filling, dredging or altering of Land Subject to Flooding (both Bordering and Isolated Areas) the issuing authority shall presume that such an area is significant to, and only to, the respective interests specified in 310 CMR 10.57(1)(a) and (b)."*

The WPA further confirms that the basis for the significance of these interests include all of the following:

- Flood control;
- Storm damage protection;
- Temporary flood storage areas;
- Wildlife habitat for amphibians and reptiles – including vernal pools;
- Hydrologic regime, plant community composition and structure, topography, soil composition, and proximity to water bodies;
- Food, shelter, migratory and overwintering areas, and breeding areas for wildlife;
- Richness and diversity of soil, vegetation, and wildlife; and
- Prevention of pollution.

These features also include the documented presence of a watercourse that runs at or near the surface along this portion of the Farm Road corridor (refer to previous PowerPoint presentation to Board of Health copied to your Board). This watercourse exists across the 65-55-53 Farm Road parcels on the northern side of Farm Road – gaining groundwater and accumulating surface water and runoff from east to west along this axis until it reaches the boundary of our 49 Farm

Road parcel immediately adjacent to our drinking water well. At this point, the intermittent stream turns and travels northerly along the eastern side of the 49/55 Farm Road mutual property line to the point marked as "STREAM" on the Plan entitled "Plan of Land in Sherbon, Massachusetts" recorded with the Middlesex Registry of Deeds as Plan 855 of 2022.

At this point it crosses onto our land – no longer as an intermittent expression of groundwater, rather it is a "perennial" or continuously-running stream meeting the definition of surface water physically connected throughout the entire hydrologic year to the surface waters of Sewall Brook. We have never considered calling this feature an illicit discharge onto our land as it has always been there, rather we have treated it as a resource area protected under the WPA.

Similar to areas subject to flooding, the WPA also includes special provisions for this type of Riverfront Area features in 310 CMR 10.58, including the following specific statement of presumption at 310 CMR 10.58(3):

> *"Where a proposed activity involves work within the riverfront area, the issuing authority shall presume that the area is significant to protect the private or public water supply; to protect the groundwater; to provide flood control; to prevent storm damage; to prevent pollution; to protect land containing shellfish; to protect wildlife habitat; and to protect fisheries."*

The WPA further confirms that further basis for protecting these interests include <u>all</u> of the following:

- Natural vegetation in these areas is critical to sustaining rivers as ecosystems and providing these public values;
- These areas can prevent degradation of water quality by filtering sediments, toxic substances (such as heavy metals), and nutrients (such as phosphorus and nitrogen) from stormwater, nonpoint pollution sources, and the river itself;
- These areas can mitigate flooding and damage from storms by providing recharge, retaining natural flood storage, and decreasing peak discharges to reduce storm damage and slow surface water runoff;
- Sediments, nutrients, toxic substances, and disease-causing bacteria can be detained or trapped in these areas by the plant root systems or soil bacteria preventing them from reaching rivers and coastal estuaries;
- These areas maintain water quality for fish and wildlife;
- These areas serve to provide induced recharge to private and public wells within the watershed – such as the "Downtown District" – and are therefore important to the maintenance of drinking water quality and quantity of the same;
- Land along these in its natural state may exhibit high infiltration capacity and thereby increase the yield of nearby water supply wells – while the absence of such land may lead to contaminants reaching human populations served by nearby wells;
- These areas filter pollutants, reducing or eliminating the need for additional costly treatment;
- Mature vegetation within these areas provides shade to moderate water temperatures and slow algal growth, which can produce odors and taste problems in water;
- These areas promote biological diversity and serve as important wildlife habitats - even for some predominantly upland species; and

- These areas serve as a source of food, shelter, breeding, migratory, and overwintering habitats, and provide corridors for the migration of wildlife for feeding or breeding, and loss of this connective function from activities that create barriers to wildlife movement within riverfront areas, results in habitat fragmentation and causes declines in wildlife populations.

We respectfully believe that both of these features require further delineation and consideration to comply with the intent and obligations established in the WPA.

3. Potential for Flooding

In January, the Pond at 65 Farm rose even higher to elevations believed to be in excess of 217.00 feet. The proponents for this project have disregarded the fact that their testing and measurements collected to 'characterize' site conditions at the 53-55-65 Farm Road parcels were collected during some of the worst drought conditions New England has ever experienced.

We believe that the information and mapping we have already provided to the Board and the Sherborn Conservation Commission indicate that there is a substantial likelihood (>25% probability) that the entire 65 Farm Road meadow will flood each and every year. It follows that further construction, compaction, and alterations of the narrow valley between Mount Misery and Pine Hill will only serve to exacerbate such conditions moving forward.

4. Drinking Water

There are several concerns related to drinking water and the proposed development at 53-55-65 Farm Road. The first concern is that an unacceptable risk to human health within the existing neighborhood population will likely result from the actions of developing the project site, the resulting stormwater and sanitary system infiltrations, or (most likely) both. The second concern is that an unacceptable risk to human health for those new inhabitants who will be purchasing properties in the Farm Road Homes development will, more likely than not, arise from the same action(s). The third and final concern is that the long-term viability of the one and only resource on which our existing neighborhood relies for their drinking water (groundwater within bedrock) may be depleted or irreparably damaged by the same action(s).

Based on our review, and the review of our experts, the nitrogen loading and groundwater mounding analyses provided by the applicant cannot be relied on to protect our resources or prevent the concerning damages based on the fact that they remain riddled with mis-representations, errors, and omissions. Furthermore, the narrative portions of the submittals present false and mis-leading information that downplays what should be considered unacceptable levels of risk, and these narratives have yet to be changed or rectified by the applicant.

One example is the application's use of the descriptive terms "downgradient" and "crossgradient." These terms are completely misleading when it comes to describing the relationship between nearby private water supply wells and the proposed on-site stormwater and sanitary septic systems. The application should only use these terms in situations where the potential receptor resides in the same unconsolidated overburden medium as the proposed discharge feature – such as when they are discussing wetlands or surface water.

Although the surface components (well head, etc.) of these receptors is located either at or immediately below grade is true, but the boreholes extend to hundreds of feet below these surface features at grade, and well pumps placed within these wells typically rest on stringers of similar length. This places these private water well intakes hydraulically beneath those surface and near-surface features . . . and as we all know what loves flowing downhill!

Other concerning examples include Hydraulic Conductivity values on the order of magnitude of 2.0E+01 feet per day. Although some empirical references have been offered for use of these "K values", our critique of his methodology clearly identifies the specific errors that were presented by the applicant within his own calculations that led to the wrong hydraulic conductivity values (please refer to specific errors identified in our previous *"Additional Comments on Farm Road Homes - Title V Plans and Nitrate/ Mounding Concern"* dated December 15, 2023).

Despite obvious errors and omissions, the applicant has refused to correct their erroneous K value/hydraulic conductivity within their design specifications. This value is at least an order of magnitude off, resulting in favorable assumptions that would ascribe the physical properties of Truro beach sand to the differentiated matrix of "Swansea Muck".

Recent literature confirms that the applicant's reliance on only selective empirical equations to estimate K value/hydraulic conductivity from grain-size distribution for this complex geologic setting could lead to errors ranging over 500% (Rosas, 2013), and that reliance on grain-size analyses for this purpose was discouraged to accurately characterize aquifers accurately since it is not sufficiently reliable (Elhakim, 2016)[1]. Furthermore, the hydraulic conductivity of *saturated* soils (K_{sat}) is typically an even smaller value based on the principles of fluid dynamics and interfacial tension(s).

Only once these basic scientific principles have been corrected, the potential risks of the applicant's project may be fully vetted, but their insistence on using faulty input values only impedes the Board's ability to work with the peer reviewer to properly characterize and weigh the risk(s) these systems pose to the regional drinking water resource.

At considerable personal expense, we have retained Scott Horsley to prepare and submit a Nitrate loading model for the combined septic system designed for the Farm Road Homes project. This model is included here at Attachment A and Horsley's analyses confirms that nitrates emanating from the septic system will reach the property line (and wetlands/riverfront area) ***at a concentration equivalent to or above the 10 milligrams per liter (mg/l) standard*** – a condition that poses an unacceptable level of risk to human health and public safety. It also suggests that the nitrates will flow in multiple directions, likely also impact those additional private water supply wells situated at 53 Farm Road and 55 Farm Road.

---

1 - Águila, J.F., McDonnell, M.C., Flynn, R. *et al.* Comparison of saturated hydraulic conductivity estimated by empirical, hydraulic and numerical modeling methods at different scales in a coastal sand aquifer in Northern Ireland. *Environ Earth Sci* **82**, 327 (2023). https://doi.org/10.1007/s12665-023-11019-6.

Rosas J, Lopez O, Missimer TM, Coulibaly KM, Dehwah AHA, Sesler K, Lujan LR, Mantilla D (2013) Determination of hydraulic conductivity from grain-size distribution for different depositional environments. Groundwater 52(3):399–413. https://doi.org/10.1111/gwat.12078

Elhakim AF (2016) Estimation of soil permeability. Alex Eng J 55:2631 2638. https://doi.org/10.1016/j.aej.2016.07.034

This model also shows that the groundwater mounding modelling conducted by the Applicant's engineer relied on a "Constant Head" model to analyze the combined septic system's impact at the downgradient wetlands/riverfront area. This is a completely erroneous application of this type of model. The Applicant's use of such a model means that they have calibrated their model to project the conditions under a given constant head potential at the downgradient wetlands. ***To put this more plainly, the model used by the applicant was calibrated in such a way that it could never, under any circumstances, yield any output that would demonstrate that the Sherborn Conservation Commission has a basis for jurisdiction over the applicant's construction of this feature.*** This is analogous to presenting color-dependent data to a jurisdictional body on a black-and-white monitor, and the acceptance of the model may unintentionally eliminate the Sherborn Conservation Commission's ability to exercise their statutory powers.

Above and beyond the use of models which mis-represent the impacts of these features, the physical limitations of the property for such a large-scale development seem to place additional undue burdens on the prospective future owners of these homes. The potential reliance on a series of private water supply wells – while feasible – also seems to increase additional potential risk to those who will be purchasing these new residences. Given how obvious it is to the common observer that it will take time for conditions at this property to evolve from their present 'static' situation (e.g., pre-development conditions) to the more dynamic developed conditions (e.g., post-redevelopment).

It may take several months, or even a few years, to achieve post-redevelopment "steady-state" conditions at this property, and this fact enforces the need for a trust-but-verify approach to ensuring the integrity, quality, and quantity of potable water for these new inhabitants. Without the front-end protections offed in the state regulations for testing, analyses, maintenance, and evaluation/approval, it seems as though the proponents are simply kicking the responsibility "down the road" to avoid these challenging - and yes, potentially more costly – obligations.

Taking recent examples from other multi-well supply situations faced by inhabitants of Sherborn, Attachment B offers an independent example of how multiple water supply wells situated in close proximity to one another, may offer significantly different yields and quality. Given conditions such as these, multiple municipal boards and committees have recommended to your Board that a project of this magnitude simply deserves all of the benefits and protections a properly-permitted, -engineered, and -tested Public Water Supply has to offer.

5. Waste Management

As of the date of this letter, it has been more than 180 days after the Board has opened the public portion of the meeting on the Farm Road Homes 40B development project, and no one appears to be in receipt of the applicant's stormwater management plans for this development.

Notwithstanding the fact that the applicant's 'final' Title V plans were submitted and posted less than a few days* before the last Board meeting (*on a Sunday), and disregarding the fact that the applicant's design team continues to present and rely on **incorrect and misleading** metrics and standards in their plans and calculations, we feel it is entirely inappropriate for the Board to be forced into rendering decisions that so obviously have the potential to directly affect human health, safety, public welfare, and the environment without the benefits of sufficient time for a thorough and thoughtful review of the plans.

Another alarming aspect this this project that has yet to be discussed at any of the forums we have attended is the fact that there is a substantial likelihood that bedrock will be encountered during this process, and that portions of this project may require the disturbance, breaking, and/or removal of bedrock. In two (2) recent instances, similar work within this Town ***has resulted in the mobilization of toxic levels of metals, such as arsenic, lead, and manganese within the nearby residential private water supply wells.*** These dissolved metals travel extremely fast through open bedrock pore space (e.g., "fractures") - velocities more than 100 times faster than those found in saturated overburden material – meaning that the effects of bedrock disturbance during development may result in nearly instantaneous risk of harm to human health in the surrounding community if precautions or prohibitions are not established ahead of time.

As discussed earlier, the fact that all neighborhood residents rely on the groundwater present within these bedrock fractures, and the fact that all nearby private water supply wells have their pumps/intakes set dozens of feet, if not hundreds of feet, below those depths where such disruption would be occurring during this project, there appears to be no safe way to feasibly condition any disruption of bedrock during this project.

The proponents for this project have presented plans depicting surveyed bedrock outcrops at various locations within the development area on their engineered plans, while at the same time claiming average overburden depths of 15 feet or more within the same locus. It seems that these two (2) contrary positions should not co-exist in an area where the applicant is planning on relying on the overburden to adsorb and treat stormwater and septic systems discharges without risking the currently clean and potable water present in the underlying bedrock.

One type of conditions that may be considered to address these disparities would be bedrock profiling using remote sensing techniques to ensure that bedrock disturbances are minimized/ avoided and a proper characterization of the overburden is available for the associated nitrogen and mounding analyses.

Conclusion and Recommendations

Our review of the information that has been prepared and submitted by the applicant as of February 15, 2024 - the 180th day anniversary of the opening of this hearting - has established that misleading and erroneous information has been presented to the various Boards and Committees of the Town within the plans presented for the Farm Road Homes development. The voluminous nature of information presented by the proponents of the development, combined with the timing of the submittals and the statutory requirements placed on your board for an expeditious review, places an unacceptable burden on the Town of Sherborn and her boards, committees, and abutters. We would recommend that the Board offer the applicant the opportunity to retract their application in its entirety and come back when the comprehensive permit plans are ready for 'prime-time'.

We further contend that the applicant has the burden of proof to demonstrate show that the restrictions are not in force, and they can develop more than one (1) additional single family home as originally contemplated and agreed to in the "common scheme." If, after deliberation, the Board feels compelled to move forward with a Conditioned Approval of the project, we

simply ask that the following specific items be considered as potential conditions on any such decision:

a> Proper adjudication of the property restriction issue, including the potential calling of a special Town meeting to vote on the Town's waiver of their rights to enforce the conservation restriction (if necessary);
b> Compliance with nitrate and mounding standards which are protective of human health in this Nitrogen Sensitive Area – including the use of models to predict how on-site stormwater retention and discharge systems will affect groundwater flow;
c> EHIR and Bedrock Profiling and Fracture Flow Analyses to evaluate risks to the neighbor's groundwater supply wells posed by condensing the equivalent of the entire Great Rock Road/Peckham Hill neighborhood onto a single parcel nestled between a Pond and the headwaters of Sewall Brook;
d> Satisfactory modelling and compliance with the 10 mg/l nitrate thresholds using an appropriate model to incorporate mounding which are protective of environmental resources and receptors such as private water supply wells, the wetlands, DEP-approved Zone II Wellhead Protection Areas, surface water quality, and riverfront areas;
e> New delineation and evaluation of the environmental resource areas that are subject to protection under the Wetlands on the 65 Farm Road parcel itself, especially those areas that are subject to periodic flooding (please refer to recent submission demonstrating a 25% annual flooding probability based on last 20 years of site data) or areas that qualify as Riverfront Areas under the WPA;
f> Potentially limiting the total number of dwellings or rooms within the proposed development to a reasonable amount that is commensurate with by-right development and what the physical characteristics of the property will allow under Title V; and
g> We recognize that the Board may not be in a position to require the establishment of a performance bond or other Financial Assurance Mechanism designed to provide assistance or recourse to those nearby owners whose private water supplies are directly jeopardized by the proposed development; but we ask that they consider imposing a requirement on the applicant to conduct annual testing costs for all household water supplies within ½ mile of the development.

In conclusion, we are of the opinion that (as of the date of this letter) the reason the applicant is incapable of providing full, complete, and accurate set of septic and stormwater development plans which comply with the relevant standards is very simple – the engineering and scientific limitations of this particular property render it incapable of supporting thirty-two (32) dwelling units with more than 70 bedrooms in a manner that complies with the relevant standards of care intended to be protective of human health, safety, public welfare, and the environment.

We support affordable housing, and living in a small 1200 square foot home surrounded by wetlands, we fully appreciate the limitations of the land around and do not oppose development that follows local environmental bylaws and zoning laws. We appreciate the applicant's goal to increase Sherborn's SHI but feel the need to stand up for ourselves and protect our interests and our neighbors' interests in clean drinking water and wetlands that should be protected.

Thank you again for your continued attention in these matters, we continue to appreciate having an opportunity to voice our concerns and look forward to your deliberations on this project.

Most respectfully,

Brian D. Moore
Mary O. Moore
49 Farm Road
Sherborn, MA 01770

Attachment A

Scott Horsley
Groundwater Mounding and Nitrate Loading Analyses

Scott Horsley
Water Resources Consultant
39 Chestnut Street • Boston, MA 02108 • 508-364-7818

February 22, 2024

VIA EMAIL

Mr. Brian Moore
49 Farm Road
Sherborn, MA
Re: Farm Road 40B, Sherborn, MA

Dear Brian:

At your request I have reviewed the most recent reports and groundwater modeling results prepared by Creative Land and Water Engineering (CLWE) associated with the proposed 40B development at Farm Road, Sherborn, MA. The proposed project is located adjacent to your property and is hydrologically upgradient from your property. I understand that you and several of your neighbors have private drinking water supply wells on your properties. I also understand that your property contains a jurisdictional wetland projected under the Massachusetts Wetlands Protection Regulations.

The Sherborn Health Regulations require a detailed review of water quality impacts of the proposed project. The Health Regulations also require an "Environmental Health Impact Report" for all developments that exceed 2000 gallons/day. The Regulations require *"Impact estimation shall be performed by employing a site-specific mass balance analysis of the area of impact (in accordance with MassDEP's Guidelines for Title 5 Aggregation of Flow and Nitrogen Loading [2/22/2016] associated with 310 CMR 15.216) or a comparable approach approved by the Board". The report shall meet the criteria required by this and all other applicable Board of Health regulations, and shall provide specific information relative to the operation of the proposed sewage treatment and disposal systems, including soil conditions, surface drainage calculations, hydrogeologic descriptions of groundwater resources and movement, effects of precipitation, and wastewater treatment methodology".*

The Applicant submitted a Hydrogeologic Evaluations Report prepared by Creative Land and Water Engineering (CLWE) dated December 11, 2023 and an Appendix Supplementary Data for Groundwater Mounding Analysis and Updated Groundwater Mounding Analysis and Nitrogen Loading Appendix dated February 2024. These reports include groundwater mounding analyses and nitrogen loading analyses that are based on methods inconsistent with MADEP guidelines and hydrologic assumptions that are not substantiated with onsite measurements.

1. Groundwater Mounding Comments

The CLWE groundwater mounding analysis is based upon permeability values calculated from Title 5 percolation tests (see figure 1). Percolation tests measure unsaturated infiltration rates above the water table. Groundwater mounding analysis requires saturated permeability (hydraulic conductivity)values from field tests below the water table.

7.2 Percolation and Permeability Test.

Creative Land & Water Engineering, LLC (CLAWE) has been conducting a hydrogeologic study of the site in accordance with 310 CMR15 for a common large Title 5 Septic system. CLAWE conducted eight deep hole soil observations successfully, 4 percolation testing to show consistent soil conditions throughout the SAS area. See Figure 6 for locations. Soil logs are presented in Appendix B. The tests were witnessed by Mr. Mark Oram of Sherborn Board of Health Agent. CLAWE's soil evaluation and percolation tests showed that the soil in the proposed SAS area has a percolation rate between 3 min/in to 5 min/in, which confirms the very permeable soil condition in this area. Based on the percolation rate, a permeability of 24 ft/day hydraulic conductivity is recommended to be used for groundwater mounding analysis. The detailed test results are attached in Appendices B and C.

Figure 1 – Excerpt from Hydrogeologic Report prepared by CLWE, December, 2023

The MADEP Stormwater Handbook clarifies this and states *"A Title 5 percolation test is not an acceptable test for saturated hydraulic conductivity. Title 5 percolation tests overestimate the saturated hydraulic conductivity rate".*

CLWE presents grain size analysis as another method to estimate hydraulic conductivity. However, the report simply presents the results of the grain size analysis, then selects the value of 24 feet/day which they calculated from the percolation tests (see Table S3 from the CLWE report below). The grain size analysis provides a broad range of hydraulic conductivity values that differ by an order of magnitude or more.

Table S3. Summary of hydraulic conductivity (permeability) analysis

Soil Sample	Location	estimated K, ft/day	Average K, ft/day	Typical K for silt/sand*	Design K	Soil texture per USDA
S1	lower edge of SAS	29-850	439	153	24	medium sand
S2	upper edge of SAS	4.39-76	40	28		medium loamy sand
SA1	Stormwater Basin A	0.52-8.5	4.51	28		medium sand loam

The most reliable method to determine hydraulic conductivity is to conduct an on-site, in-situ Permeability tests. The MADEP Stormwater Handbook (Volume 3, Chapter 1) provides clear guidance on how to properly conduct these tests as follows. To my knowledge CLWE did not apply these methods.

a. Field test methods to assess saturated hydraulic conductivity for the "Dynamic Field" method must simulate the "field-saturated" condition. See ASTM D5126-90 (2004) Standard Guide for Comparison of Field Methods for Determining Hydraulic Conductivity in the Vadose Zone. The saturated hydraulic conductivity analysis must be conducted by the Competent Soils Professional. Acceptable tests include:

i. Guelph permeameter - ASTM D5126-90 Method
ii. Falling head permeameter – ASTM D5126-90 Method
iii. Double ring permeameter or infiltrometer - ASTM D3385-035, D5093-026, D5126-90 Methods
iv. Amoozemeter or Amoozegar permeameter – Amoozegar 1992
[1] MADEP Stormwater Handbook, Volume 3, Chapter 1, page 11.
c. A Title 5 percolation test is not an acceptable test for saturated hydraulic conductivity. Title 5 percolation tests overestimate the saturated hydraulic conductivity rate.

Another critical input to the groundwater mounding model is saturated thickness. This is the vertical dimension (or depth) of groundwater measured from the water table downward to the underlying bedrock (or other confining layer such as glacial till). The CLWE report misinterprets their test pit data and reports the saturated thickness as the depth from the land surface to the water table (instead of the water table downward to the bedrock or confining layer). On page 4 of the Nitrogen Loading Appendix the report states, "The saturated soil thickness of 14.5 ft will be used to update the groundwater mounding analysis". The 14.5 feet figure is the depth to water table and is reported on page 11 of the Hydrogeologic Evaluations Report. It states, "We made an extra effort to use large machinery and get to water in the two lower test pits, DHTP 55-10AN and DHTP 55-11AN, which had water at the depth of about 14.5 ft to 18 ft". This are not saturated thickness, it is the depth to the water table.

In fact, the actual test pit data provided by CLWE shows only a saturated thickness of 3.96 feet. Table 3.1 from the Hydrogeologic Evaluations Report (shown below) summarizes the test pit data and shows the estimated seasonal high groundwater (ESHGW) or water table and the bottom of hole (test pit) – the difference is the measured saturated thickness. Although I agree that there is likely to be additional saturated thickness beneath the test pit elevations, the selection of 14.5 feet or 20 feet (later in the report) as a saturated thickness is not supported by the data.

Table 3.1 - SAS Soil Testing Summary

Test Pit #	Test Date	GSE (ft)	Depth to pit bottom (ft)	Soil Texture	Adjusted Depth to HGW (ft)	Water adjustement, ft	EHGW, ft	Perc rate, mpi	Perc depth, in	Bottom Hole El, ft	Ledge Note: L=ledge;N=no ledge; U=unknown	
DHTP 55-10	4/23/2021	196.92	11.25	Co. M. L.S.	9.42		187.50			185.67	N	well installed,upslope, dry
DHTP 55-10An	4/23/2021	192.10	14.50	Co. M. L.S.	11.17		180.93			177.60	U	Well installed,lower SLP, some weeping
DHTP 55-11	4/23/2021	201.00	16.00	Co. M. L.S.	13.75	1.83	187.25	4.00	54.00	185.00	N	Well installed, upslope, dry
DHTP 55-11An	4/23/2021	193.92	18.00	Co. M. L.S.	14.42		179.50	3.00	54.00	175.92	U	Well installed, lower SLP, some weeping
DHTP-55-11B	4/23/2021	194.00	10.00	Co. M. L.S.	n/t		n/t			184.00	U	No well, confirm soil, mid slope, dry
DHTP 5-1	11/24/2021	195.04	14.50	Co. M. L.S.	10.54		184.50			180.54	N	Well installed, lower SLP, dry
DHTP 5-2	11/24/2021	200.77	17.49	Co. M. L.S.	12.86	2.38	187.91	5.00	64.00	183.28	N	well installed, upslope, dry
DHTP 5-3	11/24/2021	198.04	16.66	Co. M. L.S.	13.53		184.51	3.00	60.00	181.38	N	well insttalled, upslope, dry

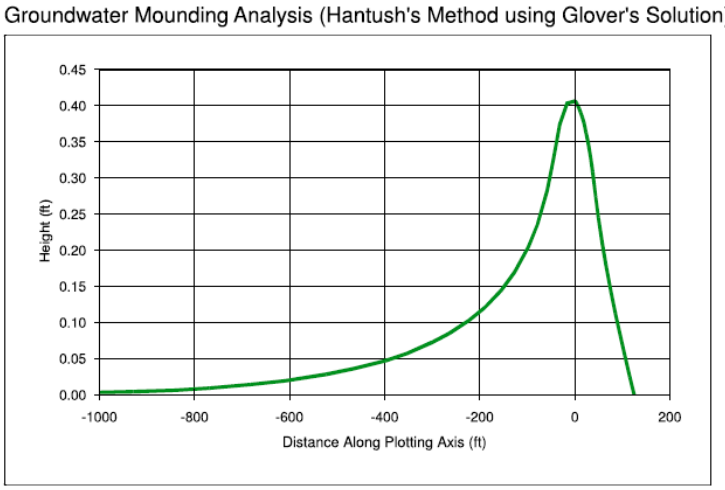
maximum measured saturated thickness = 3.96'

Note: 1. Nearby downgradient wetland is at elevation of 177-178, which is in line with the weeping water elevation in Test pits DHTP-11An and DHTP-10An; 2. Except the two test pits, other test pits were dry and no water measured and the water table based on the depth of hole is a conservative estimate and normally will not be considered.

Finally, and perhaps most importantly the CLWE groundwater mounding model places a constant head boundary at 125 feet from the wastewater disposal field (see figure 3 below). A constant head boundary means that water levels are fixed and cannot change as a result of the model.

The wetland adjacent to the wastewater system is approximately 125 feet from the wetland. This means that the model is constructed in a way that cannot predict any water level changes in the wetland. This defeats one of the principal purposes of the groundwater mounding analysis – to evaluate impacts on the adjacent wetland.

The MADEP Stormwater Handbook Volume 3, Chapter 1 (page 28) states, *"The mounding analysis must also show that the groundwater mound that forms under the recharge system will not break out above the land or water surface of a wetland (e.g., it doesn't increase the water sheet elevation in a Bordering Vegetated Wetland, Salt Marsh, or Land Under Water within the 72-hour evaluation period)".* My experience indicates that MADEP does not allow more than a 0.1-foot alteration of water levels at wetland boundaries.



COMPANY: CLAWE

PROJECT: Farm Road Homes - SAS 3

ANALYST: Desheng Wang

DATE: 2/2/2024 TIME: 10:54:47 AM

INPUT PARAMETERS

Application rate: 0.1 c.ft/day/sq. ft
Duration of application: 90 days
Fillable porosity: 0.26
Hydraulic conductivity: 24 ft/day
Initial saturated thickness: 14.5 ft
Length of application area: 82 ft
Width of application area: 46 ft
Constant head boundary used at: 125 ft
Plotting axis from Y-Axis: 0 degrees
Edge of recharge area:
positive X: 0 ft
positive Y: 41 ft
Total volume applied: 33948 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
0	-1000	-1000	0
0	-841	-841	0.01
0	-681.9	-682	0.01
0	-522.9	-523	0.03
0	-397.9	-398	0.05
0	-301	-301	0.07
0	-221.8	-222	0.1
0	-154.9	-155	0.14
0	-96.9	-97	0.2
0	-58	-58	0.28
0	-31.5	-32	0.37
0	0	0	0.41
0	3.9	4	0.4
0	7.2	7	0.4
0	12.1	12	0.39
0	19.4	19	0.38
0	27.7	28	0.35
0	37.6	38	0.31
0	49.7	50	0.24
0	65.4	65	0.18
0	85.2	85	0.11
0	105.1	105	0.06
0	125	125	0

Figure 3 – Excerpt from CLWE report – Groundwater Mounding Analysis

2. Area of Impact (Plume) Comments

The CLWE analysis misinterprets their own groundwater mounding analysis and conflates predicted water table rises with groundwater flow directions. The model predicts small rises in the water table at a distance of 841 feet from the wastewater disposal area (see Figure 3 above). They have misinterpreted this as the outer lateral bounds of the Area of Impact (or plume). The groundwater mounding predictions must be integrated with the existing (pre-development) water table to determine post-development groundwater flow directions for the purpose of determining the Area of Impact.

The CLWE reports states, *"The groundwater mounding analysis shows that plum(e) will spread out 841 ft on each side of the SAS fields and will cover the entire western property line, which received ground water recharge from about 25.57 acres and 22.88 acres of land net for nitrogen loading excluding 53 and 55 Farm Road and including off site town conservation open space to the northeast"*. This grossly overstates the area of impact and inaccurately dilutes the wastewater effluent. It conflates groundwater mounding and groundwater flow net analysis.

3. Suggested Revisions to Groundwater Mounding Analysis

I have re-run the groundwater mounding model (Hantush) using more conservative values for hydraulic conductivity and saturated thickness but maintaining other inputs to the model in accordance with CLWE's estimates. Because there are no available in-situ permeability tests (as recommended by MADEP) I selected the most conservative hydraulic conductivity values presented in CLWE's Table S3 (shown below). I assumed a saturated thickness of 8 feet (twice the value that CLWE measured).

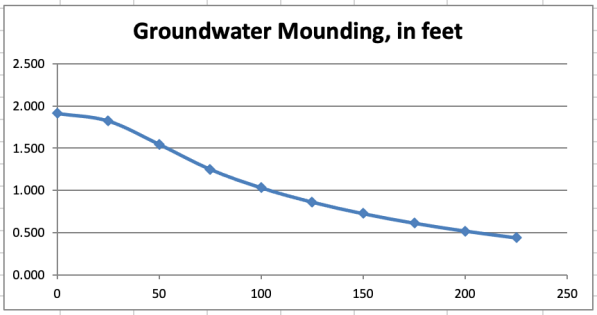
The results of the modelling shows significant groundwater mounding directly underneath the wastewater disposal field at 1.9 feet and 0.7 feet at the wetland. The results at the stormwater infiltration facility indicate groundwater mounding of 8.5 beneath the system and 2.0 feet at the wetland boundary. To my knowledge CLWE has not reported on groundwater mounding at the stormwater infiltration facility.

My analyses indicate that the groundwater mounding associated with the stormwater and wastewater facilities will overlap causing cumulative impacts. They need to be evaluated together. The stormwater mounding will redirect (or push) the wastewater effluent further south in the direction of the private wells on neighboring properties. The CLWE analysis does not provide groundwater mounding for the stormwater facility and clearly does not address the cumulative impacts between the stormwater and wastewater facilities.

0.0980	*R*	Recharge (infiltration) rate (feet/day)	0.67	1.33	
0.260	Sy	Specific yield, Sy (dimensionless, between 0 and 1)			
16.70	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00	In the repo
46.000	x	1/2 length of basin (x direction, in feet)			SIR 2010-5
41.000	y	1/2 width of basin (y direction, in feet)	hours	days	assumed t
90.000	t	duration of infiltration period (days)	36	1.50	conductivit
8.000	hi(0)	initial thickness of saturated zone (feet)			
9.912	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)			
1.912	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)			

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.912	0
1.823	25
1.547	50
1.251	75
1.033	100
0.863	125
0.727	150
0.614	175
0.520	200
0.441	225

Re-Calculate Now

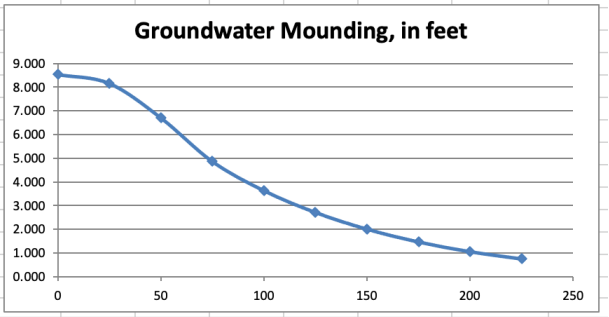


Disclaimer

Input Values			inch/hour	feet/day	
0.4475	*R*	Recharge (infiltration) rate (feet/day)	0.67	1.33	
0.260	Sy	Specific yield, Sy (dimensionless, between 0 and 1)			
4.50	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00	In the rep
50.000	x	1/2 length of basin (x direction, in feet)			SIR 2010-5
15.000	y	1/2 width of basin (y direction, in feet)	hours	days	assumed t
90.000	t	duration of infiltration period (days)	36	1.50	conductivi
8.000	hi(0)	initial thickness of saturated zone (feet)			
16.540	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)			
8.540	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)			

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
8.540	0
8.163	25
6.713	50
4.870	75
3.638	100
2.719	125
2.013	150
1.471	175
1.061	200
0.757	225

Re-Calculate Now



Disclaimer

4.0 Nitrogen Loading Analysis

As part of my previous analysis and presented in my November 5, 2023 letter I applied the nitrogen loading method as outlined in MADEP's *"Guidelines for Title 5 Aggregation of Flows and Nitrogen Loading 310 CMR 15.216"* as required by the Sherborn Health Regulations. These guidelines stipulate that for proposed wastewater flows exceeding 2000 gallons per day adjacent to areas served by private drinking water wells that nitrate-nitrogen concentrations must be maintained below 10 mg/liter at the downgradient property boundary.

To determine groundwater flow directions on the subject property I plotted existing groundwater elevations provided by the applicant's consultant, Creative Land and Water Development. A series of test pits shown on the site plans provide estimated seasonal high groundwater (ESHGW) elevations. Utilizing this data I constructed a water table map (highlighting the 195-foot contour) which indicates groundwater flow in a westerly direction.

Based upon these groundwater flow directions I delineated two Areas of Impact (AOI). The northerly AOI is downgradient of the proposed 40B development septic system and the southerly AOI is downgradient of septic systems on two adjacent lots. The locations of the septic systems are shown on a basemap prepared by Creative Land Development dated September 28, 2023 (see figure 4).

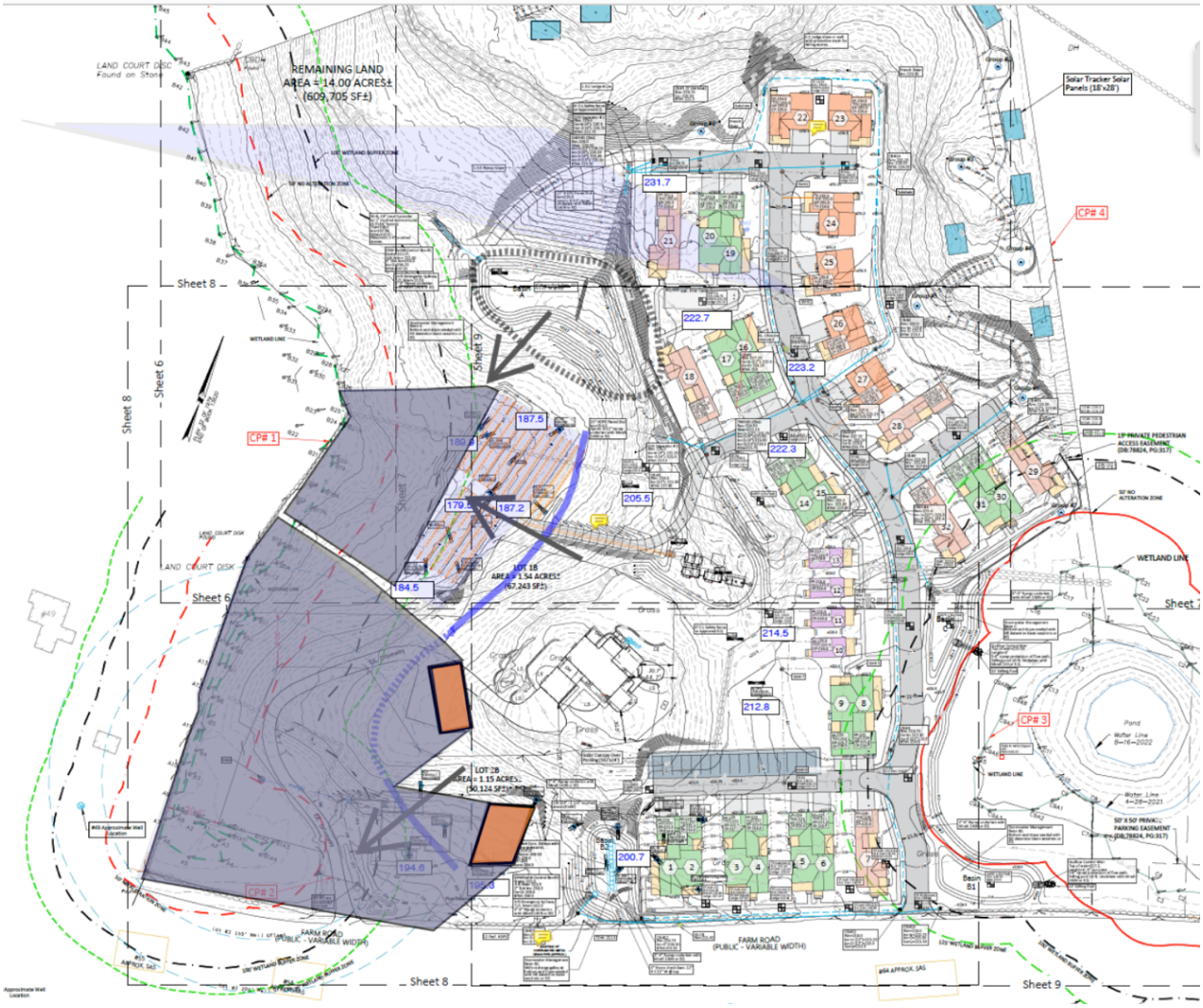


Figure 4 – Areas of Impact

I then calculated the resulting nitrogen concentrations at the downgradient property boundary adjacent to your parcel (see Table 1). I applied an average wastewater concentration of 35 mg/liter for Title 5 systems on the two adjacent lots and a concentration of 19 mg/liter for a potential innovative and alternative (I&A) septic system at the 40B project site.

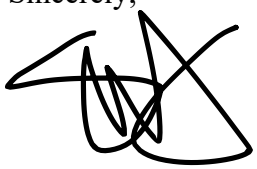
This analysis indicates that the proposed wastewater discharges will result in nitrate-nitrogen concentrations in excess of state and federal drinking water standard of 10 mg/liter for nitrate-nitrogen at the property boundary of your land. There is an additional drinking water well on the adjacent lots within the Area of Impact that will also be degraded by the wastewater discharges.

Table 1 – Summary of Nitrogen Loading Analysis

	Adjacent Lots	40B	40B
Wastewater design flow (gals/day)	880	8360	8360
Source Concentration (mg N/liter)	35	35	19
Concentration at Property Boundary (mg N/liter)	15.8	26.9	14.6

This analysis is provided as a preliminary/conceptual assessment. A more detailed analysis of these impacts is required by the Sherborn Board of Health Regulations and should be provided by the applicant. This assessment should be updated and revised to include the cumulative groundwater mounding impacts associated with the proposed stormwater and wastewater disposal systems. This will redirect the wastewater plume associated with the 40B septic system further south. A more detailed analysis of the cumulative impacts is required.

Sincerely,



Scott Horsley
Water Resources Consultant

Attachment B

OnSite Engineering Report
September 21, 2020

ONSITE ENGINEERING INC.
Water, Wastewater and Stormwater Specialists

September 21, 2020

Mr. Chris Culberson, Manager Water
WhiteWater, Inc.
253B Worcester Road
Charlton, MA 01507

Re: Woodhaven/Leland Farms Water Supply Feasibility Study
Town of Sherborn

Dear Mr. Culberson:

In accordance with our Agreement, we have prepared this letter report to summarize our findings and recommendations from the Woodhaven/Leland Farms Water Supply Feasibility Study. The purpose of the study is to evaluate the feasibility of interconnecting the public water systems serving the Woodhaven Elderly Housing Complex and the Leland Farms Condominiums both located off Village Way in Sherborn, Massachusetts. It is our understanding that various water supply, quality and treatment issues have impacted the ability to provide a reliable, cost-effective public water supply to the Leland Farms Condominiums. The Woodhaven Elderly Housing Complex, located adjacent to Leland Farms, has its own public water supply system with excess supply, reliable treatment and storage components, and adequate financial capacity. The study evaluates the water supply capacity, water quality and permitting implications, and costs associated with interconnecting the two water systems.

Water System Information

Leland Farms is a community Public Water System (PWS ID#: 3269028) that consists of a seventeen unit (10 affordable units and 7 market rate units) condominium complex housed within 5 buildings built in 1999. The dwelling units are distributed among the buildings as follows: 10 Leland Farm Road Building #1 (Units 1 thru 5), Building #2 (Units 6 thru 8), Building #3 (Units 9 thru 13), Building #4 (Units 14 thru 16) and 5 South Main Street (one unit). The Woodhaven Elderly Housing Committee ("Woodhaven"), formerly known as Woodhaven Elderly Housing or Sherborn Elderly Housing, is a community Public Water System (PWS ID#: 3269002). Woodhaven consists of a 24-unit rental complex of three separate buildings, built in 1983, with one and two bedroom apartments open to seniors that live independently. The Leland Farms and Woodhaven PWS's serve a population of approximately 25 residents and 30 residents, respectively, on a year round basis. The properties are listed at the Sherborn Assessor's office as occupying two parcels of land: Parcel IDs 11-0-53 (0.75 acres) and 11-0-165 (14.04 acres, 6 acres of which is leased to Leland Farms).

The Leland Farms water system consists of a single bedrock well (01G) located in the northern section of the site, which fills a 5,000 gallon below grade atmospheric tank. The well has an approved daily withdrawal volume of 4,000 gallons per day (gpd) and a Zone I radius of 190 feet. The well is 900 feet deep and equipped with a 15 gallon per minute (gpm) submersible pump. A vacuum primed pumping system with two hydropneumatic tanks draws water from the storage tank and pumps raw water through an ion exchange softening treatment system for iron and manganese removal, and an ultraviolet (UV) system for disinfection. A hydropneumatic tank is installed after the UV system where treated potable water enters the distribution system. The potable water system has an emergency generator for backup power located adjacent to the 5,000 gallon atmospheric tank.

The Woodhaven water system is served by three groundwater sources (01G, 02G and 03G) each with an approved daily withdrawal volume of 1,000 gpd and a Zone I radius of 100 feet. Based on available records, Well 1 appears to be equipped with a 5 gpm submersible well pump and Well 2 with a 7 gpm submersible well pump. Due to water quality issues, including high levels of manganese, Woodhaven Well 3 is utilized as an emergency backup source only. No information was found regarding the model or pumping capacity of the submersible pump in Well 3. The water is pumped from the wells through a sediment filter and water softener system to a 1,500 gallon water storage tank. Water from the storage tank is pumped through another sediment filter and UV disinfection system to distribution. Individual hydropneumatic tanks are located in each of the three Woodhaven buildings. An emergency generator is available for use in the event of a power outage. The site(s) layout are shown on Figure 1 and the components associated with the two water systems are summarized on Table 1.

Water Supply Evaluation

In accordance with our scope of work, we completed an evaluation of the existing water supplies from both sites and their ability to meet the demands of the two complexes. Water demands are met separately for the two water systems via a single well at Leland Farms and two active wells (and one emergency well) at Woodhaven.

Water usage at Woodhaven is metered via separate meters located on each well line as they enter the pump room. Water is recorded regularly by the Certified Operator and is summarized on a yearly basis within the Annual Statistical Report (ASR). Based on the ASR's, the average water use at Woodhaven over the past three years was 1,139 gpd and the maximum average monthly usage was 1,877 gpd. Similarly, Leland Farms water usage is metered after the atmospheric water storage tank, prior to treatment and is summarized on a yearly basis within the ASR. According to the ASR, the Leland Farms site had an average water usage of 2,025 gallons per day (gpd) between 2016 and 2018, and a maximum average monthly usage of 3,381 gpd. The total average day demand for the site is therefore 3,164 gpd, and the maximum estimated daily demand

is 5,258 gpd. The water demand data is summarized on Table 2 and a compilation of the water use data is included in Attachment A.

Table 1
Water System(s) Description
Woodhaven/Leland Farms Water Supply Feasibility Study
Sherborn, MA

Item	*Leland Farms Manufacturer/Model*	*Woodhaven Manufacturer/Model*
6-inch diameter Bedrock Wells	01G = 900 feet deep	01G = 400 feet deep 02G = 505 feet deep 03G = 400 feet deep
Submersible Well Pump	3 HP, 15 gpm	01G = 1 HP, 5 gpm 02G = 1 HP, 7 gpm 03G = Unknown
Atmospheric Tank	5,000 Gallon Below-Grade (located prior to treatment)	1,500 Gallon Above-Grade (located after softener)
Booster Pump System	Pump #1 & #2 – 1.5 HP, TDH=185.7 ft, 15.41 gpm Pump #3 (offline) – 5 HP, TDH=241.8 ft, 53.27 gpm	Three (3) VFD booster pumps with SyncroFlo control panel (located after atmospheric tank, prior to UV)
Hydropneumatic Tanks	Raw Water - (2) X-Trol WX 350 Distribution - WellMate WM25WB	Raw Water – None Distribution - 85 gal Flex-Lite (Model WR260R) in Buildings 1, 2 & 3
Sediment Filters		Pre-Softener - 50 gpm, 5-micron Harmsco Hurricane Pre UV - 90 gpm, 5-micron Harmsco Hurricane
Water Softener System	(2) GE Autotrol Model 268/760 4 CF of K-Life Potassium resin	Pentair Fleck 2850 K-Life Potassium resin
Ultraviolet Disinfection System	Aquafine Corp., Model CSL-8R, 100 gpm (to be confirmed)	Hallett Crossfire, Model 30-1.5 inch, 25 gpm

Table 2
Water Demand Summary
Woodhaven/Leland Farms Water Supply Feasibility Study
Sherborn, MA

Year	Leland Farms		Woodhaven		Total Average Daily Demand (gpd)
	Average Daily Demand (gpd)	Maximum Monthly Demand (gpd)	Average Daily Demand (gpd)	Maximum Monthly Demand (gpd)	
Supply Capacity	4,000 gpd		3,000 gpd		7,000 gpd
2016	2,137	2,964	1,169	1,545	3,306
2017	2,029	3,381	1,131	1,607	3,160
2018	1,908	3,120	1,116	1,877	3,024
Average:	2,025	3,155	1,139	1,676	3,164
Maximum:	2,137	3,381	1,169	1,877	5,258

As noted previously, the three Woodhaven wells each have an approved daily withdrawal volume of 1,000 gpd and the Leland Farms well has an approved daily withdrawal volume of 4,000 gpd. Therefore, the site as a whole has an approved daily withdrawal volume of 7,000 gpd (or 6,000 gpd if Well 3 continues to be left offline as an emergency source only). Based on the individual complex and total site average and maximum day demand data, it appears that the approved total withdrawal volumes are sufficient, both individually and if combined, to meet demands. Several advantages of combining the two PWS's are that the demands could be met with more flexibility in operations and back-up supply source(s) would be available in the event of an emergency. Since Leland Farms is served by only one well, connections have been made in the past to allow the complex to be served by the Woodhaven wells when the Leland Farms well was out of service.

One alternative we were tasked with is the feasibility of using the three Woodhaven sources to meet the demands of both complexes and leaving the Leland Farms well to be used as an emergency source only. This alternative was identified given the recent difficulty that Leland Farms has had with compliance with the Lead and Copper Rule, as well as issues that have been experienced with the well in the past. In order for this alternative to be feasible, the approved volume of the Woodhaven wells would need to be increased such that the total demand of the site could be met. This scenario could be achieved if the capacity of all three wells was increased from 1,000 gpd to 2,000 gpd – bringing the total capacity of the Woodhaven wells to 6,000 gpd, which is sufficient to meet the maximum average demand recorded over the past three years (5,258 gpd). In this scenario, the average day demand of 3,164 gpd could also be met even if one of the three sources is offline for maintenance. The feasibility of this alternative was evaluated by reviewing the

original pump test data for the three Woodhaven wells, consulting with MassDEP and reviewing the impact of the increased pumping rate on the Zone I radii.

Site plan data and original pump test data for the Woodhaven wells was obtained from the Sherborn Board of Health through Mr. Sean Killeen, Director of Public Works/Facilities Manager. MassDEP was also consulted, but they were unable to find any records regarding the original installation, pump testing or permitting of the wells. File reviews and obtaining copies of necessary documents were complicated by the Covid-19 pandemic and shut down of most public buildings and facilities. The pump test data provided indicate that pump testing of four wells on site, as well as the Town Hall well, were completed circa October 1982. The four wells installed and pump tested on the Woodhaven site included the three subject wells (Well 1, Well 2 and Well 4 (aka as PWS Well 3), as well as "Well 3" which was not pursued due to low yield. The pump testing completed did not meet current requirements as outlined in MassDEP, Chapter 4 –Groundwater Supply Development guidelines - notably the tests were conducted for a duration between 8 and 24 hours, whereas MassDEP guidelines require a 48-hour duration pump test for bedrock wells; and it does not appear that MassDEP stabilization criteria (Section 4.3.1.4(5)(e)) was met, nor was sufficient recovery data recorded. The pump test data and our analysis of said data is included in Attachment B. Upon consultation with MassDEP we confirmed that new 48-hour duration pump tests would need to be completed for each well to verify that the increase in withdrawal would be sustainable.

An increase in withdrawal from 1,000 gpd to 2,000 gpd would also require an increase in the Zone I protective radius from 100 feet to 145 feet. In order to evaluate the impact of the larger radius, the existing and new Zone I radii were overlaid on the existing site plan, as shown on Figure 2. As shown, the increased protective radius for Well 1 extends beyond the property boundary, may intercept a portion of Abbey Road and would include the Woodhaven drywell which accepts the backwash water from the treatment process. In accordance with MassDEP Guidelines, the Zone I radius for PWS's must be owned or controlled by the Owner and drywells are generally required to be located outside of the Zone I. It should also be noted that the existing Zone I radii for the Woodhaven wells are already non-conforming with MassDEP's requirement (310 CMR 22.21(1)(b)(5)) that Zone I activities be limited to those directly related to the provision of public water including parking lots, driveways and buildings; although this non-conformance is currently grandfathered, if an increase in the Zone I was sought, these uses within the Zone I would be problematic. In addition, MassDEP questioned the sustainability of an increased pumping rate of Well 1 in particular given its proximity to the Abbey Road development. Given these complications, an increase in withdrawal from Well 1 would be difficult to achieve through MassDEP permitting. Although the increase in the Zone I at Well 2 does not appear to be a problem as compared to its existing Zone I, the increase in Zone I at Well 3 would encompass larger portions of Leland Farm Road and the existing buildings on site and extends to the edge of the Leland Farms septic system. In addition, Well 3 is currently offline due to water quality issues and increasing the pump rate of the well may exacerbate the decline in water quality.

Based upon our analysis and conversations with MassDEP and Whitewater, we concluded that from a water supply perspective, the most advantageous option moving forward would be to maintain all four wells on site as water supply sources for a single public water system serving both complexes. The costs associated with repermitting the Woodhaven wells at a higher rate, combined with the potential Zone I protective radius issues, make the option of utilizing only the Woodhaven wells less attractive. In addition, reactivation of Woodhaven Well 3 on a regular basis would require additional treatment equipment and expense due to its poor water quality. Given these conclusions, a joint decision was made by Whitewater and Onsite to not utilize Cummings Well & Pump to conduct short duration pumping and analysis of the Woodhaven wells (i.e., Task 3 of the Scope of Services). It is our opinion that the monies associated with completing that scope item are better spent implementing the recommendations contained herein.

Water Quality

In order to evaluate if all four wells could be utilized to meet the water supply needs of the two complexes, a review of the water quality and water chemistry of the sources was completed. A summary of lead and copper water quality data is presented in Table 3 and laboratory analytical data is provided in Attachment C.

Table 3
Lead and Copper Water Quality Summary
Woodhaven/Leland Farms Water Supply Feasibility Study
Sherborn, MA

Sample Date	Lead (mg/L) 90th Percentile Value		Copper (mg/L) 90th Percentile Value	
	Woodhaven	Leland Farms	Woodhaven	Leland Farms
2013	0.001	0.004	0.59	1.19
2014	0.015*	0.006	ND	1.20
2015	0.024*	0.004	ND	1.10
2016 (Spring)	0.065*	0.003	0.67	NR
2016 (Fall)	0.0105	0.003	0.49	1.51*
2017 (Spring)	NR	0.005	NR	1.20
2017 (Fall)	0.0125	0.002	ND	1.28
2018	0.012	0.003	0.59	1.40*
2019 (Spring)	NR	0.002	NR	1.04
2019 (Fall)	0.005	0.002	0.734	1.20

(1) Lead 90th Percentile Action Level is 0.015 mg/L
(2) Copper 90th Percentile Action Level is 1.3 mg/L
(3) * Indicates 90th Percentile Action Level Met or Exceeded
(4) NR = Not Required; ND = Not Detected

As shown, Woodhaven had compliance issues for lead in 2014, 2015 and 2016, but have not had any issues since. Copper compliance has been consistently achieved at the Woodhaven site. It is our understanding that the service lines at the Woodhaven complex were replaced in 2016 eliminating lead solder present in the plumbing fixtures thereby addressing the lead compliance issue. In contrast, Leland Farms samples have consistently remained below the lead action level, but have had intermittent compliance issues (in 2016 and 2018) with copper.

Based on the lead and copper compliance issues that both sites have had in the past, it is expected that the water chemistry of the wells are similar and that the water is corrosive. In order to compare the water chemistry we reviewed historical water quality data as found on the Massachusetts Energy & Environmental Affairs (EEA) Data Portal, as well as water quality results provided by Whitewater including those results from a sampling round completed in July 2020. Water quality data of interest is provided in Table 4 and the laboratory data is provided in tabular form in Attachment C.

Table 4
Raw Water Quality – July 21, 2020 Sampling Round
Woodhaven/Leland Farms Water Supply Feasibility Study
Sherborn, MA

Parameter *(mg/L unless noted)*	MMCL and/or Typical Levels	Woodhaven Well 1	Woodhaven Well 2	Woodhaven Well 3	Leland Farms
Alkalinity	*20-200 (typ)*	97	108	125	106
Chloride	250	335	268	424	424
Nitrate as N	10	1.34	0.649	ND	0.678
pH (SU)	6.5-8.5	6.6	6.6	6.1	6.6
Conductance (uS/cm)	*200-800 (typ)*	1320	1100	1510	1200
TDS	500	920	620	836	708
Calcium	*40-80 (typ)*	142	107	93.9	104
Iron	0.30	ND	ND	52	ND
Arsenic	0.01	ND	ND	0.004	ND
Manganese	0.005	ND	0.005	3.21	0.089
Sodium	20	71	59	128	91
Hardness	*Very Hard>250*	423	341	329	324

Based on the raw water quality data presented above, it appears that the water chemistry of the four wells is similar. Notably pH levels are in the acidic portion (i.e., 6.6) of the pH range; the water is very hard; and sodium and chloride levels are above the Massachusetts Maximum Contaminant Level (MMCL). Conductance and TDS levels are roughly double those levels typically recorded in drinking water. According to the USGS each of these factors contribute to corrosivity "including elevated concentrations of chloride, pH

out of neutral, elevated concentrations of dissolved and suspended solids, and lower alkalinity." Given this data, lead and copper compliance issues are not unexpected.

Data from the EEA data portal indicated similar results as that presented on Table 4. While raw water manganese concentrations at both sites have historically exceeded the 0.05 mg/L standard, finished water levels consistently remain below the standard indicating that the water softening treatment systems are generally functioning as designed. Similarly, raw water iron concentrations have exceeded the 0.30 mg/L secondary standard; but finished water concentrations are acceptable. It is noted however that the raw water iron concentration present in Well 3 in the July 2020 sampling round is approximately 170 times the drinking water standard and would typically not be treatable using ion exchange/water softening. However, the concentration may not be indicative of the actual water quality as the well has not been used and therefore, the water stagnant.

The data also indicate that sodium and chloride levels are trending upwards likely due to the use of deicing products on the roads and driveways within the two complexes. Nitrate levels are also increasing; nitrates in drinking water are often attributed to proximity of the water source to septic systems and/or the use of fertilizers onsite. Volatile organic compounds (VOC) and synthetic organic compounds (SOC) have not been detected in any of the Woodhaven or Leland Farms wells over the 10-year period queried. Radionuclides have been detected at both sites with gross alpha detected at 3.8 pCi/L and 5.2 pCi/L at the Woodhaven and Leland Farms wells, respectively as compared to the MCL of 15 pCi/L; and radium 226/228 detected at levels between 0.31 pCi/L and 2.5 pCi/L in comparison to the MCL of 5. Perchlorate has also been detected at concentrations from 0.054 ug/L to 0.163 ug/L, well below the MCL of 2 ug/L.

Given our review of the water quality data, it is our opinion that the source water is generally of good drinking water quality. The existing treatment systems in place (i.e., sediment filters and water softening) should allow for the water to continue to meet drinking water standards for iron, manganese, hardness and low concentrations of arsenic. However, as noted the waters are in the corrosive range and as such treatment for corrosion control should be incorporated into the long term plan for the sites. In addition, given past issues with the detection of bacteria in both water systems, the continuation of ultraviolet disinfection treatment is recommended. The trend of increasing sodium and chloride has and will continue to contribute to the corrosion issues present in the distribution system; as such, limiting and/or managing use of deicing chemicals and the location of snow piles is necessary. Lastly, nitrate concentrations should continue to be monitored and use of fertilizer on site should be managed.

FINANCIAL

It is our understanding that the Elder Housing maintains a revolving fund and collects rents for the units at Woodhaven and uses those funds to maintain Woodhaven's buildings and grounds. Town issued bonds have been issued in the past for renovations and improvements as needed. In general, funds for necessary improvements come out of the Woodhaven revolving funds, and not from Town operating funds or new borrowing. Although Leland Farms has an operating budget, it is our understanding that funding of large capital projects at the site is problematic. Combining the two public water systems would allow for more financial stability and more reliable funding. In addition, the expected operation and maintenance costs would likely decrease, as Certified Operator services could handle the needs of both systems under a single contract.

CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations of the Woodhaven/Leland Farms Feasibility Study are summarized as follows:

- Water Supply – We recommend that all four wells be used to meet the water supply needs of the Woodhaven and Leland Farms residential buildings. Since water demands can be met with Woodhaven Well 3 offline, we recommend that Well 3 remain as a designated emergency source until or if necessary to activate. As stated previously, reduction and management of the use of deicing chemicals for roadway maintenance and fertilizer for lawn maintenance should be prioritized especially within the Zone I of the wellheads. The use of these products on site is contributing to high sodium, chloride and TDS levels, making the water less palatable and more corrosive. It also appears that nitrate levels in the drinking water may be trending upward.

- Water Treatment - The water from all four wells should be piped to a common treatment building located at Woodhaven prior to being sent to distribution. All water would be treated with sediment filters and ion exchange softening for iron and manganese removal and hardness reduction, prior to discharge to the existing Woodhaven and Leland Farms atmospheric water storage tanks. An evaluation of the ion exchange equipment at both sites would need to be completed to identify if the existing equipment could be utilized, if the Leland Farms equipment could be moved and reutilized at the Woodhaven site, or if additional softening vessels would be required. If corrosion control treatment is required for compliance with the lead and copper rule, we recommend that chemical addition also occur within the common treatment building at Woodhaven.

  From atmospheric storage, the water would be treated via ultraviolet (UV) disinfection and sent to the individual buildings. The existing UV systems at both sites would be maintained and used for this purpose. Further review and evaluation of the existing SyncroFlo booster pump system at the Woodhaven site would be necessary to confirm that pumping to the Leland Farms atmospheric tank

could be achieved and programmed utilizing the existing control panel. We recommend maintaining the three existing hydropneumatic tanks at each of the Woodhaven buildings, as well as the pumping equipment and distribution hydropneumatic tank at Leland Farms. The preliminary layout of the combined water system is provided on Figure 3.

- Preliminary discussions with MassDEP have indicated that a BRP WS 33 application for a Distribution Modification for Systems that serve 3,300 people or fewer would be required prior to implementation of the recommended piping and treatment reconfiguration. If corrosion control is still deemed necessary in order to comply with the Lead and Copper rule, a BRP WS 34 application for Water Treatment and associated design of said treatment will also be required. Based on our conversations with MassDEP to date, further evaluation by MassDEP would be required to decide if both public water systems would remain as separate entities, if the systems would be considered a "consecutive" PWS, or if the two PWS would be re-established as a single PWS.

ESTIMATE OF PROBABLE COSTS

The estimated probable engineering and construction costs to implement the above recommendations are summarized on Table 5. It should be noted that these costs are based on recent construction projects for private developments; bidding, award and construction services associated with a publicly bid project would result in an increase in costs of 25% or more. As shown, the estimated capital cost to combine the two water systems and provide corrosion control treatment is $180,000.

We trust that the findings presented in this feasibility study satisfy the intent of the project. We greatly appreciate the opportunity to assist you in this capacity. If you have any questions or require additional information or assistance, please feel free to contact me directly.

Sincerely,

Onsite Engineering, Inc.

Susan Hunnewell

Susan Hunnewell, P.E.
Vice President – Director of Water Engineering

Attachments

Table 5
Estimate of Probable Costs
Woodhaven/Leland Farms Water Supply Feasibility Study
Sherborn, MA

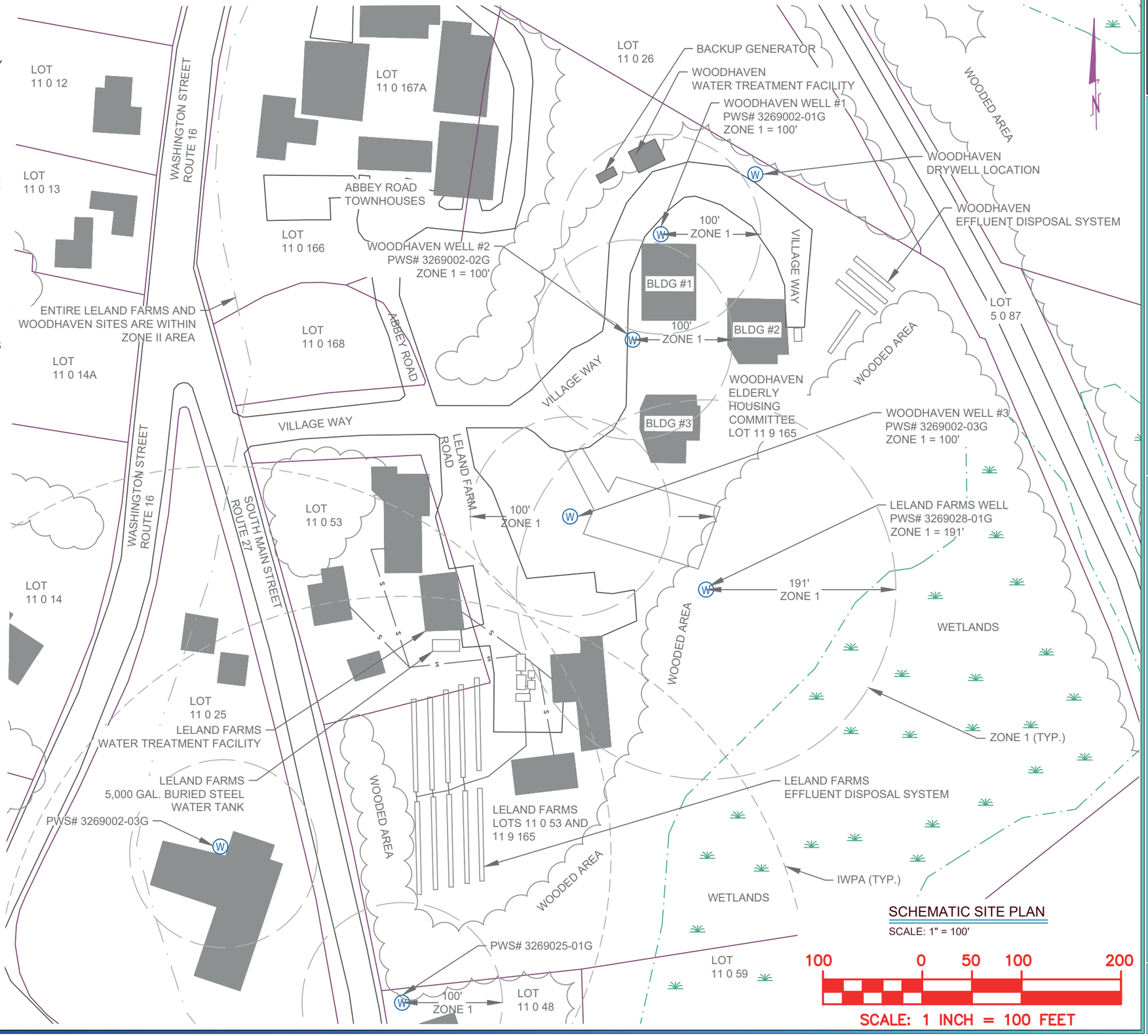
Item	
Piping, Treatment and Distribution System Modifications to Combine PWSs	
• Piping from Leland Farms well to Woodhaven Treatment building	$37,500
• Existing piping, pump and treatment modifications within Woodhaven Treatment building	$30,000
• Piping from Woodhaven Treatment building to Leland Farms atmospheric tank	$22,500
• Design and BRP WS 33 Permitting	$15,000
Corrosion Control Treatment for Lead and Copper Compliance	
• Furnish and Install Corrosion Control Treatment Equipment	$30,000
• Design and BRP WS 34 Permitting	$10,000
Total Estimated Cost	$145,000
Total Estimated Cost with Public Bidding	$180,000

Figures

GENERAL NOTES

1. THE LOCATION AND ELEVATION OF ANY EXISTING UTILITIES SHALL BE CONSIDERED APPROXIMATE AND MUST BE VERIFIED PRIOR TO ANY CONSTRUCTION. UNDERGROUND UTILITIES SHOWN ARE FROM FIELD OBSERVATION AND THE BEST AVAILABLE RECORD INFORMATION AND ARE NOT WARRANTED TO BE EXACT, NOR IS IT WARRANTED THAT ALL UNDERGROUND PIPES OR STRUCTURES ARE SHOWN. CONTACT THE RESPECTIVE UTILITY COMPANIES TO DETERMINE THE LOCATION, SIZE, MATERIALS AND ELEVATION OF ALL EXISTING UTILITIES, CONDUITS AND LINES. ADDITIONALLY, THE PLANS MAY NOT SHOW ALL WALKWAYS AND LANDSCAPE FEATURES.

2. PLAN REFLECTS SCHEMATIC MAP PREPARED BY ONSITE ENGINEERING INC. SCHEMATIC MAP IS BASED OFF MASSGIS OLIVER JULY 2020 DATA. WOODHAVEN AND SHERBORN SEPTIC LOCATIONS ARE BASED OFF CHARLES A. PERKINS CO., CLINTON, MA AS-BUILT PLANS DATED AUGUST 1983. ALL EXISTING INFRASTRUCTURE IS APPROXIMATE AND SHALL BE VERIFIED IN FIELD PRIOR TO CONSTRUCTION. ONSITE ENGINEERING, INC. IMPLIES NO WARRANTY OR CERTIFICATION AS TO THE ACCURACY OF ANY RECORD PROPERTY LINE DATA SHOWN ON THIS PLAN.



SCHEMATIC SITE PLAN

SCALE: 1" = 100'

100 0 50 100 200

SCALE: 1 INCH = 100 FEET

ONSITE ENGINEERING INC.
Water, Wastewater and Stormwater Specialists
279 East Central Street
Franklin, MA 02038
508-553-0616
www.onsite-eng.com

WOODHAVEN/LELAND FARMS SHERBORN, MASSACHUSETTS

SCHEMATIC LOCUS MAP

REVIEW SUBMITTAL

NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION

PROJECT NO.: 01561
DATE: AUGUST 2020
SCALE: 1" = 100'
SHEET: 1

DRAWN BY: PRR DESIGNED BY: PRR
CHECKED BY: STH APPROVED BY: STH

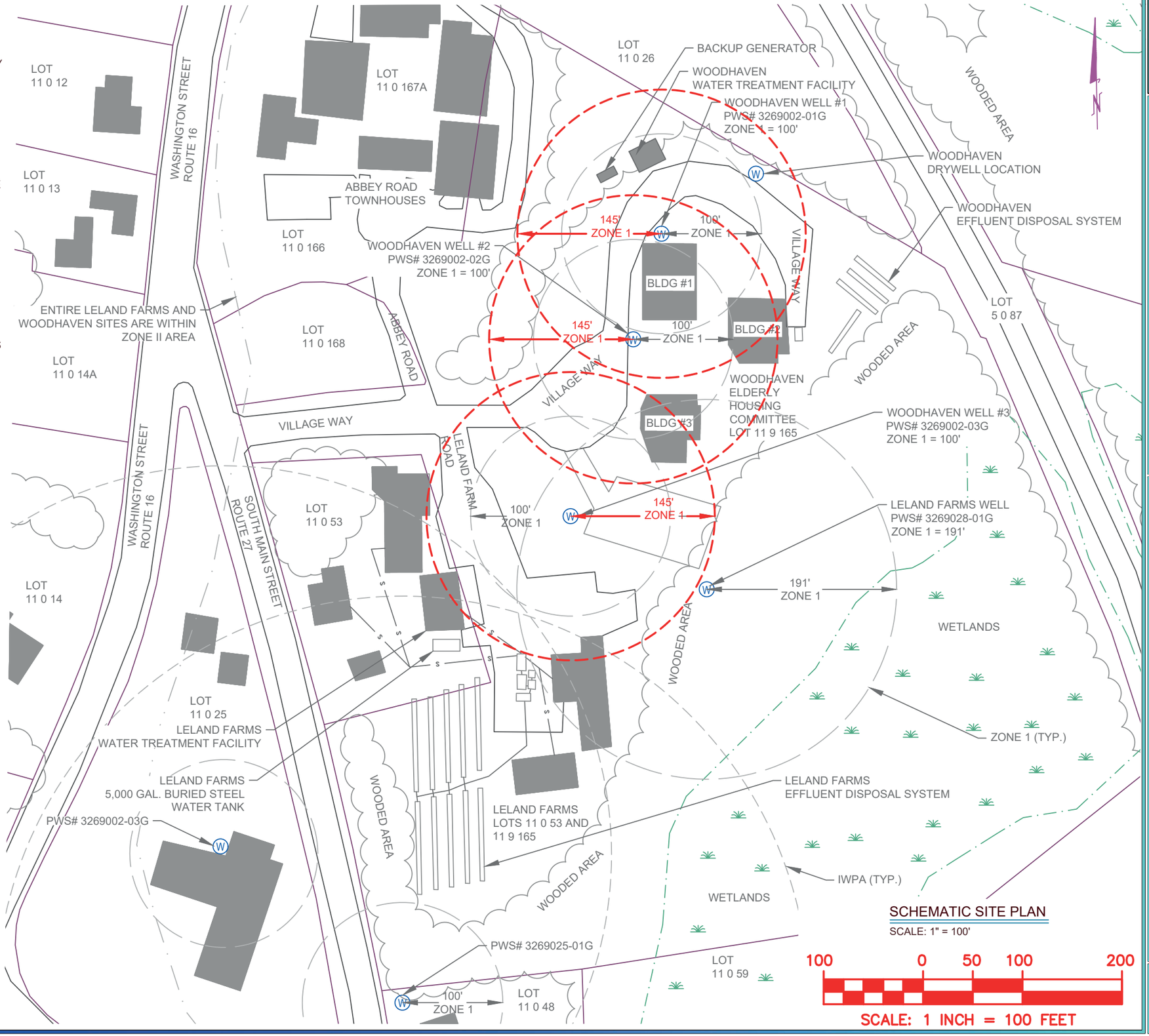
THIS PLAN IS THE PROPERTY OF ONSITE ENGINEERING, INC. AND ITS CLIENT. COPYING OR MODIFYING WITHOUT WRITTEN PERMISSION IS PROHIBITED.

Fig. 1

GENERAL NOTES

1. THE LOCATION AND ELEVATION OF ANY EXISTING UTILITIES SHALL BE CONSIDERED APPROXIMATE AND MUST BE VERIFIED PRIOR TO ANY CONSTRUCTION. UNDERGROUND UTILITIES SHOWN ARE FROM FIELD OBSERVATION AND THE BEST AVAILABLE RECORD INFORMATION AND ARE NOT WARRANTED TO BE EXACT, NOR IS IT WARRANTED THAT ALL UNDERGROUND PIPES OR STRUCTURES ARE SHOWN. CONTACT THE RESPECTIVE UTILITY COMPANIES TO DETERMINE THE LOCATION, SIZE, MATERIALS AND ELEVATION OF ALL EXISTING UTILITIES, CONDUITS AND LINES. ADDITIONALLY, THE PLANS MAY NOT SHOW ALL WALKWAYS AND LANDSCAPE FEATURES.

2. PLAN REFLECTS SCHEMATIC MAP PREPARED BY ONSITE ENGINEERING INC. SCHEMATIC MAP IS BASED OFF MASSGIS OLIVER JULY 2020 DATA. WOODHAVEN AND SHERBORN SEPTIC LOCATIONS ARE BASED OFF CHARLES A. PERKINS CO., CLINTON, MA AS-BUILT PLANS DATED AUGUST 1983. ALL EXISTING INFRASTRUCTURE IS APPROXIMATE AND SHALL BE VERIFIED IN FIELD PRIOR TO CONSTRUCTION. ONSITE ENGINEERING, INC. IMPLIES NO WARRANTY OR CERTIFICATION AS TO THE ACCURACY OF ANY RECORD PROPERTY LINE DATA SHOWN ON THIS PLAN.



SCHEMATIC SITE PLAN

SCALE: 1" = 100'

100 0 50 100 200

SCALE: 1 INCH = 100 FEET

ONSITE ENGINEERING INC.
Water, Wastewater and Stormwater Specialists
279 East Central Street
Franklin, MA 02038
508-553-0616
www.onsite-eng.com

WOODHAVEN/LELAND FARMS SHERBORN, MASSACHUSETTS

PROPOSED ZONE 1 LOCUS MAP

REVIEW SUBMITTAL

NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION

PROJECT NO.: 01561
DATE: AUGUST 2020
SCALE: 1" = 100'
SHEET: 2

DRAWN BY: PRR DESIGNED BY: PRR
CHECKED BY: STH APPROVED BY: STH

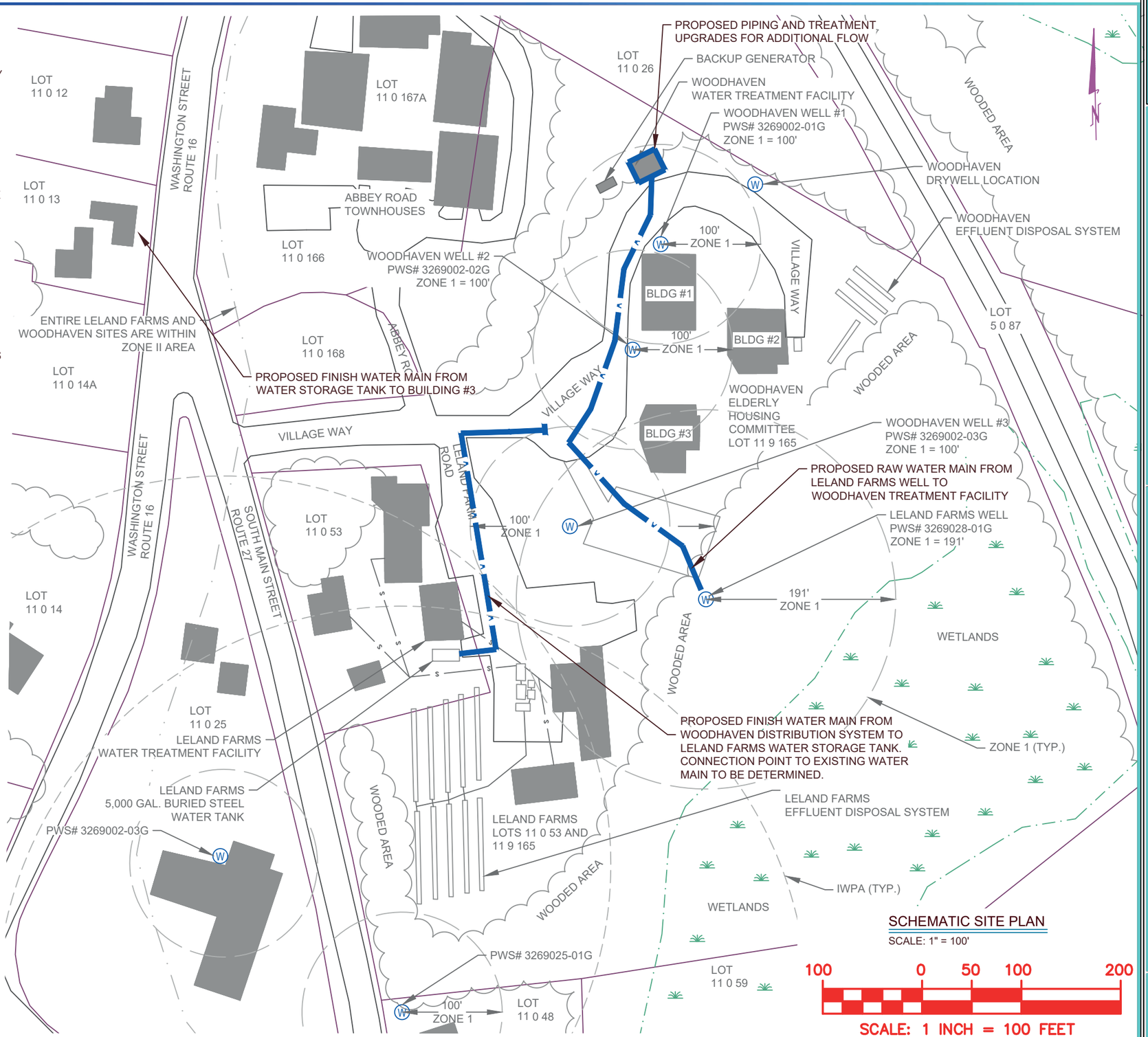
THIS PLAN IS THE PROPERTY OF ONSITE ENGINEERING, INC. AND ITS CLIENT. COPYING OR MODIFYING WITHOUT WRITTEN PERMISSION IS PROHIBITED.

Fig. 2

GENERAL NOTES

1. THE LOCATION AND ELEVATION OF ANY EXISTING UTILITIES SHALL BE CONSIDERED APPROXIMATE AND MUST BE VERIFIED PRIOR TO ANY CONSTRUCTION. UNDERGROUND UTILITIES SHOWN ARE FROM FIELD OBSERVATION AND THE BEST AVAILABLE RECORD INFORMATION AND ARE NOT WARRANTED TO BE EXACT, NOR IS IT WARRANTED THAT ALL UNDERGROUND PIPES OR STRUCTURES ARE SHOWN. CONTACT THE RESPECTIVE UTILITY COMPANIES TO DETERMINE THE LOCATION, SIZE, MATERIALS AND ELEVATION OF ALL EXISTING UTILITIES, CONDUITS AND LINES. ADDITIONALLY, THE PLANS MAY NOT SHOW ALL WALKWAYS AND LANDSCAPE FEATURES.

2. PLAN REFLECTS SCHEMATIC MAP PREPARED BY ONSITE ENGINEERING INC. SCHEMATIC MAP IS BASED OFF MASSGIS OLIVER JULY 2020 DATA. WOODHAVEN AND SHERBORN SEPTIC LOCATIONS ARE BASED OFF CHARLES A. PERKINS CO., CLINTON, MA AS-BUILT PLANS DATED AUGUST 1983. ALL EXISTING INFRASTRUCTURE IS APPROXIMATE AND SHALL BE VERIFIED IN FIELD PRIOR TO CONSTRUCTION. ONSITE ENGINEERING, INC. IMPLIES NO WARRANTY OR CERTIFICATION AS TO THE ACCURACY OF ANY RECORD PROPERTY LINE DATA SHOWN ON THIS PLAN.



SCHEMATIC SITE PLAN

SCALE: 1" = 100'

100 0 50 100 200

SCALE: 1 INCH = 100 FEET

ONSITE ENGINEERING INC.
Water, Wastewater and Stormwater Specialists
279 East Central Street
Franklin, MA 02038
508-553-0618
www.onsite-eng.com

WOODHAVEN/LELAND FARMS SHERBORN, MASSACHUSETTS

PROPOSED WATER SYSTEM IMPROVEMENTS

REVIEW SUBMITTAL

NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION

PROJECT NO.: 01561
DATE: AUGUST 2020
SCALE: 1" = 100'
SHEET: 3

DRAWN BY: PRR DESIGNED BY: PRR
CHECKED BY: STH APPROVED BY: STH

THIS PLAN IS THE PROPERTY OF ONSITE ENGINEERING, INC. AND ITS CLIENT. COPYING OR MODIFYING WITHOUT WRITTEN PERMISSION IS PROHIBITED.

Fig. 3

Attachment A

Water Use Data

Woodhaven - Water Use Data
Woodhaven/Leland Farms Water Supply Feasibility Study
Sherborn, MA

PWS ID: 3269002
PWS Name: Woodhaven Elderly Housing Committee

Month		**2016**			**2017**			**2018**	
	Well 01G	**Well 02G**	**Total**	**Well 01G**	**Well 02G**	**Total**	**Well 01G**	**Well 02G**	**Total**
January	26,740	21,170	47,910	23,790	18,200	41,990	31,260	23,730	54,990
February	22,740	17,990	40,730	21,320	16,210	37,530	17,170	13,370	30,540
March	11,470	9,100	20,570	17,760	13,480	31,240	14,630	10,920	25,550
April	23,090	18,370	41,460	20,750	15,800	36,550	31,800	24,500	56,300
May	26,280	20,920	47,200	27,730	21,820	49,550	15,880	12,670	28,550
June	12,160	9,650	21,810	11,650	8,950	20,600	15,510	12,080	27,590
July	23,040	18,040	41,080	17,330	13,230	30,560	21,220	16,500	37,720
August	22,630	17,390	40,020	28,360	21,460	49,820	16,230	12,580	28,810
September	16,520	12,740	29,260	12,760	9,740	22,500	20,970	16,140	37,110
October	16,710	12,890	29,600	17,290	13,180	30,470	13,170	10,470	23,640
November	18,540	14,330	32,870	16,250	12,440	28,690	23,070	18,010	41,080
December	19,290	14,810	34,100	18,970	14,450	33,420	8,690	6,790	15,480
TOTAL	239,210	187,400	426,610	233,960	178,960	412,920	229,600	177,760	407,360
ADD	655	513	1,169	641	490	1,131	629	487	1,116
MDD	863	683	1,545	915	704	1,607	1,060	817	1,877
MDD Date	1/1/2016	1/1/2016	1/1/2016	8/1/2017	5/1/2017	8/1/2017	4/1/2018	4/1/2018	4/1/2018

ADD Average	1,139		
ADD Range	1116-1169		
MDD	1,877		
	Month	gpd	
Max Month (Total) - 1	56,300	1877	Apr-18
Max Month (Total) - 2	54,990	1774	Jan-18
Max Month (01G)	31,800	1060	Apr-18
Max Month (02G)	24,500	817	Apr-18

Leland Farms - Water Use Data
Woodhaven/Leland Farms Water Supply Feasibility Study
Sherborn, MA

PWS ID:	3269028
PWS Name:	Leland Farms

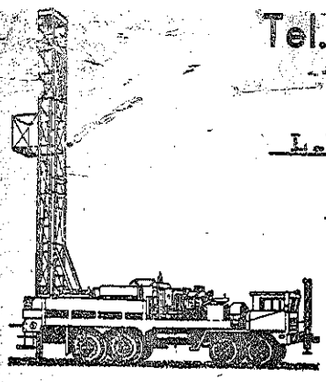
Month	**2016**	**2017**	**2018**
	Well 01G	**Well 01G**	**Well 01G**
January	78,180	76,170	96,750
February	64,000	64,490	41,120
March	66,900	60,200	43,090
April	59,260	63,980	78,770
May	91,880	104,820	60,150
June	61,050	58,980	38,170
July	45,940	36,610	57,810
August	80,220	65,620	60,080
September	49,620	51,510	68,950
October	49,870	56,720	44,270
November	75,750	47,500	79,130
December	57,170	53,920	28,240
TOTAL	779,840	740,520	696,530
ADD	2,137	2,029	1,908
MDD	3,061	3,494	2,638
MDD Date	5/31/2016	5/1/2017	11/1/2018

ADD Average	2,025
ADD Range	1908-2137
MDD	3,494
Max Month	104,820

Attachment B

Woodhaven – Original Pump Test Data & Analysis

ONSITE ENGINEERING INC.

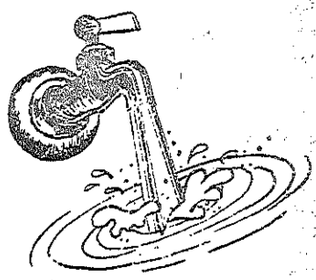


Tel. 779-6677

November 2, 1982

L.H. Hewett Jr.,

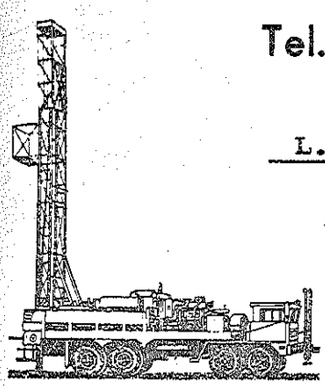
145 Meadow St., Framingham, Mass.



E. R. SULLIVAN Inc.

Artesian Wells
Wattaquadock Hill Road
Bolton, Mass. 01740

		Well at Sherborn Housing for Elderly
10/12/82		Drilled a 6" Diameter Well
		Well No. 1
		400 ft. deep @ $6.00 per ft.
		14 ft. to bedrock
		40 ft. 6" pipe into rock 26ft.
Rotary		40 ft. @ $7.00 per ft.
Drill		5 gallons water per minute
		25 ft. water level
		drive shoe
OK		machine pump tested
MTS		Total



Tel. 779-6677

November 2, 1982

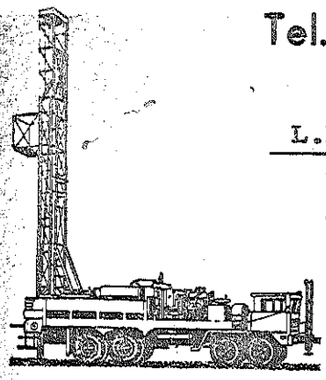
L.H. Hewett

145 Meadow St., Framingham, Mass.

E. R. SULLIVAN Inc.

Artesian Wells
Wattaquadock Hill Road
Bolton, Mass. 01740

		Well at Sherborn, Mass. for Housing for Elderly
10/15/82		Drilled a 6" Diameter Well
Well No.	2	505 ft. deep @ $6.00 per ft.
		15 ft. to bedrock
		40 ft. 6" pipe into rock 25 ft.
		40 ft. @ $7.00 per ft.
Rotary		15 ft. water level
Drill		3 gallons water per minute
		drive shoe
OK ATS		machine pump tested
		Total

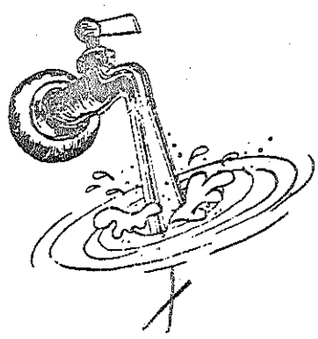


Tel. 779-6677

November 2, 1982

L.H. Hewett,

145 Meadow St, Framingham, Mass.



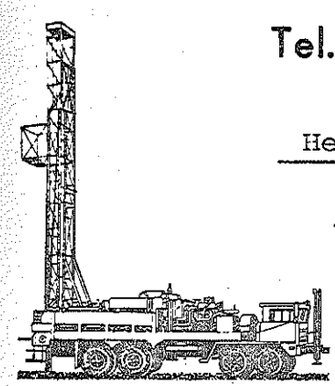
E. R. SULLIVAN Inc.

Artesian Wells
Wattaquadock Hill Road
Bolton, Mass. 01740

		Well at Sherborn, Mass. for Housing for Elderly
10/19/82		Drilled a 6" Diameter Well
Well No.	3	450 ft. deep @ $6.00 per ft.
		12 ft. to bedrock
		40 ft. 6" pipe into rock 28ft.
		40 ft. @ $7.00 per ft.
Rotary		30 ft. water level
Drill		¼ gallon water per minute
		drive shoe
OK		machine pump tested
AFS		Total

044 10/13-01 PR

1



Tel. 779-6677

November 2, 1982

Hewett, L.H.

145 Meadow St., Framingham, Mass.

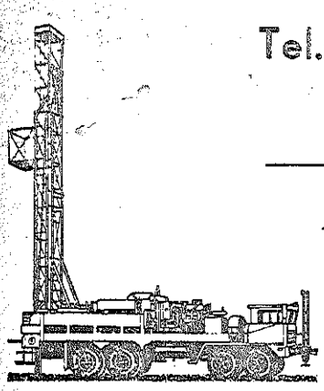
E. R. SULLIVAN Inc.

Artesian Wells
Wattaquadock Hill Road
Bolton, Mass. 01740

		Well at Sherborn, Mass.--Housing for Elderly
10/21/82		Drilled a 6" Diameter Well
Well No.	4	400 ft. deep @ $6.00 per ft.
		13 ft. to bedrock
		40 ft. 6" pipe into bedrock 27ft.
		40 ft. @ $7.00 per ft.
Rotary		6 gallons water per minute
Drill		15 ft. water level
		drive shoe
OK		machine pump tested
		Total

044 10/13-01 PR

1



Tel. 779-6677

November 9, 1982

NOV 10 1982

L.H. Hewitt Jr.

145 Meadow St., Framingham, Mass.

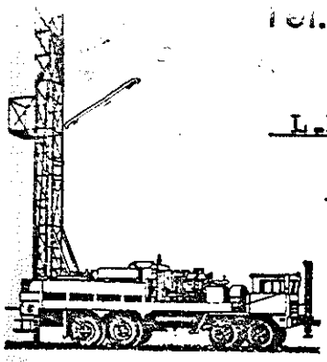
E. R. SULLIVAN Inc.

Artesian Wells
Wattaquadock Hill Road
Bolton, Mass. 01740

Town Hall---Well No.5

		Well at Sherborn Housing for the Elderly
11/2/82		Drilled a 6" Diameter Well
Well No.	5	400 ft. deep @ $6.00 per ft.
		21 ft. to bedrock
		40 ft. 6" pipe in @ $7.00 per ft.
		40 ft. @ $7.00 per ft.
Rotary		20 ft. water level
Drill		4 gallons water per minute
		drive shoe
		machine pump tested
		Total Cost

JOB NUMBER 0649
ACCOUNT NUMBER 1043-01
APPROVED BY BJW
DATE PAID
CHECK NO.
COMMENTS



Tel. 779-6677

November 2, 19 82

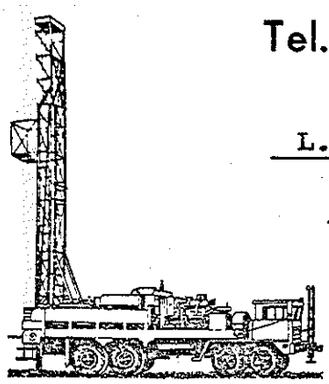
L.H. Hewett Jr.,

145 Meadow St., Framingham, Mass.

E. R. SULLIVAN Inc.

Artesian Wells
Wattaquadock Hill Road
Bolton, Mass. 01740

		Well at Sherborn Housing for Elderly
10/12/82		Drilled a 6" Diameter Well
		Well No. 1
		400 ft. deep @ $6.00 per ft.
		14 ft. to bedrock
		40 ft. 6" pipe into rock 26ft.
Rotary		40 ft. @ $7.00 per ft.
Drill		5 gallons water per minute
		25 ft. water level
		drive shoe
OK		machine pump tested
AFS		Total



Tel. 779-6677

November 2, 19 82

L.H. Hewett

145 Meadow St., Framingham, Mass.

E. R. SULLIVAN Inc.

Artesian Wells
Wattaquadock Hill Road
Bolton, Mass. 01740

		Well at Sherborn, Mass. for Housing for Elderly
10/15/82		Drilled a 6" Diameter Well
Well No.	2	505 ft. deep @ $6.00 per ft.
		15 ft. to bedrock
		40 ft. 6" pipe into rock 25 ft.
		40 ft. @ $7.00 per ft.
Rotary		15 ft. water level
Drill		3 gallons water per minute
		drive shoe
OK AFS		machine pump tested
		Total

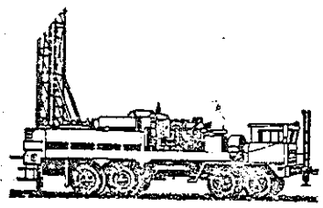
Tel. 779-6677

November 9, 1982

NOV 10 1982

L.H. Hewitt Jr.

145 Meadow St., Framingham, Mass.



E. R. SULLIVAN Inc.

Artesian Wells
Wattaquadock Hill Road
Bolton, Mass. 01740

Town Hall---Well No.5

		Well at Sherborn Housing for the Elderly
11/2/82		Drilled a 6" Diameter Well
Well No.	5	400 ft. deep @ $6.00 per ft.
		21 ft. to bedrock
		40 ft. 6" pipe in @ $6.00 per ft.
		40 ft. @ $7.00 per ft.
Rotary		20 ft. water level
Drill		4 gallons water per minute
		drive shoe
		machine pump tested
		Total Cost

JOB NUMBER 0419

ACCOUNT NUMBER 1043-01

APPROVED BY

DATE PAID

CHECK NO.

COMMENTS

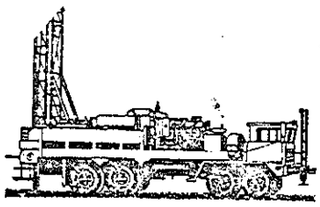
Tel. 779-6677

November 9, 1982

NOV 10 1982

L.H. Hewitt Jr.

145 Meadow St., Framingham, Mass.



E. R. SULLIVAN Inc.

Artesian Wells
Wattaquadock Hill Road
Bolton, Mass. 01740

Town Hall---Well No.5

		Well at Sherborn Housing for the Elderly
11/2/82		Drilled a 6" Diameter Well
Well No.	5	400 ft. deep @ $6.00 per ft.
		21 ft. to bedrock
		40 ft. 6" pipe in @ $6.00 ft.
		40 ft. @ $7.00 per ft.
Rotary		20 ft. water level
Drill		4 gallons water per minute
		drive shoe
		machine pump tested
		Total Cost

JOB NUMBER 0479

DATE PAID

ACCOUNT NUMBER

CHECK NO.

APPROVED BY

COMMENTS

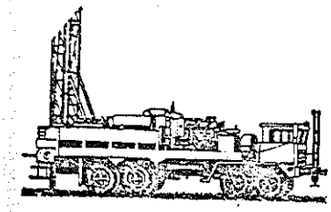
Tel. 779-6677

November 9, 1982

NOV 10 1982

L.H. Hewitt Jr.

145 Meadow St., Framingham, Mass.



E. R. SULLIVAN Inc.

Artesian Wells
Wattaquadock Hill Road
Bolton, Mass. 01740

Town Hall---Well No.5

		Well at Sherborn Housing for the Elderly
11/2/82		Drilled a 6" Diameter Well
Well No.	5	400 ft. deep @ $6.00 per ft.
		21 ft. to bedrock
		40 ft. 6" pipe in @ $6.00 per ft.
		40 ft. @ $7.00 per ft.
Rotary		20 ft. water level
Drill		4 gallons water per minute
		drive shoe
		machine pump tested
		Total Cost

JOB NUMBER 0619 | DATE PAID

ACCOUNT NUMBER | CHECK NO.

10/13/01

APPROVED BY | COMMENTS

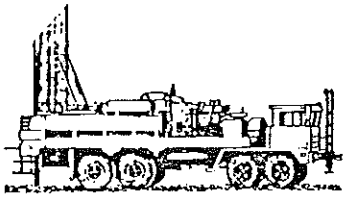
CHARLES A. PERKINS CO., INC.
Registered Engineers and Surveyors
CLINTON, MASSACHUSETTS 01510

JOB SHERBURN HOUSING
SHEET NO. 1 OF
CALCULATED BY MTO DATE 12/17/82
CHECKED BY DATE
SCALE

WELL NO	DEPTH V.F.	OVERBURDEN THICKNESS	CASING LENGTH	WATER DEPTH 1	DEPTH TO STATIC 2	PUMP DEPTH	YIELD GPM 3	STORAGE IN WELL 4
1	400	14	40	200'	25'	380	3.5	532
2	505	15	40	360'	15	400	4.0	578
4	400	13	40	95	15	380	7.5	540

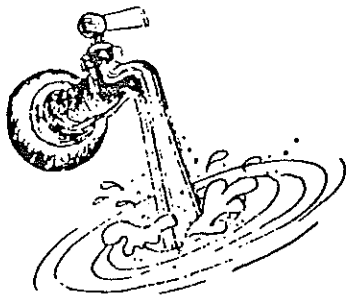
1. DEPTH TO WATER BARRIER EQUALS
2. WELLS RECOVERED TO ALMOST STATIC LEVELS
3. ACTUAL USING PUMP TEST - FROM NEO PUMP
4. STATIC WATER LEVEL TO PUMP 6 1/8" ID WELL 1.5 GPD/LF

NOTE: 3.5 GPM = 5,040 GPD
4.0 GPM = 5,760 GPD
7.5 GPM = 10,800 GPD



E. R. SULLIVAN Inc.

Artesian Wells
Wattaquadock Hill Road
Bolton, Mass. 01740



December 17, 1982

Town of Sherborn
Sherborn, Ma

Gentlemen:

E. R. Sullivan Inc. was hired by L. H. Hewett Jr. Inc. to drill a number of wells in the Town of Sherborn. The wells were to be for the Sherborn Housing for the Elderly. Permits were obtained, and work was started on or about October 12, 1982. Wells were numbered one thru six as they were done. All wells were to be 6" in diameter and the casing was to be well casing of good quality (6" inside diameter), and a 6" drive shoe used. Casing was cemented into ledge on all wells. Casing was left above grade approximately 18" on all wells.

Number one well is 400' deep, with 14' of overburden, sandy clay and hardpan. Forty feet of 6" casing cemented into ledge. Water bearing ledge at approximately 200'. Number one well was machine pump tested with a yield of five gallons per minute. The static water level was 25'. 3.5

Number two well was 505' deep with 15' overburden, sandy clay and hardpan. Forty feet of 6" casing, cemented into ledge. Water bearing ledge at approximately 360'. Number two well was machine pump tested with a yield of three gallons per minute. The static water level was 15'. This well was dynamited. The results would be known at pump test.
4.0

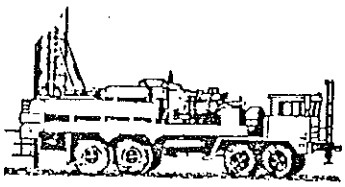
Number three well was 450' deep with overburden of 12'. Forty feet of 6" casing cemented into ledge. Number three well was machine pump tested with a yield of 1/4 gallon per minute. The static water level was 30'. This well was dynamited, and did not improve.

Number four well is 400' deep, with a 13' overburden, clay, hardpan. Forty feet of casing cemented into ledge. Water bearing ledge at approximately 95'. Number four well was machine pump tested with a yield of 6 gallons per minute. The static water level was 15'.
7.5 GPM

The pump testing was done on all wells by Need Pump Company of Sterling, Ma. All laboratory work was done by Rietzel Associates of Boylston,Ma. The drilling of these four wells was completed on October 25,1982.

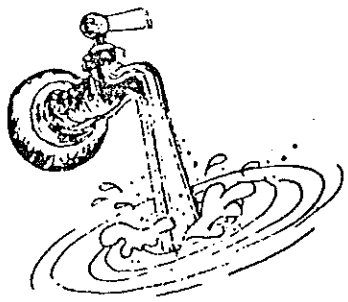
Yours truly,

E.R. Sullivan E R Sullivan



E. R. SULLIVAN Inc.

Artesian Wells
Wattaquadock Hill Road
Bolton, Mass. 01740



November 2, 1982

Number five well (Town Hall) was 400' deep, 21' overburden. Forty feet of 6' casing cemented into ledge, Machine pump tested with a yield of 4 gallons per minute, static water level was 20 feet.

November 18, 1982

Number six well (Mr. Wilhelm) was 205' deep, with 28' of overburden, 40' of 6" casing cemented into ledge. Machine pump tested with a yield of 6 gallons per minute, with a static water level of 30 feet.

350 WELL NO 2 NO. WELL 1 360 LOG OF PUMP TEST

CUSTOMER [redacted]

START PUMP TEST READINGS BELOW THIS LINE TAPS G.P.M.

Date, Weather and Sample Taken	Time	Water Temperature	Air Gauge Reading	Tape Meas'nt in Well	Orifice Head in Inches	GPM	Water Level	[redacted]	Water Level	[redacted] Level	Water Level	Water Level
OCT 28, 1982	11.45 AM			24.60		[redacted]		41.61	STATIC WATER LEVEL			
THURSDAY	11:50			50.01		15	5:10 PM			10 GPM		
	11:55			68.22		15	5:40	77.50		[redacted] 9½		
	12:00			82.42		15	6:10	123.60		8		
	12:05			98.20		15	6:40	166.01		8		
	12:10			114.01		14	7:10	200.00		7		
	12:15			126.42		14	7:40	234.56		6½		
	12:20			134.31		14	8:10	263.95		6 [redacted]		
	12:50						8:40	296.40		6 [redacted]		
							9:10	313.40		6		
							9:40	324.28	324.28	6		
	4:30 PM			26.84		15	10.10	334.61		6		
	5:00			113.81		14	10:40	341.81		5		
	5:30			153.31		10	11.10	350.00		5		
	6:00			177.85		6	11:40	351.50		5		
	6:30			223.95		8	12 10 AM	354.50	OCT 29	5		
	7:00			272.65		8	1:00	356.10		5		
	7:30			308.30		6	2:00	359.20		5		
	8:00			320.52		6	~~3:00~~ 4:00	356.36		~~4~~ 5		
	8:30			328.72		5	6:00	365.31		4½		
	9:00			334.10		5	9:00	371.44		4		
	9:30			337.77		5	7:00	372.40		3		
	10:00			336.31		5	11.00 AM	372.10		3+		
	10:30			337.44		5	2.00 PM	372.10		3½		
	11:00			339.40		5						
	11:30 PM			340.00		5						
	2:00 AM Oct 29			350.00		4½						
	4:00			350.00		4½						
	6:00			345.21		5						
	8:00			348.61		4						
	9:00			346.44		4½						

E.T. NEWELL

CUSTOMER (1) well

NO. 4 well

LOG OF PUMP TEST

START PUMP TEST READINGS BELOW THIS LINE

TAPE MEASMT C-PUMP

Date, Weather and Sample Taken	Time	Water Temperature	Alt. Gauge Reading	Tape Meas'nt in Well	Orifice Head in Inches	GPM	[illegible]	[illegible]	Water Level	[illegible]	Water Level	Water Level
Oct 27, 1982	10:00			35'85		10.	10:35	30.00		12		
WEDS DAY	10:05			50:00		10	10:40	62.62		12		
	10:10			59'22		10	10:45	76.38		12 ≤ 12		
	10:15			64.95		10	10:50	90.90		12		
	10:20			68.50		10	10:55	105.94		12		
	10:25			80.00		10	11:05	126.51		12		
	10:30			[illegible]	84.31	10	11:35	175.00		9		
	11:00			141.51		8	12:05	210.26		9		
	11:30			230.00		8	12:35	215.80		9		
	12:00		27070	27070		7	1:05	165.00		5	SHUT OFF	
SHUT OFF	12:30	on 12:40		300.00		5	1:35	198.91		9		
	[illegible]	12.46		35990	SHUTOFF 5 min	4	2:05	[illegible]	221.07	9		
	[illegible]	1:50					2:35	232.45		9		
	2:00	1:50			SHUT OFF					[illegible]		
	2:30	2:10 START		275		Recovery						
		2:30		281.82		2½	3:30	268.38		7 1/2		
		3:30 ≤ 3:25		300		2½	[illegible]					
		4:30					[illegible]				7 1/2	
		5:30					[illegible]					
							3:55	270.54		7 1/2		
		3:55		280.55		2½	4:00	268.51		7 1/2		
		4:10		291.60		2½	4:15	275.35		7 1/2		
		4:25		310.00		2 [illegible]	4:30	275.08		7 1/2		
		[illegible]	4:15	315.00		2½	5:30	277.95		7 1/2		
		5:30		324		1¼	6:00	281.70		7 1/2		
		6:00		350		[illegible]	6:30	280.00		7 1/2		
		6:30		376		3½ QTS	7:00	281.00		7 1/2		
		7:00		376		3½ QT	7:30	280.00		7 1/2		
		7:30		370		3½ QT						
							[illegible] 28 — 10.45 —			RECOVERY OF WELL		
							THURSDAY			45 ft		

Woodhaven - Original Pump Test Data
Woodhaven/Leland Farms Water Supply Feasibility Study
Sherborn, MA

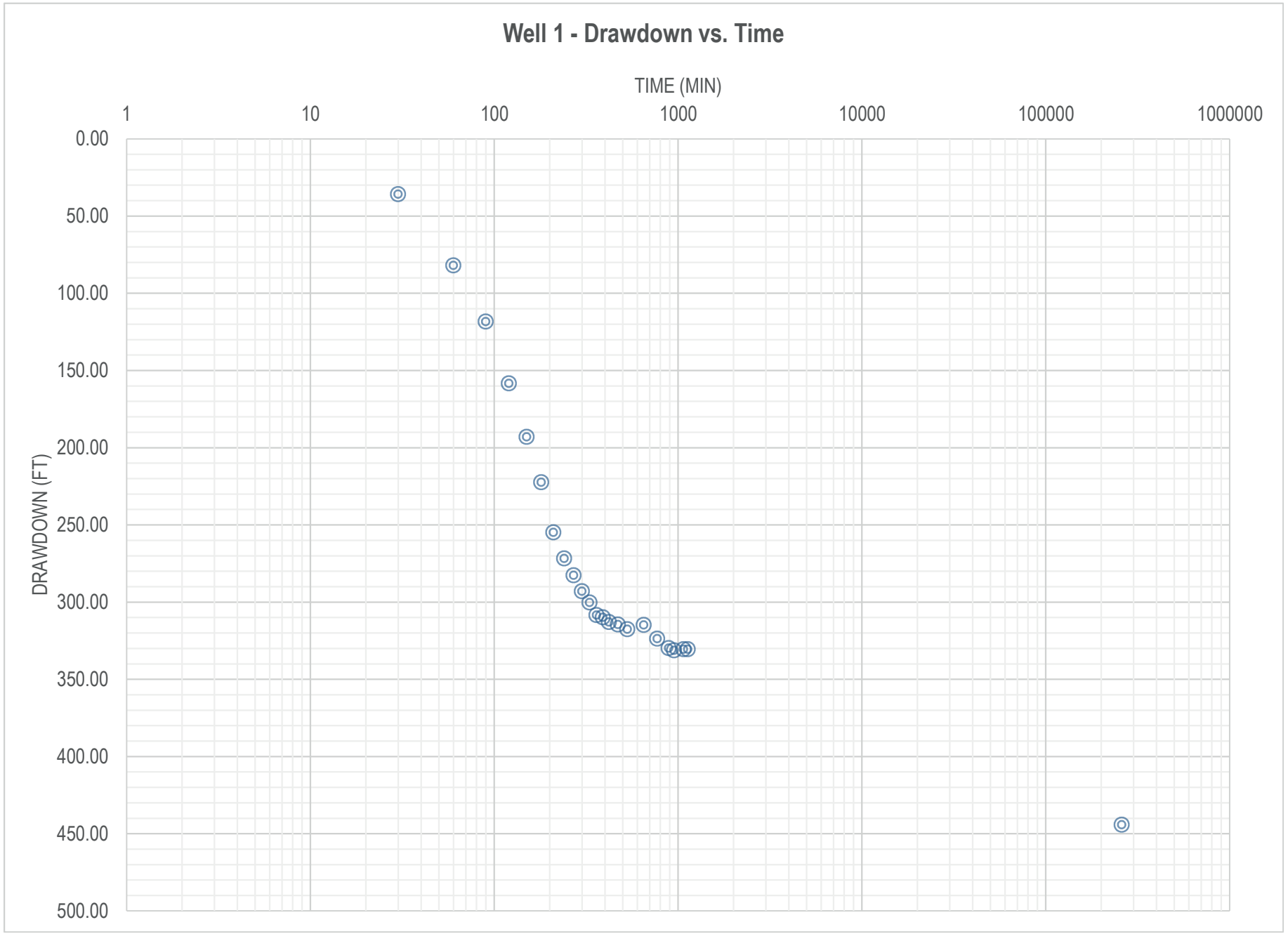
Woodhaven, Sherborn, MA

Bedrock Well Pump Test - Well No. 1

Well Information: Depth = 400'; SWL = 25'; Estimated Yield = 5 gpm; Installed - 10/12/82

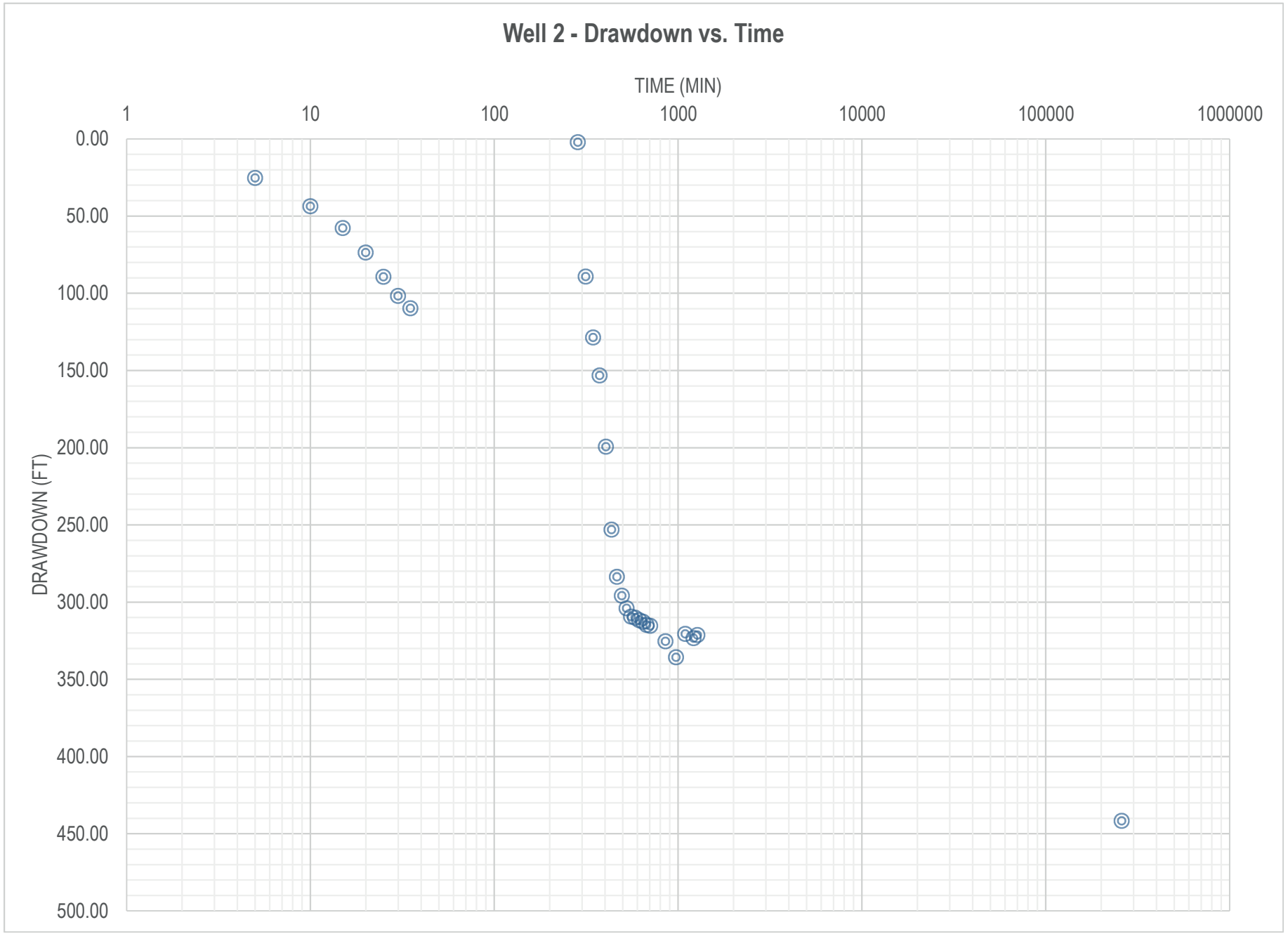
Pump Test Conducted by E.R. Sullivan, Inc., Bolton, MA in October 1982

Time	Time Elapsed Minutes	Well 1 Water Level (ft btoc)	Well 1 Drawdown (ft)	Well 1 Pumping Rate (GPM)	Notes
Static Water Level					
10/28/82 5:10 PM	0	41.61	0.00	10.0	
10/28/82 5:40 PM	30	77.50	35.89	10.0	
10/28/82 6:10 PM	60	123.60	81.99	9.5	
10/28/82 6:40 PM	90	160.01	118.40	8.0	
10/28/82 7:10 PM	120	200.00	158.39	8.0	
10/28/82 7:40 PM	150	234.56	192.95	7.0	
10/28/82 8:10 PM	180	263.95	222.34	6.5	
10/28/82 8:40 PM	210	296.40	254.79	6.25	
10/28/82 9:10 PM	240	313.40	271.79	6.0	
10/28/82 9:40 PM	270	324.28	282.67	6.0	
10/28/82 10:10 PM	300	334.61	293.00	6.0	
10/28/82 10:40 PM	330	341.81	300.20	5.0	
10/28/82 11:10 PM	360	350.00	308.39	5.0	
10/28/82 11:40 PM	390	351.50	309.89	5.0	
10/29/82 12:10 AM	420	354.50	312.89	5.0	
10/29/82 1:00 AM	470	356.10	314.49	5.0	
10/29/82 2:00 AM	530	359.20	317.59	5.0	
10/29/82 4:00 AM	650	356.36	314.75	5.0	
10/29/82 6:00 AM	770	365.31	323.70	4.5	
10/29/82 8:00 AM	890	371.44	329.83	4.0	
10/29/82 9:00 AM	950	372.90	331.29	3.0	
10/29/82 11:00 AM	1070	372.10	330.49	3.0	
10/29/82 12:00 PM	1130	372.20	330.59	3.5	
180 Days	**259200**		**444.20**		Projected 180-Day Drawdown


Well 1 - Drawdown vs. Time
TIME (MIN)
1
10
100
1000
10000
100000
1000000
DRAWDOWN (FT)
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00

Woodhaven, Sherborn, MA
Bedrock Well Pump Test - Well No. 2
Well Information: Depth = 505'; SWL = 15'; Estimated Yield = 3 gpm; Installed - 10/15/82
Pump Test Conducted by E.R. Sullivan, Inc., Bolton, MA in October 1982

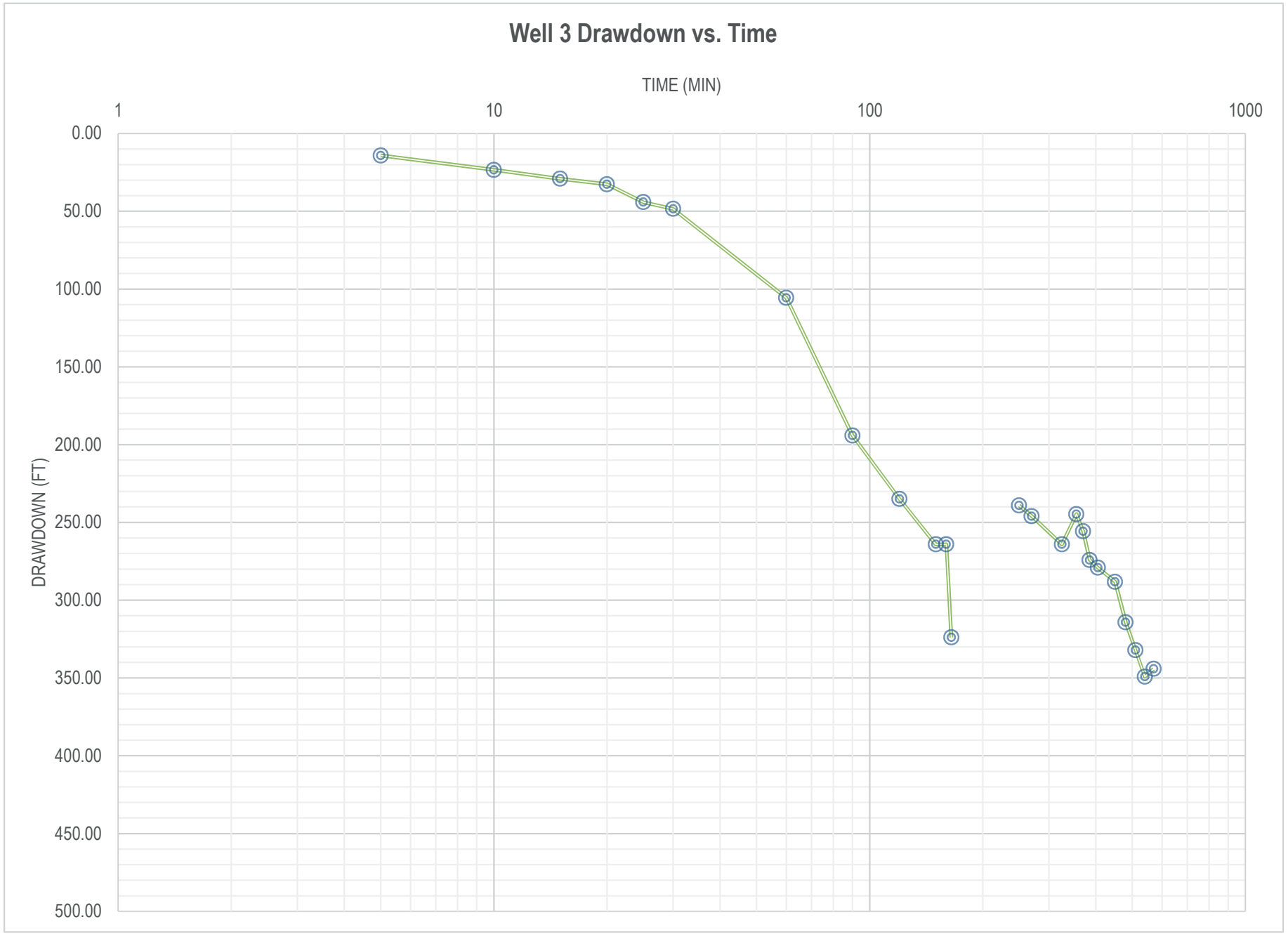
Time	Time Elapsed Minutes	Well 2 Water Level (ft btoc)	Well 2 Drawdown (ft)	Well 2 Pumping Rate (GPM)	Notes
Static Water Level					
10/28/82 11:45 AM		24.6	0.00	0.00	
10/28/82 11:50 AM	5	50.01	25.41	15	
10/28/82 11:55 AM	10	68.22	43.62	15	
10/28/82 12:00 PM	15	82.42	57.82	15	
10/28/82 12:05 PM	20	98.20	73.60	15	
10/28/82 12:10 PM	25	114.01	89.41	14	
10/28/82 12:15 PM	30	126.42	101.82	14	
10/28/82 12:20 PM	35	134.31	109.71	14	
10/28/82 12:50 PM	65				Shutdown
10/28/82 4:30 PM	285	26.84	2.24	15.0	Restarted
10/28/82 5:00 PM	315	113.81	89.21	14.0	
10/28/82 5:30 PM	345	153.31	128.71	10.0	
10/28/82 6:00 PM	375	177.85	153.25	8.0	
10/28/82 6:30 PM	405	223.95	199.35	8.0	
10/28/82 7:00 PM	435	277.65	253.05	8.0	
10/28/82 7:30 PM	465	308.30	283.70	6.0	
10/28/82 8:00 PM	495	320.52	295.92	6.0	
10/28/82 8:30 PM	525	328.72	304.12	5.0	
10/28/82 9:00 PM	555	334.10	309.50	5.0	
10/28/82 9:30 PM	585	334.77	310.17	5.0	
10/28/82 10:00 PM	615	336.31	311.71	5.0	
10/28/82 10:30 PM	645	337.44	312.84	5.0	
10/28/82 11:00 PM	675	339.40	314.80	5.0	
10/28/82 11:30 PM	705	340.00	315.40	5.0	
10/29/82 2:00 AM	855	350.00	325.40	4.5	
10/29/82 4:00 AM	975	360.42	335.82	4.5	
10/29/82 6:00 AM	1095	345.21	320.61	5.0	
10/29/82 8:00 AM	1215	348.01	323.41	4.0	
10/29/82 9:00 AM	1275	346.00	321.40	4.5	
180 Days	**259200**		**441.76**		Projected 180-Day Drawdown


Well 2 - Drawdown vs. Time
TIME (MIN)
1
10
100
1000
10000
100000
1000000
DRAWDOWN (FT)
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00

Woodhaven, Sherborn, MA
Bedrock Well Pump Test - Well No. 3
Well Information: Depth = 450'; SWL = 30'; Estimated Yield = 0.25 gpm; Installed - 10/19/82
Pump Test Conducted by E.R. Sullivan, Inc., Bolton, MA in October 1982

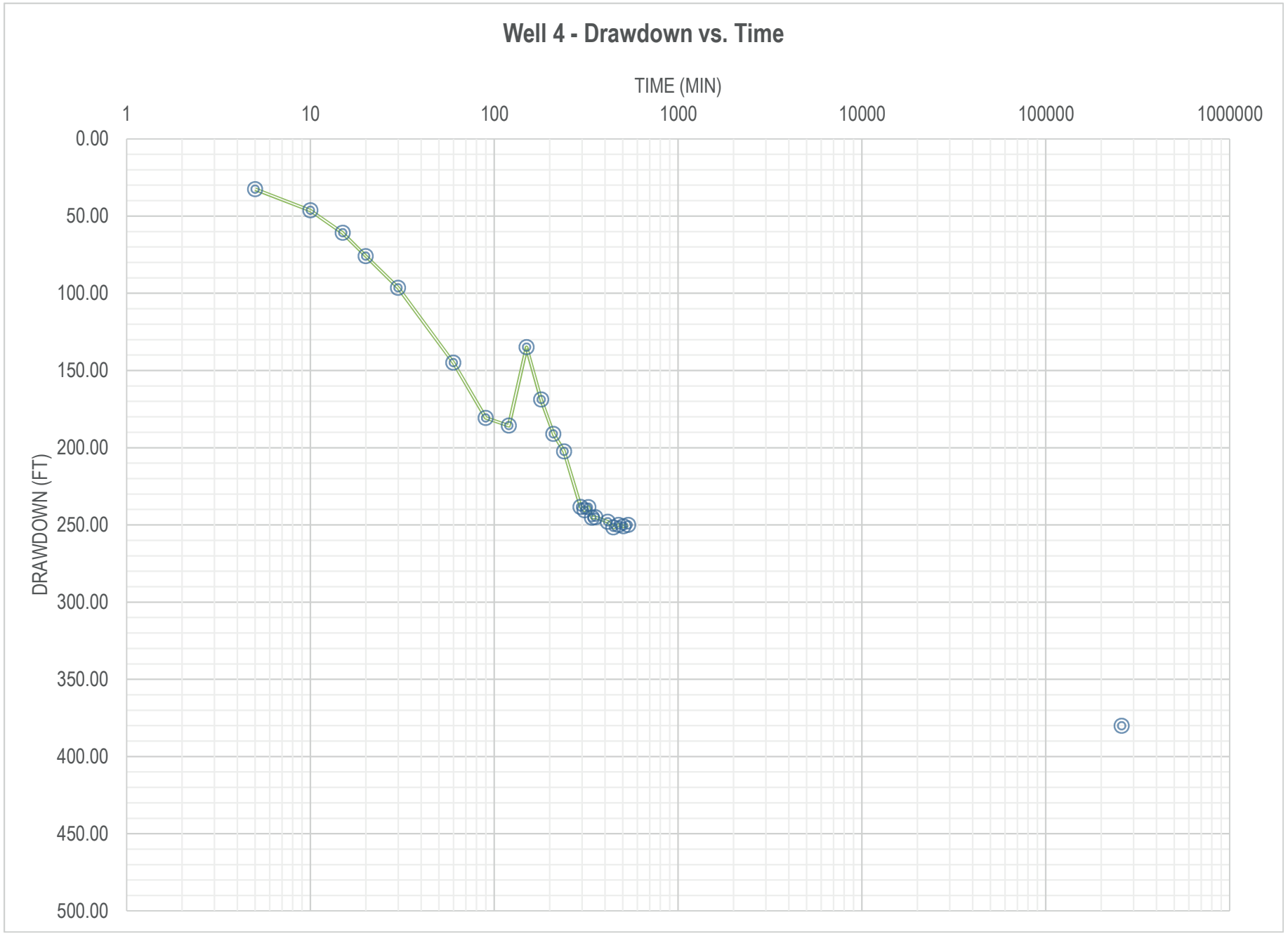
Time	Time Elapsed Minutes	Well 3 Water Level (ft btoc)	Well 3 Drawdown (ft)	Well 3 Pumping Rate (GPM)	Notes
Static Water Level				0.00	
10/27/82 10:00 AM		35.85		10	
10/27/82 10:05 AM	5	50.00	14.15	10	
10/27/82 10:10 AM	10	59.22	23.37	10	
10/27/82 10:15 AM	15	64.95	29.10	10	
10/27/82 10:20 AM	20	68.50	32.65	10	
10/27/82 10:25 AM	25	80.00	44.15	10	
10/27/82 10:30 AM	30	84.31	48.46	10	
10/27/82 11:00 AM	60	141.51	105.66	8	
10/27/82 11:30 AM	90	230	194.15	8	
10/27/82 12:00 PM	120	270.7	234.85	7	
10/27/82 12:30 PM	150	300	264.15	0	Shut -off (broken pipe)
10/27/82 12:40 PM	160	300	264.15	5	Restart
10/27/82 12:45 PM	165	359.8	323.95	4	
10/27/82 1:50 PM	230			0	Shut off
10/27/82 2:10 PM	250	275	239.15	2.5	Restart
10/27/82 2:30 PM	270	281.82	245.97	2.5	
10/27/82 3:25 PM	325	300	264.15	2.5	
10/27/82 3:55 PM	355	280.55	244.70	2.5	
10/27/82 4:10 PM	370	291.6	255.75	2.5	
10/27/82 4:25 PM	385	310	274.15	2	
10/27/82 4:45 PM	405	315	279.15	1.5	
10/27/82 5:30 PM	450	324	288.15	1.25	
10/27/82 6:00 PM	480	350	314.15		
10/27/82 6:30 PM	510	368	332.15	0.875	3.5 Qts
10/27/82 7:00 PM	540	385	349.15	0.875	3.5 Qts
10/27/82 7:30 PM	570	380	344.15	0.875	3.5 Qts

**** Well deemed unsuitable for development due to low yield**


Well 3 Drawdown vs. Time
TIME (MIN)
1
10
100
1000
DRAWDOWN (FT)
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00

Woodhaven, Sherborn, MA
Bedrock Well Pump Test - Well No. 4 *(Note: Eventually named PWS Well 3)*
Well Information: Depth = 400'; SWL = 15'; Estimated Yield = 6 gpm; Installed - 10/21/82
Pump Test Conducted by E.R. Sullivan, Inc., Bolton, MA in October 1982

Time	Time Elapsed Minutes	Well 4 Water Level (ft btoc)	Well 4 Drawdown (ft)	Well 4 Pumping Rate (GPM)	Notes
Static Water Level					
10/27/82 10:35 AM		30.00		0	
10/27/82 10:40 AM	5	62.62	32.62	12	
10/27/82 10:45 AM	10	76.38	46.38	12	
10/27/82 10:50 AM	15	90.90	60.90	12	
10/27/82 10:55 AM	20	105.94	75.94	12	
10/27/82 11:05 AM	30	126.51	96.51	12	
10/27/82 11:35 AM	60	175.00	145.00	9	
10/27/82 12:05 PM	90	210.76	180.76	9	
10/27/82 12:35 PM	120	215.80	185.80	9	
10/27/82 1:05 PM	150	165.00	135.00	5	
10/27/82 1:35 PM	180	198.91	168.91	9	
10/27/82 2:05 PM	210	221.07	191.07	9	
10/27/82 2:35 PM	240	232.45	202.45	9	
10/27/82 3:30 PM	295	268.38	238.38	7.5	
10/27/82 3:45 PM	310	270.54	240.54	7.5	
10/27/82 4:00 PM	325	268.51	238.51	7.5	
10/27/82 4:15 PM	340	275.35	245.35	7.5	
10/27/82 4:30 PM	355	275.08	245.08	7.5	
10/27/82 5:30 PM	415	277.95	247.95	7.5	
10/27/82 6:00 PM	445	281.70	251.70	7.5	
10/27/82 6:30 PM	475	280.00	250.00	7.5	
10/27/82 7:00 PM	505	281.00	251.00	7.5	
10/27/82 7:30 PM	535	280.00	250.00	7.5	
180 Days	**259200**		**380.18**		Projected 180-Day Drawdown


Well 4 - Drawdown vs. Time
TIME (MIN)
1
10
100
1000
10000
100000
1000000
DRAWDOWN (FT)
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00

Attachment C

Water Quality Data

ONSITE ENGINEERING INC.

Woodhaven
Water Quality Summary
Woodhaven/Leland Farms Water Supply Feasibility Study
Sherborn, MA

		Well 1	**Well 2**	**Well 3**
		7/21/2020	7/21/2020	7/21/2020
Parameter	MCL	Result	Result	Result
Total Coliform Bacteria	Absent	Absent	Absent	Absent
Alkalinity	None	97	108	125
Ammonia	None	ND	ND	ND
Chloride	250	335	268	424
Color	15	<5	<5	120
Chlorine	4	ND	0.09	0.26
Nitrate	10	1.34	0.649	ND
Nitrite	1	ND	ND	ND
Odor	3	1	1	1
pH	6.5-8.5	6.6	6.6	6.1
Conductivity	NA	1320	1100	1510
Sulfate	250	21	18	13
TDS	500	920	620	836
TSS	None	ND	ND	110
Turbidity	None	ND	0.7	315
Calcium	None	142	107	93.9
Iron	0.3	ND	ND	52
Magnesium	None	16.7	17.9	12
Arsenic	0.01	ND	ND	0.004
Copper	1	ND	ND	0.493
Manganese	0.005	ND	0.005	3.21
Lead	0.015	ND	ND	0.004
Potassium	None	8	9	16
Sodium	20	71	59	128
Hardness*	None	423	341	329

** Hardness Levels: 0-75=Soft; 76-150=Moderate; 150-250=Hard; 250+=Very Hard*

Leland Farms
Water Quality Summary
Woodhaven/Leland Farms Water Supply Feasibility Study
Sherborn, MA

		11/8/2016		7/21/2020
		Raw	Entry Point	Raw
Parameter	MCL	Result	Result	Result
Total Coliform Bacteria	Absent	Absent	Absent	Absent
Alkalinity	None	123	117	106
Ammonia	None	<0.1	<0.1	ND
Chloride	250	290	273	424
Color	15	<5	<5	<5
Chlorine	4	<0.01	<0.01	ND
Nitrate	10	2.15	1.62	0.678
Nitrite	1	<0.007	<0.007	ND
Odor	3	Free	Free	1
pH	6.5-8.5	7.16	7.02	6.6
Conductivity	NA	1406	1605	1200
Sulfate	250	26	30	30
TDS	500	1080	768	708
TSS	None	5	<2	ND
Turbidity	None	0.39	0.24	0.2
Calcium	None	124.1	66.3	104
Iron	0.3	<0.05	0.011	ND
Magnesium	None	27.1	13.7	15.8
Arsenic	0.01	<0.005	<0.005	ND
Copper	1	<0.01	0.01	0.008
Manganese	0.005	0.112	<0.005	0.089
Lead	0.015	<0.001	<0.001	ND
Potassium	None	13.8	228.9 (1)	10
Sodium	20	67.5	49.5	91
Hardness (2)	None	421.5	222	324

Notes:

(1) Potassium in entry point sample likely due to potassium chlorinde used for ion exchange treatment

(2) Hardness Levels: 0-75=Soft; 76-150=Moderate; 150-250=Hard; 250+=Very Hard

New England Testing Laboratory, Inc.
(401) 353-3420

REPORT OF ANALYTICAL RESULTS

NETLAB Work Order Number: 0G21063
Client Project: Woodhaven Elderly Housing Committee

Report Date: 29-July-2020

Prepared for:

Andrew Donnelly
WhiteWater
253B Worcester Road
Charlton, MA 01507

Richard Warila, Laboratory Director
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, RI 02893
rich.warila@newenglandtesting.com

Samples Submitted:

The samples listed below were submitted to New England Testing Laboratory on 07/21/20. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the sample(s) provided to us by the client which are indicated on the custody record. The case number for this sample submission is 0G21063. Custody records are included in this report.

Lab ID	Sample	Matrix	Date Sampled
0G21063-01	WELL 1 RAW	Drinking water	07/21/2020
0G21063-02	WELL 2 RAW	Drinking water	07/21/2020
0G21063-03	WELL 3 RAW	Drinking water	07/21/2020

Request for Analysis

At the client's request, the analyses presented in the following table were performed on the samples submitted.

WELL 1 RAW

Nitrite as N	SM4500-N02-B (11)
Turbidity	SM2130-B (11)
Total Suspended Solids	SM2540-D (11)
Total Dissolved Solids	SM2540-C (11)
Sulfate	SM4500-S04-E (11)
Specific Conductance	SM2510-B (11)
Calcium	SM3120-B (11)
Odor	SM2150 (11)
Nitrate and Nitrite as N	4500-N03-E
Nitrate as N	4500-N03-E
Residual Chlorine	SM4500-CI-G (11)
Color	SM 2120 (11)
Magnesium	SM3120-B (11)
pH	SM4500-H-B (11)
Iron	SM3120-B (11)
Chloride	SM4500CI-B (11)
Arsenic	EPA 200.8
Copper	EPA 200.8
Manganese	EPA 200.8
Potassium	EPA 200.7
Sodium	EPA 200.7
Total Coliform and E. coli bacteria	SM9223B(04) (Colilert 18)
Alkalinity (CaCO3)	SM2320-B (11)
Ammonia	SM4500-NH3-D (11)
Lead	EPA 200.8

WELL 2 RAW

Magnesium	SM3120-B (11)
Alkalinity (CaCO3)	SM2320-B (11)
Total Coliform and E. coli bacteria	SM9223B(04) (Colilert 18)
Sodium	EPA 200.7
Potassium	EPA 200.7

WELL 2 RAW	(continued)
Lead	EPA 200.8
Manganese	EPA 200.8
Calcium	SM3120-B (11)
Arsenic	EPA 200.8
Iron	SM3120-B (11)
Color	SM 2120 (11)
Copper	EPA 200.8
Total Suspended Solids	SM2540-D (11)
Ammonia	SM4500-NH3-D (11)
Chloride	SM4500CI-B (11)
Turbidity	SM2130-B (11)
Total Dissolved Solids	SM2540-C (11)
Sulfate	SM4500-S04-E (11)
Specific Conductance	SM2510-B (11)
Odor	SM2150 (11)
Nitrite as N	SM4500-N02-B (11)
Nitrate and Nitrite as N	4500-N03-E
Nitrate as N	4500-N03-E
pH	SM4500-H-B (11)
Residual Chlorine	SM4500-CI-G (11)
WELL 3 RAW	
Specific Conductance	SM2510-B (11)
Residual Chlorine	SM4500-CI-G (11)
Nitrate as N	4500-N03-E
Nitrate and Nitrite as N	4500-N03-E
Total Suspended Solids	SM2540-D (11)
Nitrite as N	SM4500-N02-B (11)
Total Dissolved Solids	SM2540-C (11)
pH	SM4500-H-B (11)
Sulfate	SM4500-S04-E (11)
Color	SM 2120 (11)
Manganese	EPA 200.8
Odor	SM2150 (11)
Chloride	SM4500CI-B (11)
Ammonia	SM4500-NH3-D (11)
Alkalinity (CaCO3)	SM2320-B (11)
Total Coliform and E. coli bacteria	SM9223B(04) (Colilert 18)
Sodium	EPA 200.7
Lead	EPA 200.8
Copper	EPA 200.8
Arsenic	EPA 200.8
Magnesium	SM3120-B (11)
Iron	SM3120-B (11)
Calcium	SM3120-B (11)
Turbidity	SM2130-B (11)
Potassium	EPA 200.7

The analytical methods provided are documented in the following references:

Manual of Methods for Chemical Analysis of Water and Water Wastes, EPA-600/4-79-020 (Revised 1983), USEPA/EMSL.
Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, APHA, AWWA-WPCF.
40 CFR 136, *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act*, Office of Federal Register National Archives and Records Administration.

Results:

Sample: WELL 1 RAW
0G21063-01 (Drinking water)

Microbiology

	Result	Reporting Limit	Units	Date Analyzed
Total coliform	ABSENT	1.00	P/A	07/21/20 17:10

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO3	**97**	2	mg/L	07/24/20
Ammonia	ND	0.1	mg/L	07/24/20
Chloride	**335**	10	mg/L	07/24/20
Color	<	5	C.U.	07/21/20 16:40
Free Residual Chlorine	ND	0.01	mg/L	07/21/20 16:35
Nitrate as N	**1.34**	0.0300	mg/L	07/22/20 15:30
Nitrate and Nitrite as N	**1.34**	0.03	mg/L	07/22/20
Nitrite as N	ND	0.007	mg/L	07/22/20 12:35
Odor	**1**	1	T.O.N	07/21/20 16:40
pH	**6.6**	0.1	SU	07/21/20 15:55
Specific Conductance	**1320**	2	uS/cm	07/23/20
Sulfate	**21**	2	mg/L	07/24/20
Total Dissolved Solids	**920**	10	mg/L	07/22/20
Total Suspended Solids	ND	2	mg/L	07/22/20
Turbidity	ND	0.1	NTU	07/21/20 16:25

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	**142**	0.05	mg/L	07/22/20
Iron	ND	0.05	mg/L	07/22/20
Magnesium	**16.7**	0.05	mg/L	07/22/20
Arsenic	ND	0.001	mg/L	07/28/20
Copper	ND	0.005	mg/L	07/28/20
Manganese	ND	0.005	mg/L	07/28/20
Lead	ND	0.001	mg/L	07/28/20
Potassium	**8**	2	mg/L	07/22/20
Sodium	**71**	2	mg/L	07/22/20
Total Hardness	**423**	0.125	mg/L	07/22/20

Sample: WELL 2 RAW
0G21063-02 (Drinking water)

Microbiology

	Result	Reporting Limit	Units	Date Analyzed
Total coliform	ABSENT	1.00	P/A	07/21/20 17:10

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO3	**108**	2	mg/L	07/24/20
Ammonia	ND	0.1	mg/L	07/24/20
Chloride	**268**	10	mg/L	07/24/20
Color	<	5	C.U.	07/21/20 16:40
Free Residual Chlorine	**0.09**	0.01	mg/L	07/21/20 16:35
Nitrate as N	**0.649**	0.0300	mg/L	07/22/20 15:30
Nitrate and Nitrite as N	**0.65**	0.03	mg/L	07/22/20
Nitrite as N	ND	0.007	mg/L	07/22/20 12:35
Odor	**1**	1	T.O.N	07/21/20 16:40
pH	**6.6**	0.1	SU	07/21/20 15:55
Specific Conductance	**1100**	2	uS/cm	07/23/20
Sulfate	**18**	2	mg/L	07/24/20
Total Dissolved Solids	**620**	10	mg/L	07/22/20
Total Suspended Solids	ND	2	mg/L	07/22/20
Turbidity	**0.7**	0.1	NTU	07/21/20 16:25

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	**107**	0.05	mg/L	07/22/20
Iron	ND	0.05	mg/L	07/22/20
Magnesium	**17.9**	0.05	mg/L	07/22/20
Arsenic	ND	0.001	mg/L	07/28/20
Copper	ND	0.005	mg/L	07/28/20
Manganese	**0.005**	0.005	mg/L	07/28/20
Lead	ND	0.001	mg/L	07/28/20
Potassium	**9**	2	mg/L	07/22/20
Sodium	**59**	2	mg/L	07/22/20
Total Hardness	**341**	0.125	mg/L	07/22/20

Sample: WELL 3 RAW
0G21063-03 (Drinking water)

Sample: WELL 3 RAW (Continued)
0G21063-03 (Drinking water)

Microbiology

	Result	Reporting Limit	Units	Date Analyzed
Total coliform	ABSENT	1.00	P/A	07/21/20 17:10

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO3	**125**	2	mg/L	07/24/20
Ammonia	ND	0.1	mg/L	07/24/20
Chloride	**424**	50	mg/L	07/24/20
Color	**120**	25	C.U.	07/22/20 11:30
Free Residual Chlorine	**0.26**	0.01	mg/L	07/21/20 16:35
Nitrate as N	ND	0.0300	mg/L	07/22/20 15:30
Nitrate and Nitrite as N	ND	0.03	mg/L	07/22/20
Nitrite as N	ND	0.007	mg/L	07/22/20 12:35
Odor	**1**	1	T.O.N	07/21/20 16:40
pH	**6.1**	0.1	SU	07/21/20 15:55
Specific Conductance	**1510**	2	uS/cm	07/23/20
Sulfate	**13**	2	mg/L	07/24/20
Total Dissolved Solids	**836**	10	mg/L	07/22/20
Total Suspended Solids	**110**	2	mg/L	07/22/20
Turbidity	**315**	1.0	NTU	07/21/20 16:25

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	**93.9**	0.05	mg/L	07/22/20
Iron	**52.0**	0.05	mg/L	07/22/20
Magnesium	**23.0**	0.05	mg/L	07/22/20
Arsenic	**0.004**	0.001	mg/L	07/28/20
Copper	**0.493**	0.005	mg/L	07/28/20
Manganese	**3.21**	0.005	mg/L	07/28/20
Lead	**0.004**	0.001	mg/L	07/28/20
Potassium	**16**	2	mg/L	07/22/20
Sodium	**128**	2	mg/L	07/22/20
Total Hardness	**329**	0.125	mg/L	07/22/20

Case Narrative

All samples were submitted in the proper containers and were properly cooled/preserved upon receipt with the following exceptions: none.

The chain of custody was adequately completed and corresponded to the samples submitted with the following exceptions: none.

All preparation/analysis holding times were met and all quality control audits were within control limits with the following exceptions: none.

NEW ENGLAND TESTING LABORATORY, INC.
1254 Douglas Ave.
North Providence, RI 02904
1-888-863-8522

0 G 2 1063 N

CHAIN OF CUSTODY RECORD

PROJ. NO.

PROJECT NAME/LOCATION: Woodhaven Elderly Center

CLIENT: WhiteWater

REPORT TO:

INVOICE TO:

DATE	TIME	COMP	GRAB	SAMPLE I.D.	AQUEOUS	SOIL	OTHER	NO. OF CONTAINERS	PRESERVATIVE	TESTS: WWI Comp. Scan	REMARKS
7/21	0715		✓	well #1 RAW	✓			3	—	✓	WhiteWater
	0725		✓	well #2 RAW	✓			3	—	✓	comprehensive Scan,
✓	0755		✓	well #3 RAW	✓			3	—	✓	Special Samples
											for engineering study
								9			
											well #1 PH - 6.95
											well #2 PH - 6.90
											well #3 PH - 6.50

Sampled by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Laboratory Remarks:	Special Instructions:
[signature]	7/21/20 0715			Temp. received: 4	List Specific Detection Limit Requirements:
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Cooled ☐	
[signature]	7/21/20 1150	[signature]	7/21/h 134h		
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time		Turnaround (Business Days)_____
[signature]	7/21/20 1455	[signature]	7/21 1457		

TA

New England Testing Laboratory, Inc.
(401) 353-3420

REPORT OF ANALYTICAL RESULTS

NETLAB Work Order Number: 0G21061
Client Project: Leland Farms

Report Date: 29-July-2020

Prepared for:

Andrew Donnelly
WhiteWater
253B Worcester Road
Charlton, MA 01507

Richard Warila, Laboratory Director
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, RI 02893
rich.warila@newenglandtesting.com

Samples Submitted:

The samples listed below were submitted to New England Testing Laboratory on 07/21/20. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the sample(s) provided to us by the client which are indicated on the custody record. The case number for this sample submission is 0G21061. Custody records are included in this report.

Lab ID	Sample	Matrix	Date Sampled
0G21061-01	Well Raw	Drinking water	07/21/2020

Request for Analysis

At the client's request, the analyses presented in the following table were performed on the samples submitted.

Well Raw

Color	SM 2120 (11)
Iron	SM3120-B (11)
Magnesium	SM3120-B (11)
Arsenic	EPA 200.8
Copper	EPA 200.8
Manganese	EPA 200.8
Lead	EPA 200.8
Potassium	EPA 200.7
Sodium	EPA 200.7
Total Coliform and E. coli bacteria	SM9223B(04) (Colilert 18)
Alkalinity (CaCO3)	SM2320-B (11)
Calcium	SM3120-B (11)
Chloride	SM4500Cl-B (11)
Turbidity	SM2130-B (11)
Residual Chlorine	SM4500-Cl-G (11)
Nitrate as N	4500-N03-E
Nitrate and Nitrite as N	4500-N03-E
Nitrite as N	SM4500-N02-B (11)
Odor	SM2150 (11)
pH	SM4500-H-B (11)
Specific Conductance	SM2510-B (11)
Sulfate	SM4500-S04-E (11)
Total Dissolved Solids	SM2540-C (11)
Total Suspended Solids	SM2540-D (11)
Ammonia	SM4500-NH3-D (11)

The analytical methods provided are documented in the following references:

Manual of Methods for Chemical Analysis of Water and Water Wastes, EPA-600/4-79-020 (Revised 1983), USEPA/EMSL.
Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, APHA, AWWA-WPCF.
40 CFR 136, *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act*, Office of Federal Register National Archives and Records Administration.

Results:

Sample: Well Raw
0G21061-01 (Drinking water)

Microbiology

	Result	Reporting Limit	Units	Date Analyzed
Total coliform	ABSENT	1.00	P/A	07/21/20 17:10

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO3	**106**	2	mg/L	07/24/20
Ammonia	ND	0.1	mg/L	07/24/20
Chloride	**424**	50	mg/L	07/24/20
Color	<	5	C.U.	07/21/20 16:40
Free Residual Chlorine	ND	0.01	mg/L	07/21/20 16:35
Nitrate as N	**0.338**	0.0300	mg/L	07/22/20 11:25
Nitrate and Nitrite as N	**0.34**	0.03	mg/L	07/22/20
Nitrite as N	ND	0.007	mg/L	07/22/20 11:25
Odor	**1**	1	T.O.N	07/21/20 16:40
pH	**6.6**	0.1	SU	07/21/20 15:55
Specific Conductance	**1200**	2	uS/cm	07/23/20
Sulfate	**30**	2	mg/L	07/24/20
Total Dissolved Solids	**708**	10	mg/L	07/22/20
Total Suspended Solids	ND	2	mg/L	07/22/20
Turbidity	**0.2**	0.1	NTU	07/21/20 16:25

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	**104**	0.05	mg/L	07/22/20
Iron	ND	0.05	mg/L	07/22/20
Magnesium	**15.8**	0.05	mg/L	07/22/20
Arsenic	ND	0.001	mg/L	07/28/20
Copper	**0.008**	0.005	mg/L	07/28/20
Manganese	**0.089**	0.005	mg/L	07/28/20
Lead	ND	0.001	mg/L	07/28/20
Potassium	**10**	2	mg/L	07/22/20
Sodium	**91**	2	mg/L	07/22/20
Total Hardness	**324**	0.125	mg/L	07/22/20

Case Narrative

All samples were submitted in the proper containers and were properly cooled/preserved upon receipt with the following exceptions: none.

The chain of custody was adequately completed and corresponded to the samples submitted with the following exceptions: none.

All preparation/analysis holding times were met and all quality control audits were within control limits with the following exceptions: For the free residual chlorine analysis the matrix spike for the 'Well Raw' sample recovered outside of the recommended QC parameters.

NEW ENGLAND TESTING LABORATORY, INC.
1254 Douglas Ave.
North Providence, RI 02904
1-888-863-8522

0 G 2 1061 B

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME/LOCATION: Leland Farms																	
	CLIENT: WhiteWater																	
	REPORT TO:																	
	INVOICE TO:																	
DATE	TIME	COMP	GRAB	SAMPLE I.D.	AQUEOUS	SOIL	OTHER	NO. OF CONTAINERS	PRESERVATIVE	TESTS: WWTI Comp. Scan							REMARKS	
7/21	0950		✓	well - RAW	✓			(3)	-	✓							White Water comprehensive scan Special Samples for engineering study	
																	PH - 6,80	

Sampled by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Laboratory Remarks: 4
[signature]	7/21/20 0950			Temp. received: ____
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Cooled ☐
[signature]	7/21/20 1150	[signature]	7/24 1345	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	
[signature]	7/24/2 1400	[signature]	7/21 1405	

Special Instructions:
List Specific Detection Limit Requirements:

Turnaround (Business Days)____

TA