October 1, 2012

Mr. H. Criss Stephens
Massachusetts Department of Environmental Protection
205B Lowell Street
Wilmington, MA 01887

RE: Request for Additional Information
Wayland Town Office Discharge Site
Transmittal No. X250635

Dear Criss:

Tighe & Bond has prepared the following response to your email dated September 13, 2012 which requested additional information regarding the proposed groundwater discharge at the Wayland Town Offices. A copy of your comments has been incorporated into this letter with Tighe & Bond's response immediately following. A copy of the email has been appended to this document for reference purposes.

- The additional test pitting and percolation testing provided adequately characterize the near surface, unconsolidated sediments found at the proposed discharge location.

  Tighe & Bond Response:

  Acknowledged, no further action is required for soil characterization.

- We concur that the mounding analysis method employed is acceptable to MassDEP, however we noticed that several of the input aquifer parameters employed in the most recent mounding analysis differ from the values determined in the initial hydrogeologic report; specifically hydraulic conductivity was initially determined to be 76 feet/day and a value of 0.12 was assigned to specific yield. These values in the latest mounding analysis have been revised to 57 feet/day and 0.24 respectively. While these changes do not significantly alter the results of the mounding analysis, what is the rationale behind the change?

  Tighe & Bond Response:

  Regarding the specific yield, there was a typo in the Section 4.6 of the originally submitted hydrogeologic report that stated that "a specific yield of 0.12 ft^3/ft^3 was selected for the analysis". If you reference Appendix F of the report, a specific yield of 0.24 ft^3/ft^3 was actually used to conduct the groundwater mounding calculation. This is the correct value for the specific yield and has been used consistently for all calculation.

  Regarding the hydraulic conductivity, this number was decreased from 76 feet/day to 57 feet/day based on the incorporation of the percolation test results. Based on our discussions, we understand that this is not a MassDEP accepted practice, even though it has been used on other MassDEP approved projects. In response to your comment, the data point associated with the percolation test has been eliminated and the hydraulic conductivity value was recalculated to the original value of 76 feet/day.

Based on this, all calculations submitted under this response are based on a specific yield of 0.24 ft^3/ft^3 and a hydraulic conductivity (K) of 76 feet/day. The groundwater mounding analysis was updated to reflect these changes. As a result, the projected groundwater mound height is 2.4 feet, approximately 0.3 feet less than submitted under the letter response. The corresponding elevations and grading have been updated to reflect this change. Attached to this letter are the following figures:

- *Figure 4-2R2 – Geologic Cross-Sections, Updated October 2012*
- *Figure 4-3R2 – Groundwater Contour Plan, Updated October 2012*
- *Figure 5-1R2 – Effluent Disposal Layout, Updated October 2012*
- *Figure 5-2R2 – Disposal Bed Profile, Updated October 2012*

These are the updated versions of the previously submitted figures, and reflect the changes based on the revised groundwater mounding calculation. Also attached is a revised version of Section 6 Conclusion which updates these results.

- Tighe and Bond (T&B) has determined that the aerial extent of groundwater mounding at the proposed location will be limited to 37 feet from the edge of the SAS and will not have a negative impact on the basements and septic systems of abutting properties. Kevin and I are concerned about the appropriateness of the method employed to evaluate the aerial extent of mounding and potential impacts to below grade structures and foundations. Bouwer (Hydrogeology Journal; 2002; 10:121-142) states that the method employed by T&B is appropriate when evaluating rectangular recharge basins where the length of the basin is **at least** five times the width. The length to width ratio of the proposed SAS is, however, less than half that required by Bouwer for this method.

  In the same paper Bouwer proposes an alternate method for evaluating round, square or irregular shaped basins that can be represented by an equivalent circular area. While the proposed basin is not a square, its shape is arguably closer to this geometry than that of the method employed. Keeping all other parameters the same, the limit of mounding influence determined by using this method ranges from 122 feet (using a radius value of 85 feet; equal recharge area) to 369 feet (using a radius of 50 feet; half of the width of the proposed SAS). Both of these values extend mounding impacts well beyond the distance of the nearest abutting structure located approximately 50 feet north of the proposed discharge.

  Given the site's shallow depth to groundwater, relatively flat water table (hydraulic gradient of approximately 0.005 ft/ft) and close proximity to abutters north of the proposed discharge, MassDEP requests that T&B reassess how abutting foundations, basements and septic systems will be impacted by the proposed discharge. MassDEP recommends that T&B contact the Wayland Board of Health to obtain all available information regarding the location and construction of septic systems, depths to groundwater and history of wet or flooded basements for all abutting properties located north and east of the proposed discharge location. T&B must adequately evaluate and assess potential hydraulic impacts to abutting sensitive receptors before a site approval letter can be issued by MassDEP.

Tighe & Bond Response:

Tighe & Bond agrees that using the Bouwer method for square or irregular shaped basins is an appropriate method for the SAS layout in Wayland. Using the revised hydraulic conductivity (K) value of 76 feet/day and an H_c feet (height of groundwater mound in center of recharge area) value of 2.4, with all other parameters the same, this results in a L_n (distance from the center of recharge area and control area) of 147.1 feet. This is the revised estimated extent of the groundwater mound from the center of the recharge area. This revised horizontal extent has been updated in all of the attached figures previously mentioned. In addition, an additional figure called Septic System Analysis has been appended to this letter to show the proposed SAS in relation to the neighboring septic systems. A circle has been drawn to show the horizontal extents of the proposed SAS, and as you will see in the figure, an emergent groundwater problem is not anticipated as there are no basements or septic systems within the horizontal extent of the groundwater mound. For your reference, the documentation obtained from the Wayland Board of Health that was used to develop this figure and locate the existing septic systems in the area has also been appended to this document.

- MassDEP has completed its review of the proposed increased loading rates for drip dispersal. A decision has been made to increase the maximum loading rate for drip dispersal to 1.5 gpd/sf. If the area between drip lines is to be designated as reserve area, then the minimum spacing between drip lines remains 4 feet on center. Also, MassDEP has allowed a 50% reduction in reserve area for projects which utilize an MBR or equivalent technology. You are welcome to revise your application if you desire to reflect this change.

  Tighe & Bond Response: Tighe & Bond appreciates this update regarding the drip dispersal loading rate decision. As time and effort has been invested into redesigning this system to a trench system, the Town is going to proceed forward with design using a trench system.

In closing, we would like to thank the Department for their ongoing cooperation in the review of this project. Should you have additional questions or comments regarding this project please contact the undersigned at (508) 471-9644 or via email at klking@tighebond.com .

Regards,

Karla L. King, P.E.
Project Engineer

CC: Fred Turkington, Town of Wayland
John Moynihan, Town of Wayland
Criss Stephens, DEP NERO
File: W1396/Hydrogeo Report

J:\W\W1396 Wayland\LTR\Hydrogeo Response to MassDEP\Response to Email Comments 100112\Response to Criss Email 100112.doc

Karla L. King

From: Stephens, Harold (DEP) <harold.stephens@state.ma.us>
Sent: Thursday, September 13, 2012 2:32 PM
To: Ian B. Catlow
Cc: Brander, Kevin (DEP); fturkington@wayland.ma.us; Karla L. King; Worrall, Eric (DEP)
Subject: Wayland/Town Office Discharge Site

Categories: Wayland

Ian;

Kevin Brander and I have completed our review of the additional information you provided for the proposed groundwater discharge at the Town Office Site in Wayland, Massachusetts. The following are our comments and concerns regarding your submittal:

- The additional test pitting and percolation testing provided adequately characterize the near surface, unconsolidated sediments found at the proposed discharge location.

- We concur that the mounding analysis method employed is acceptable to MassDEP, however we noticed that several of the input aquifer parameters employed in the most recent mounding analysis differ from the values determined in the initial hydrogeologic report; specifically hydraulic conductivity was initially determined to be 76 feet/day and a value of 0.12 was assigned to specific yield. These values in the latest mounding analysis have been revised to 57 feet/day and 0.24 respectively. While these changes do not significantly alter the results of the mounding analysis, what is the rationale behind the change?

- Tighe and Bond (T&B) has determined that the aerial extent of groundwater mounding at the proposed location will be limited to 37 feet from the edge of the SAS and will not have a negative impact on the basements and septic systems of abutting properties. Kevin and I are concerned about the appropriateness of the method employed to evaluate the aerial extent of mounding and potential impacts to below grade structures and foundations. Bouwer (Hydrogeology Journal; 2002; 10:121-142) states that the method employed by T&B is appropriate when evaluating rectangular recharge basins where the length of the basin is **at least** five times the width. The length to width ratio of the proposed SAS is, however, less than half that required by Bouwer for this method.

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  Given the site's shallow depth to groundwater, relatively flat water table (hydraulic gradient of approximately 0.005 ft/ft) and close proximity to abutters north of the proposed discharge, MassDEP requests that T&B reassess how abutting foundations, basements and septic systems will be impacted by the proposed discharge. MassDEP recommends that T&B contact the Wayland Board of Health to obtain all available information regarding the location and construction of septic systems, depths to groundwater and history of wet or flooded basements for all abutting properties located north and east of the proposed discharge location. T&B

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- MassDEP has completed its review of the proposed increased loading rates for drip dispersal. A decision has been made to increase the maximum loading rate for drip dispersal to 1.5 gpd/sf. If the area between drip lines is to be designated as reserve area, then the minimum spacing between drip lines remains 4 feet on center. Also, MassDEP has allowed a 50% reduction in reserve area for projects which utilize an MBR or equivalent technology. You are welcome to revise your application if you desire to reflect this change.

Please contact either myself or Kevin Brander if you have questions or comments regarding the above.

Criss

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H. Criss Stephens
Hydrogeologist
MassDEP/NERO/BRP
978-694-3241

Groundwater Mounding Analysis

Project: Wayland Town Offices **Project #:** W-1396
Performed By: KLK **Description:** Existing Leachfield
Checked By: _____ **Calculated Mound Height:** 2.4 **feet**

Input Parameters (input only shaded areas):

Recharge Period	t	90 days	Time to equilibrium
Width of Field	W	100 feet	
Length of Field	L	226 feet	
Hydraulic Conductivity	K	76 ft/day	
Specific Yield	V	0.24 ft^3/ft^3	
Saturated Thickness	D	1.67 feet	
Daily Flow	Q	13,600 gpd	

Calculated Parameters:

1/2 width	a =	50 feet
1/2 length	b =	113 feet
Recharge Rate	j =	0.08 ft/day

$$\gamma = \frac{KD}{V} =$$ 527.8 ft^2/day

Dimensionless width $$\alpha = \frac{a}{\sqrt{4\gamma t}} =$$ 0.1147

Dimensionless length $$\beta = \frac{b}{\sqrt{4\gamma t}} =$$ 0.2592

Solution:
From Table 1of Hantush (1967), attached:

Function S*(a , b) = 0.1329

Water Table + Mound $$h_m = \sqrt{h_i^2 + \left[\frac{2j}{K}\lambda t \cdot S^*(\alpha,\beta)\right]}$$

h_m = 4.0 feet

Therefore:
Mound Height = $h_m - D$ = **2.4 feet**

Reference: Hantush, M.S. 1967. "Growth and Decay of Groundwater Mounds in Response to Uniform Percolation." Water Resources Research, 3, pp. 227-234.

Groundwater Mounding Analysis

Client Name:	Town of Wayland	**Project Number:**	W-1396
Description:	Existing Leachfield (Square)	**Project Location:**	Wayland, MA
Performed By:		**Checked By:**	

Input Parameters:

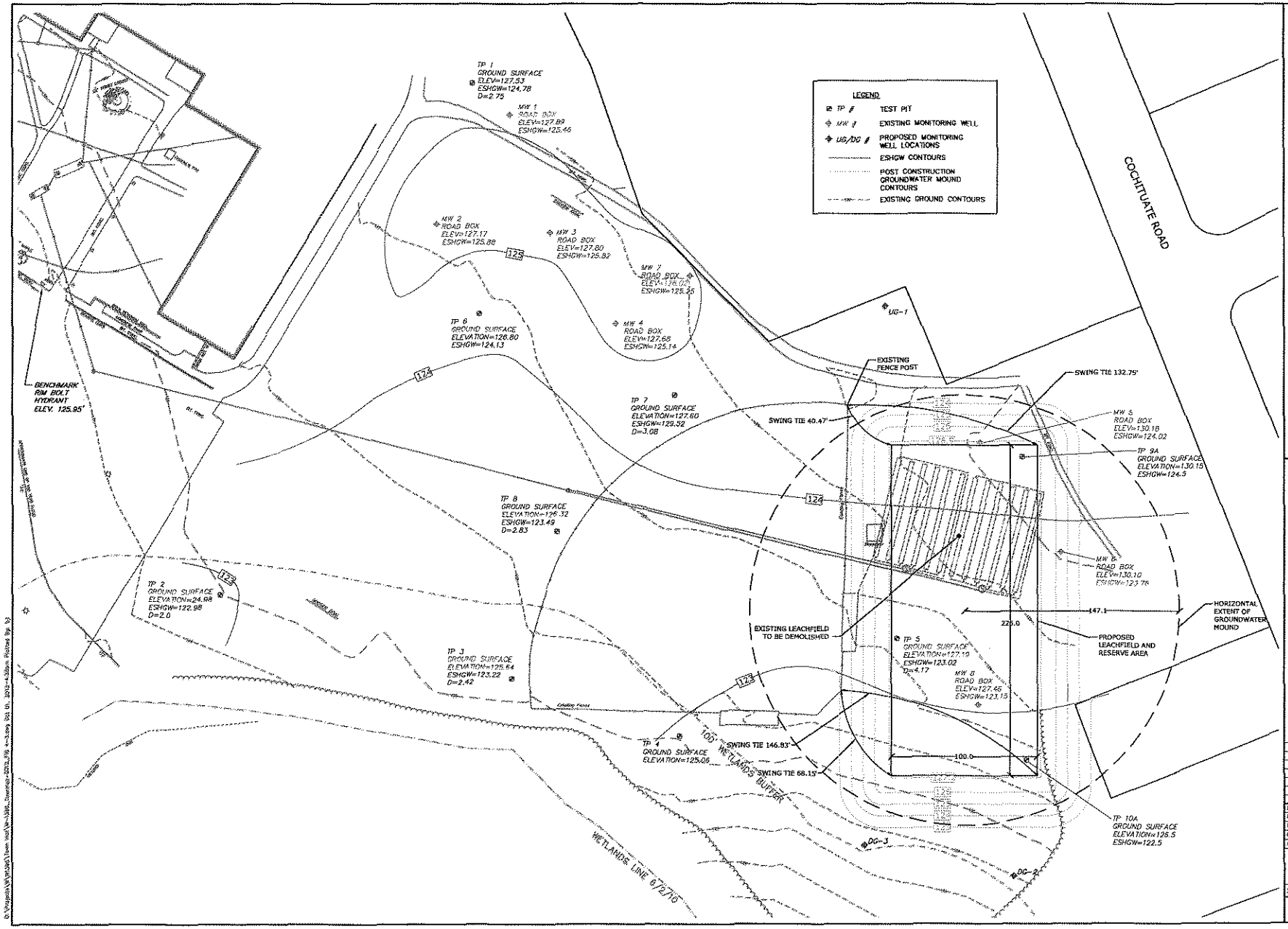
H_n:	0	*Height of groundwater table at control area. (ft)*
Q:	1,818	*Total daily flow. (ft^3 /day)*
A:	22,600	*Total recharge area. (ft^2)*
W:		*Width of recharge area. (ft)*
R_n:	147.10	*Distance from the center of recharge area and control area. (ft)*
K:	76	*Hydraulic conductivity. (ft/day)*
b:	1.67	*Saturated thickness. (ft)*

Calculated Parameters:

T:	126.6666667	ft^2/day	*Transmissivity*
i:	0.080	gal/day/ft^2	*Average infiltration rate in recharge area.*
R:	84.82	ft	*Equivalent radius of recharge area.*
H_c:	**2.40**	ft	*Height of groundwater mound in center of recharge area.*

Where: $$H_c = \left[\frac{iR^2}{4T}\left(1 + 2\ln\frac{R_n}{R}\right)\right] + H_n$$

This spreadsheet uses the method presented by Herman Bouwer in Chapter 24 of the Hydraulic Design Handbook. McGraw-Hill, New York, NY. 1999. The method is appropriate for square or circular infiltration areas.



Tighe&Bond
Consulting Engineers
www.tighebond.com

Town Office Building Groundwater Discharge

41 Cochituate Road

Wayland, Massachusetts

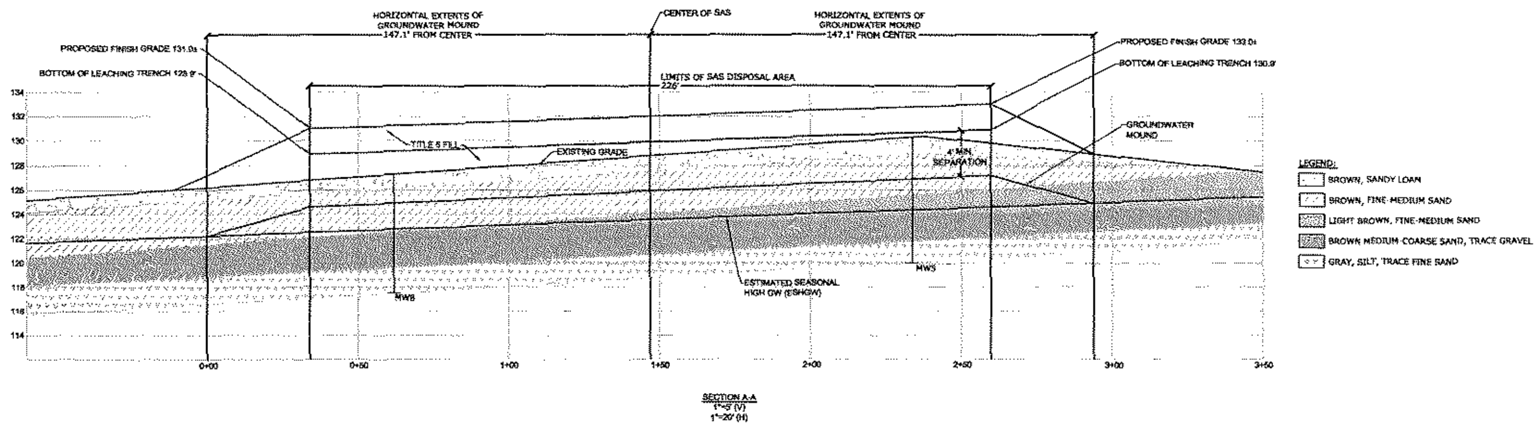
VERIFY SCALE
BAR IS 1 INCH ON ORIGINAL DRAWING
0 1 INCH
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Mark	Date	Description
PROJECT NO:		W1396
FILE:		Townhall_2017
DRAWN BY:		WJL
CHECKED:		MJK
APPROVED BY:		TBC

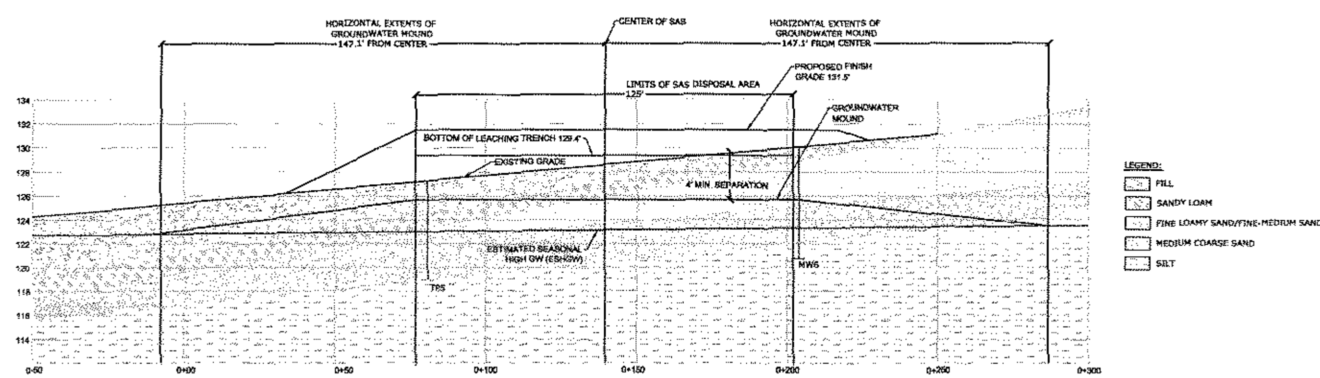
GROUNDWATER CONTOUR PLAN

SCALE: 1"=30'

FIGURE 4-3R2


HORIZONTAL EXTENTS OF GROUNDWATER MOUND 147.1' FROM CENTER
CENTER OF SAS
HORIZONTAL EXTENTS OF GROUNDWATER MOUND 147.1' FROM CENTER
PROPOSED FINISH GRADE 131.0±
BOTTOM OF LEACHING TRENCH 128.9'
PROPOSED FINISH GRADE 133.0±
BOTTOM OF LEACHING TRENCH 130.9'
LIMITS OF SAS DISPOSAL AREA 226'
TITLE 5 FILL
EXISTING GRADE
4' MIN. SEPARATION
GROUNDWATER MOUND
ESTIMATED SEASONAL HIGH GW (ESHGW)
MW8
MW5
LEGEND:
BROWN, SANDY LOAM
BROWN, FINE-MEDIUM SAND
LIGHT BROWN, FINE-MEDIUM SAND
BROWN MEDIUM-COARSE SAND, TRACE GRAVEL
GRAY, SILT, TRACE FINE SAND

SECTION A-A
1"=5' (V)
1"=20' (H)


HORIZONTAL EXTENTS OF GROUNDWATER MOUND 147.1' FROM CENTER
CENTER OF SAS
HORIZONTAL EXTENTS OF GROUNDWATER MOUND 147.1' FROM CENTER
PROPOSED FINISH GRADE 131.5'
LIMITS OF SAS DISPOSAL AREA 125'
GROUNDWATER MOUND
BOTTOM OF LEACHING TRENCH 129.4'
EXISTING GRADE
4' MIN. SEPARATION
ESTIMATED SEASONAL HIGH GW (ESHGW)
TP5
MW6
LEGEND:
FILL
SANDY LOAM
FINE LOAMY SAND/FINE-MEDIUM SAND
MEDIUM COARSE SAND
SILT

SECTION B-B
1"=5' (V)
1"=20' (H)

Tighe&Bond
Consulting Engineers
www.tighebond.com

Town Office Building Groundwater Discharge

41 Cochituate Road

Wayland, Massachusetts

VERIFY SCALE
BAR IS 1 INCH ON ORIGINAL DRAWING
0 — 1 INCH
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

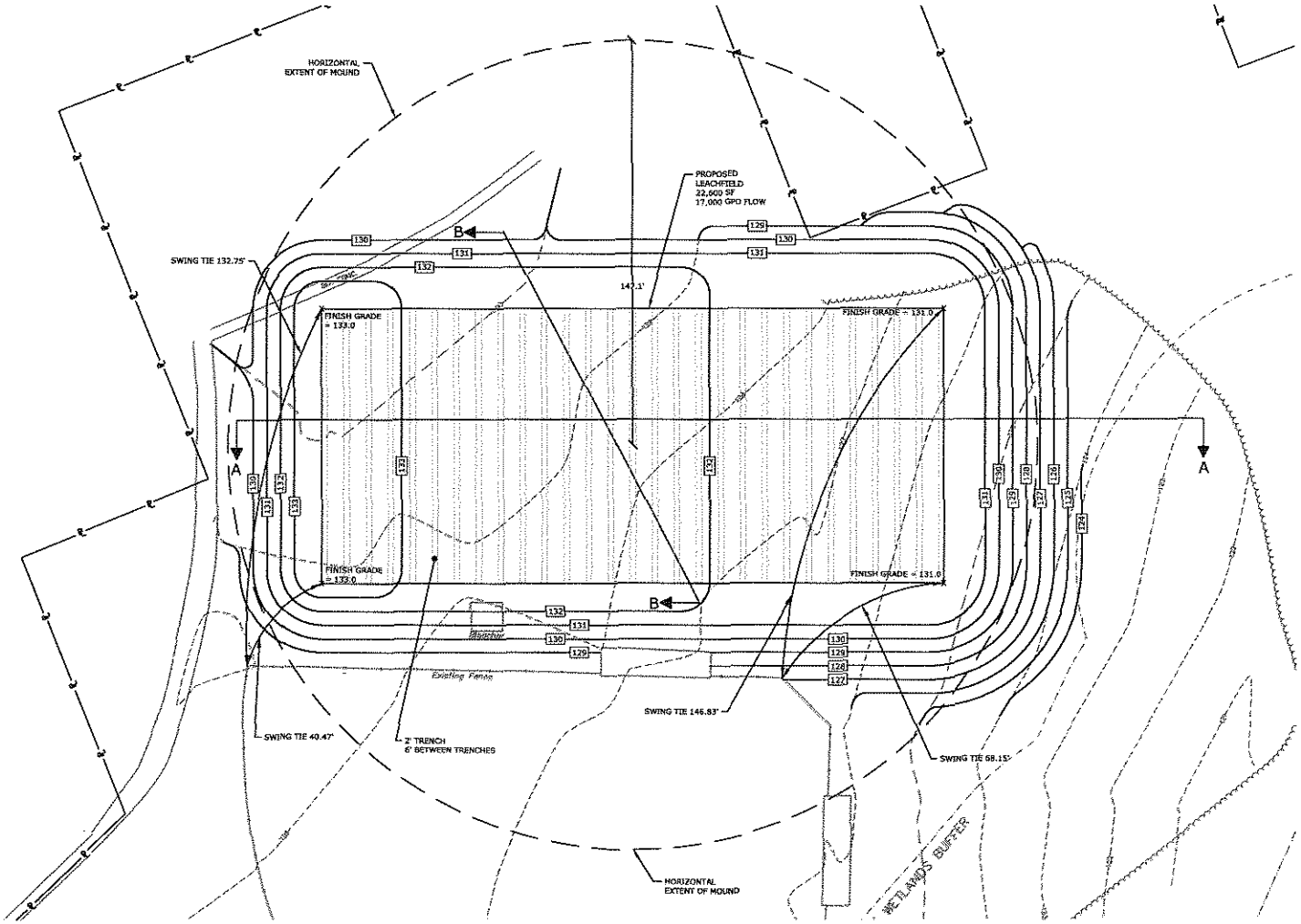
Mark	Date	Description

PROJECT NO:	W1396
FILE:	TownHall_2012
DRAWN BY:	BJL
CHECKED:	KLK
APPROVED BY:	JBC

GEOLOGIC CROSS-SECTIONS

SCALE: AS SHOWN

FIGURE 4-2R2



Tighe&Bond
Consulting Engineers
www.tighebond.com

SCALE IN FEET
0 20' 40'
GRAPHIC SCALE

Town Office Building Groundwater Discharge

41 Cochituate Road

Wayland, Massachusetts

VERIFY SCALE
BAR IS 1 INCH ON ORIGINAL DRAWING
0 1 INCH
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Mark	Date	Description

PROJECT NO:	W1396
FILE:	TownHall_2012
DRAWN BY:	BJL
CHECKED:	KLK
APPROVED BY:	TBC

EFFLUENT DISPOSAL LAYOUT

SCALE: 1"=20'

FIGURE 5-1R2

12/9/12

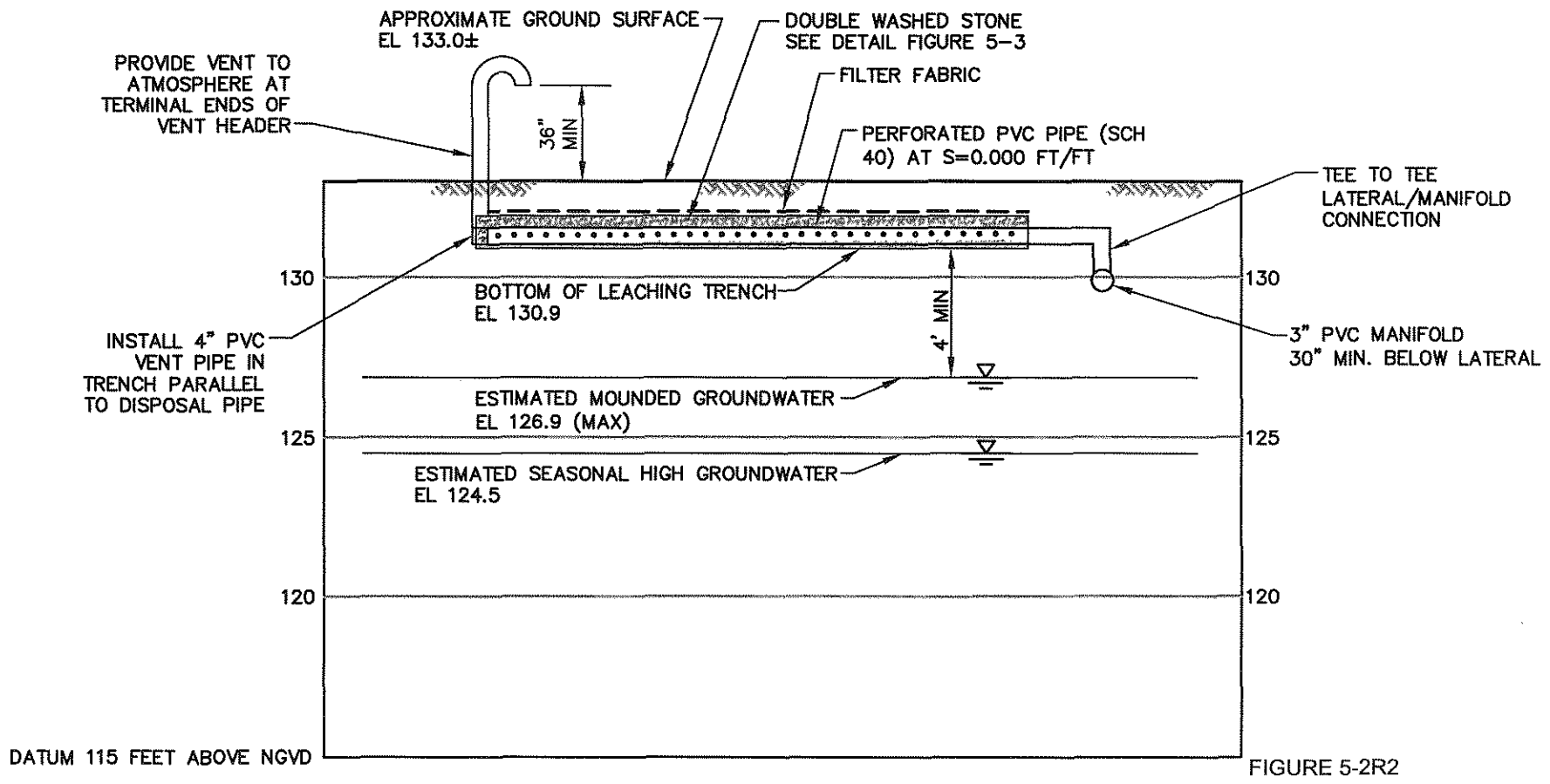


FIGURE 5-2R2

DISPOSAL BED PROFILE

TOWN OFFICE BUILDING
GROUNDWATER DISCHARGE
41 COCHITUATE ROAD
WAYLAND, MASSACHUSETTS

Tighe&Bond *Consulting Engineers*
www.tighebond.com

SCALE: 1"=20'H;1"=5'V DATE: October 2012

O:\Projects\W\W1398\Town Hall\W-1398_TownHall-2012_Fig 5-2R.dwg Oct 01, 2012-2:30pm

Section 6 Conclusion

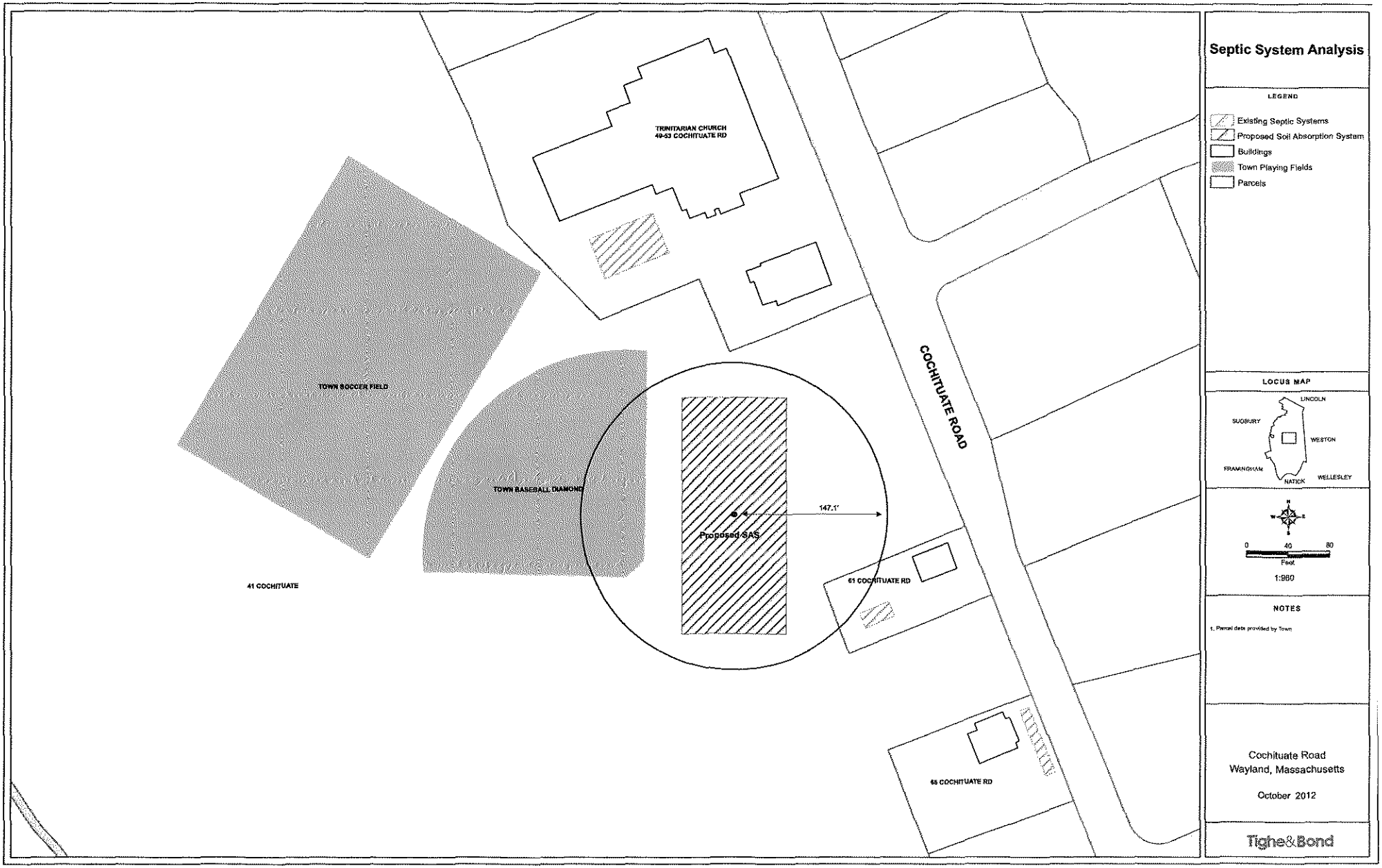
The proposed soil absorption system (SAS) will partially overlap the existing Town Office leachfield located adjacent to the ballfields at the Town of Wayland Administration Building. Based on the test pit excavations, percolation tests, and slug tests conducted at the monitoring wells, local soils have a hydraulic conductivity of 76 feet per day. Percolation test results completed within the proposed SAS footprint were less than 2 minutes per inch, and matched results from testing performed at the time of the existing system's design.

The layout of the SAS is designed to minimize mounding. In order to do this, the footprint of the SAS is 100' wide and 226' long providing a total area of 22,600 square feet. According to DEP Guidelines, an SAS with percolation rates <2 minutes per inch can have a design loading rate of 2.5 gallons per day per square foot. However, with a total flow of 17,000 gallons per day and a 22,600 square foot SAS, the proposed design will only be designed for a loading rate of 1.47 gallons per day per square foot. The design approach spreads the hydraulic load over a wide area so as to minimize mounding and grading impacts on the adjacent baseball field. This design is based on a trench system with 2' effective width and a depth of 1' for the sides, providing a total effective area of four (4) square feet of effective area per linear foot. Based on this design, there are a total of 2,900 linear feet of trench configured as twenty-nine (29), one hundred foot (100') long trenches. Each trench is separated by 6' for designated reserve area.

Groundwater mounding produced by the SAS was calculated based on eighty-percent (80%) of the 17,000 gallon per day peak design flow, or 13,600 gallons per day. Using the Hantush method, it was determined that a groundwater mound of 2.4 feet will be produced under the 80% peak design flow conditions over a period of 90 days. The bottom of the leaching trench system will be a minimum 4 feet above the estimated groundwater mound. Based on an estimated seasonal high groundwater elevation of 124.5', the mound elevation will be approximately 126.9' and the bottom of the system will be at 130.9'. With the perforated pipe, 6" gravel, and 3" loam and seed, the approximate surface elevation will be 133.0'.

Given the proximity of the proposed disposal site to down gradient slopes, it was necessary to evaluate the possibility of groundwater breakout from the disposal site. The Bower method was used to generate an estimated horizontal extent of 147.1' from the center of the recharge area. Based on this estimate of the horizontal area impacted by groundwater mounding an emergent groundwater problem is not anticipated as there are no basements, steep slopes, or other properties within the horizontal extent of the groundwater mound.

J:\W\W1396 Wayland\Hydrogeologic Report\Report\Town of Wayland Hydrogeologic Evaluation.doc



Septic System Analysis

LEGEND

- Existing Septic Systems
- Proposed Soil Absorption System
- Buildings
- Town Playing Fields
- Parcels

LOCUS MAP

1:960

NOTES

1. Parcel data provided by Town

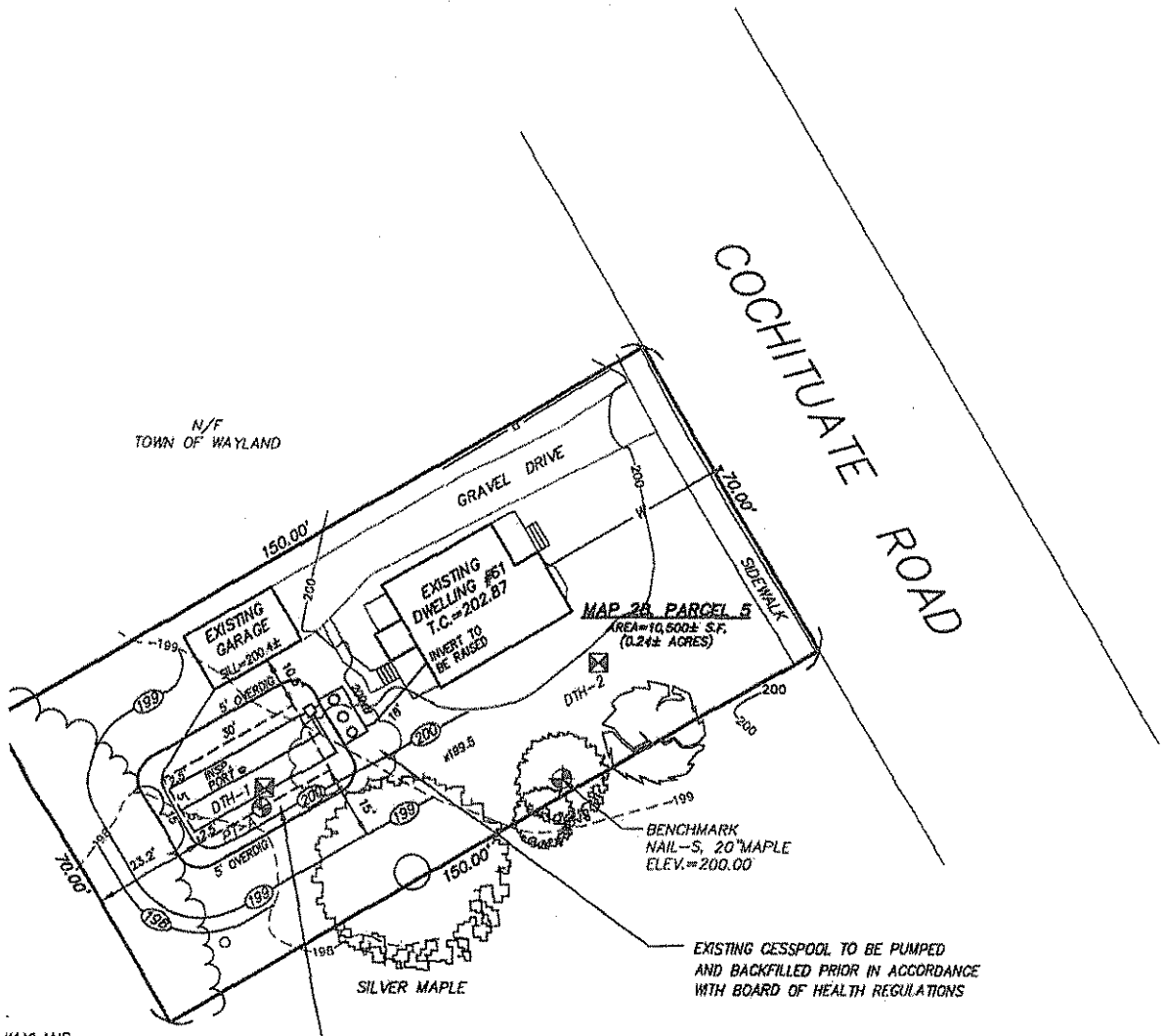
Cochituate Road
Wayland, Massachusetts

October 2012

Tighe&Bond

G:\GIS\MA\Wayland\MA\arcproj\SepticAnalysis.mxd Date Saved: 9/21/2012 User: scs

61 Cochituate Rd



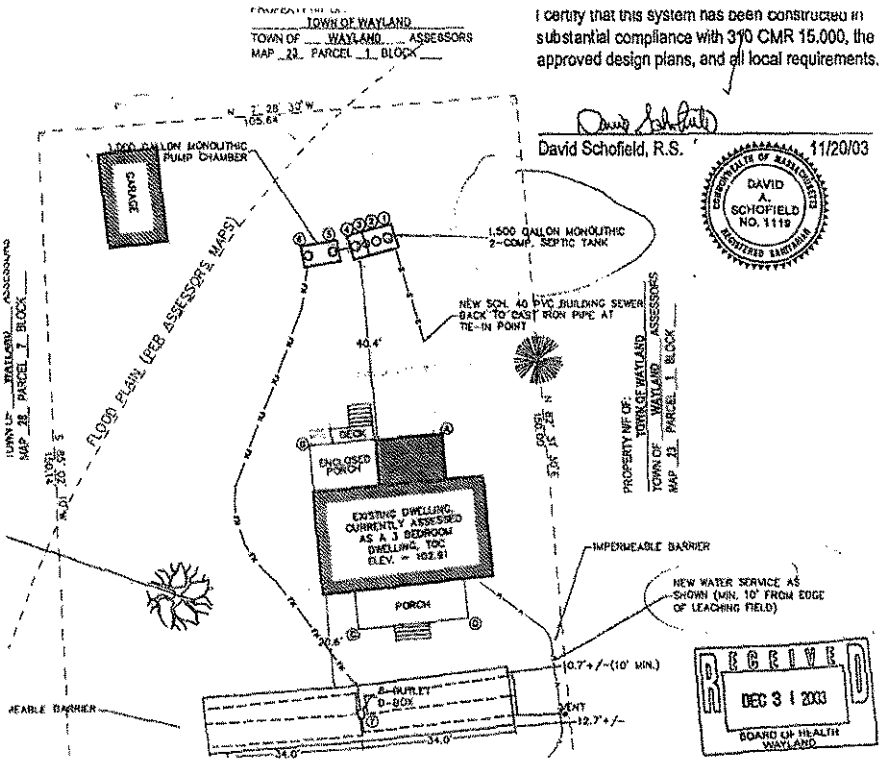
SITE PLAN

SCALE: 1" = 20'

NOTE:
ALL SYSTEM COMPONENTS ARE TO BE MARKED WITH MAGNETIC MARKING TAPE

FINAL GRADING NOTES

1. 2% SLOPE MUST BE PROVIDED OVER AND AROUND
2. SURFACE DRAINAGE MUST BE AWAY FROM SYSTEM.



I certify that this system has been constructed in substantial compliance with 310 CMR 15.000, the approved design plans, and all local requirements.

David Schofield, R.S. 11/20/03

DAVID A. SCHOFIELD NO. 1119 REGISTERED SANITARIAN COMMONWEALTH OF MASSACHUSETTS

RECEIVED
DEC 3 1 2003
BOARD OF HEALTH WAYLAND

'As Built' Elevations	Proposed	
TIE IN POINT		
SEPTIC TANK INLET	96.46	96.[illegible]
SEPTIC TANK OUTLET	96.21	95.84
PUMP CHAMBER INLET	95.11	95.75
PUMP CHAMBER OUTLET	95.91	94.84
D-BOX INLET	100.00	100.08
D-BOX OUTLET	99.83	99.84
SAS ORIGIN	99.73	99.75
SAS TERMINUS	99.56	99.60 - 99.62
SAS BOTTOM	99.06	[illegible]

'As Built' Component Ties

	A	B	C	D
SEPTIC TANK IN (1)	45.1'	50.0'		
SEPTIC TANK MID (2)	45.2'	48.4'		
SEPTIC TANK BAFFLE (3)	45.3'	47.3'		
SEPTIC TANK OUT (4)	45.6'	46.1'		
PUMP CHAMBER IN (5)	47.1'	43.7'		
PUMP CHAMBER OUT (6)	49.2'	42.4'		
DISTRIBUTION BOX (7)			18.8'	32.6'

Firm Name and Address

SCHOFIELD ENGINEERING GROUP
Post Office Box 127
Wayland, Massachusetts 01778
(508) 358-5763

Project Name and Address

'AS BUILT' PLAN FOR
JEFF & MIMI LICHT
65 COCHITUATE ROAD
WAYLAND, MASSACHUSETTS