



August 30, 2012

Mr. Eric Worrall
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 Eric:

Tighe & Bond has prepared the following response to your letter dated June 15, 2012 which requested additional information regarding the proposed groundwater discharge at the Wayland Town Offices. The response that follows uses the same numbering system as the Department's letter (Attachment A) and a copy of that letter has been appended to this document for reference purposes.

Issue #1 – On June 22, 2012 Tighe & Bond's Soil Evaluator advanced three additional test pits within the proposed recharge area in the presence of Department staff. Soil logs from this effort are included as Attachment B to this letter.

Issue #2 – During the June 22, 2012 test pit excavation, Tighe & Bond performed percolation testing to confirm soil permeability. Testing results indicated a percolation rate of less than 2 min/in as stated in our initial report. Percolation test reports are also included in Attachment B to this letter.

Issue #3 – Tighe & Bond's previous design was based on loading rate guidance from the drip disposal system manufacturer (Oakson, inc.) and a review of loading rates utilized at other similar projects. This design approach was used because; a) the Department has no published guidelines under the Groundwater Discharge program "Guidelines"¹ indicating specific loading rates for drip dispersal, and b) drip dispersal systems are essentially functionally identical to pressurized PVC pipe and trench dispersal systems which the Department does address in the "Guidelines". Based on the similarity to PVC pipe systems, we believe that drip systems could be safely implemented at loading rates similar to those approved for PVC pipe systems, which in this case would be a loading rate of 2.5 gpd/sf. Our prior design utilized a loading rate of 0.85 gpd/sf to minimize mounding on the site and did not approach the loading rate described above. In citing the 0.74 gpd/sf loading rate developed for drip dispersal systems under the Title 5 I/A program, we believe that the Department is taking an overly conservative approach on the design recharge rate. Designs regulated by the I/A program rely on some level of treatment in the SAS and do not receive the same highly treated effluent that will be produced by this project. Given that this system will receive highly treated effluent from a membrane bioreactor (MBR) WWTF, there is little risk of solids fouling of the system and there is no need for vadose zone treatment of effluent. Both Tighe & Bond and Oakson have discussed these and other related issues with senior Department staff over the last six weeks, however we have not received definitive guidance on the matter. Given the time constraints imposed on this project due to pending litigation, we have revised our design to utilize a more traditional trench discharge system. This system has been laid out using 1 ft (D) by 2 ft (W) trenches and a loading rate of 1.47

¹ Guidelines for the Design, Construction, Operation and Maintenance of Small Wastewater Treatment Facilities with Land Disposal. MADEP, 2004



gpd/sf. Revised mounding calculation for this system have been included in Attachment C and updated plan and profile views of the system are included in Attachment D.

Issue #4 – Tighe & Bond has revised our groundwater mounding calculations to reflect this updated policy guidance regarding loading rates. Calculations in Attachment C reflect this change.

Issue #5 – Tighe & Bond stands by our previously submitted method of mound calculation and subsequent conversations with the Department's Hydrogeologist, Criss Stephens, have confirmed that all parties now agree with the accuracy of our approach.

Issue #6 – A post construction groundwater contour plan has been included as Figure 4-3R in Attachment D.

Issue #7 – Tighe & Bond has reviewed the aerial extent of the groundwater mound produced by the proposed discharge and found that it does not intersect nearby below grade foundations/structures.

Issue #8 - One upgradient and two down gradient monitoring well locations have been identified on Figure 4-3R, provided in Attachment D. These locations were selected based on regional groundwater flow patterns and property ownership constraints. The latter constraint has produced an 'upgradient' well location that is probably better described as cross-gradient. In spite of this issue, we believe that the well indicated as UG-1 will still accurately capture ambient groundwater conditions and meet the intent of the Department's requirement. If the discharge area is ever constructed the proposed wells will be installed in accordance with the prevailing Department guidelines on well construction at that time.

Issue #9 – A conclusion section to the report briefly summarizing report findings has been included as Attachment E.

Issue #10 – The requested plan showing SAS location and other required items has been included in Attachment C.

In addition to the issues highlighted in the Department's June 15, 2012 letter, subsequent correspondence with the Department has indicated a need for additional or separate reserve area. Tighe & Bond believes that these issues have been addressed though the transition to a trench based design and this is adequately detailed on the attached plans.

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) 471-9605 or via email at ibcatlow@tighebond.com.

Regards,



Ian Catlow, P.E.
Project Manager

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



Attachment A

MassDEP Letter dated June 15, 2012



Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Northeast Regional Office • 205B Lowell Street, Wilmington MA 01887 • 978-694-3200

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

John Moynihan, Facilities Director
Wayland Wastewater District Commission
41 Cochituate Road
Wayland, MA 01778

June 15, 2012

RE: Request for Additional Information
BRP WP 83/Hydrogeologic Evaluation Report
Transmittal Number X250635

Dear Mr. Moynihan:

The Northeast Regional Office of MassDEP has received the hydrogeologic evaluation report and application submitted on your behalf by Tighe & Bond, Incorporated (T&B). The report is entitled "Hydrogeologic Report" and is dated March 2012. Upon review of this document, MassDEP has determined that additional information is needed before a decision can be made regarding the suitability of the Wayland Town Office Ball Field as a future groundwater discharge location. Processing of your application will continue once the following comments have been addressed and/or the requested information has been received by MassDEP:

1. The number of witnessed test pits excavated within the footprint of the proposed soil absorption system (SAS) is insufficient to fully characterize the upper soil profile. MassDEP typically requires a minimum of two test pits within each primary and/or reserve disposal area. Only one witnessed test pit, however, has been excavated in the proposed area to date. Since the proposed reserve area lies within the footprint of the primary area, MassDEP requires a minimum of two additional test pits be excavated and the soils characterized by a certified soil evaluator.
2. MassDEP requires that, for all new construction, infiltration testing be performed in the most restrictive soil horizon that will be receiving discharged sanitary effluent. Typically for discharges $\leq 20,000$ gallons per day (gpd), this requirement is met by percolation testing of the soil horizon. Alternative methods for evaluating infiltration include; a double ring infiltration test, a permeameter test, or a basin loading test.

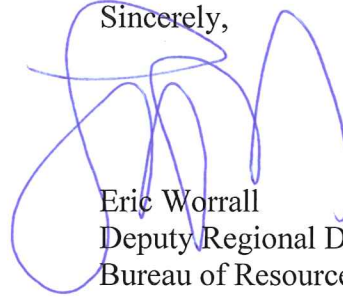
3. The SAS proposed by T&B consists of a 200' by 100' drip dispersal field. The field was sized using a loading rate of 0.85 gpd/ft². The maximum loading rate permitted by MassDEP for drip dispersal is 0.74 gpd/ft². T&B shall revise its report to reflect the use of the correct drip dispersal loading rate, or propose the use of a different infiltration technology and support the final loading rate used to size the SAS.
4. T&B's estimate of groundwater mounding at the proposed SAS location is based on an anticipated design flow of 17,000 gpd. MassDEP policy allows mounding potential to be evaluated at 80% of design flow. The SAS, however, must still be sized for 100% of design flow.
5. T&B's mounding analysis was performed using the Hantush Method for estimating mound height development. MassDEP concurs that Hantush is an acceptable method for groundwater discharges of this magnitude and in this type of setting. Furthermore, MassDEP finds that the aquifer input parameters selected by T&B appear reasonable. MassDEP is, however, unfamiliar with the final step of T&B's analysis wherein the initial value of saturated thickness is subtracted from calculated mound height. Prior to this step MassDEP's analysis corresponded well with the T&B analysis. Please provide MassDEP with justification for this approach.
6. T&B shall construct a post-disposal groundwater contour plan showing the effects of groundwater mounding on estimated seasonal high groundwater and include it in the hydrogeologic report.
7. MassDEP requires an evaluation of potential groundwater mounding impacts to the basements and septic systems of properties that abut the proposed discharge location.
8. The submitted hydrogeologic report shall be expanded to include a groundwater monitoring plan capable of identifying and assessing any impacts to groundwater flow and quality resulting from a discharge of effluent at the proposed location. A minimum of three monitoring wells (one upgradient and two downgradient) are required. Monitoring wells installed as part of the site investigation may be utilized provided they are appropriately located and constructed in accordance with MassDEP's *Standard References for Monitoring Wells*. Additional well locations may be needed to monitor impacts to abutting properties and downgradient sensitive receptors.
9. A conclusion section must be added to the submitted report. This section should summarize the findings of the hydrogeologic investigation and discuss the suitability of the site for the disposal of treated sanitary effluent at the proposed volume and rate.
10. A surveyed site plan, prepared and stamped by a Massachusetts Professional Engineer, must accompany the hydrogeologic report. At a minimum the plan must identify and document the following;
 - The locations/footprints of the primary and reserve disposal areas,

- The locations of all test pits and percolation tests conducted as part of the hydrogeological investigation,
- The locations and top-of-casing/top-of-PVC elevations of all borings/monitoring wells installed as part of the investigation, and
- The proposed locations of monitoring wells to be installed as part of the approved groundwater monitoring plan.

The surveyed site plan, along with an approved maximum daily discharge volume will be referenced in MassDEP's Site Approval Letter. Any SAS installed at the site shall be constructed within the footprint indicated on the plan and the discharge limited to that contained within the site approval letter.

The information listed above must be submitted to MassDEP's Northeast Regional Office on or before September 15, 2012. If you have questions or comments regarding the above, please contact Criss Stephens of my staff at 978-694-3241.

Sincerely,



Eric Worrall
Deputy Regional Director
Bureau of Resource Protection

EW/HS/hs

Cc: Fred Turkington/Town of Wayland
Ian Catlow/Tighe & Bond
Karla King/Tighe & Bond
Marybeth Chubb/MassDEP/Boston
Greg Tomaszewski/MassDEP/NERO

Attachment B

Test Pit Logs and Percolation Test Results



Commonwealth of Massachusetts
City/Town of Wayland
Percolation Test
Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A. Site Information

Town of Wayland

Owner Name

41 Cochituate Road

Street Address or Lot #

Wayland

City/Town

MA

State

Zip Code

Contact Person (if different from Owner)

Telephone Number

B. Test Results

	6/21/12 Date	12:38 pm Time	Date	Time
Observation Hole #	10A			
Depth of Perc	Top=24", Bott.=42"			
Start Pre-Soak	12:38:00			
End Pre-Soak	12:53:00			
Time at 12"	12:53:00			
Time at 9"	12:55:45			
Time at 6"	12:58:50			
Time (9"-6")	3 min 5 seconds			
Rate (Min./Inch)	< 2 mpi			
	Test Passed: <input checked="" type="checkbox"/>		Test Passed: <input type="checkbox"/>	
	Test Failed: <input type="checkbox"/>		Test Failed: <input type="checkbox"/>	

Jeremy Cigal, Tighe&Bond

Test Performed By:

H. Criss Stephens, DEP NERO

Witnessed By:

Comments:

Dug multiple perc holes attempting to perc within C2 horizon observed in the deep hole. Only thin pockets of this material was observed in the perc holes. In general the material in the C2 horizon was thinner or non existant as we moved north and away from TP-10A. Used approx. 24 gallons during pre-soak.



Commonwealth of Massachusetts

City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Town of Wayland

Owner Name

41 Cochtuate Road

Street Address

Wayland

City

MA

State

Map/Lot #

01778

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

☐ Repair

2. Published Soil Survey Available? ☒ Yes ☐ No

If yes: Year Published Publication Scale Soil Map Unit

Soil Name

Soil Limitations

3. Surficial Geological Report Available? ☒ Yes ☐ No

If yes: Year Published Publication Scale Map Unit

Geologic Material

Landform

4. Flood Rate Insurance Map

Above the 500-year flood boundary? ☐ Yes ☐ No

Within the 100-year flood boundary? ☐ Yes ☐ No

Within the 500-year flood boundary? ☐ Yes ☐ No

Within a velocity zone? ☐ Yes ☐ No

5. Wetland Area: National Wetland Inventory Map

Map Unit Name

Wetlands Conservancy Program Map

Map Unit Name

6. Current Water Resource Conditions (USGS): Month/Year

Range: ☐ Above Normal ☐ Normal ☐ Below Normal

7. Other references reviewed:



Commonwealth of Massachusetts

City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserved disposal area)*

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

Location (identify on plan): _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.) _____

Surface Stones _____

Slope (%) _____

Vegetation _____

Landform _____

Position on Landscape (attach sheet) _____

3. Distances from:

Open Water Body

_____ feet

Drainage Way

_____ feet

Possible Wet Area

_____ feet

Property Line

_____ feet

Drinking Water Well

_____ feet

Other

_____ feet

4. Parent Material: _____

Unsuitable Materials Present:

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☒ Yes

☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

_____ elevation



Commonwealth of Massachusetts

City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-09A

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-30	Fill	Brown	--	--	--	--	10	0	MASS	FRIABLE	
30-37	A _{buried}	10YR/3/2	--	--	--	SL	0	0	MASS	FRIABLE	
37-42	B _{buried}	7.5YR/5/3	--	--	--	SL	0	0	MASS	FRIABLE	
42-68	C1	2.5Y/5/4	--	--	--	LS	0	0	MASS	FRIABLE	
68-111	C2	2.5Y/5/4	68	5YR/5/8	>5%	MED SAND	0	0	SINGLE GRAIN	LOOSE	
111-126	C3	5YR/5/4	111	5YR/5/8	>5%	M-C SAND	10	0	SINGLE GRAIN	LOOSE	
126-132	C4	5Y/6/4	126	7.5YR/6/ 1	>5%	SILT LOAM	0	0	MASS	FIRM	

Additional Notes:

Fill consisted of mostly gravelly topsoil with a 2" layer of dense-firm black gravel approximately 18" deep. A few chipped pieces of brick were also observed in the fill.

Heavy weeping = 111", ESHW = 68", water appears to be perched on top of silt loam (C4). Town Park and Rec. Dept. excavated deep holes with a backhoe (John

Deere 310SG). Weather was sunny, 95 degrees.



Commonwealth of Massachusetts

City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____ Date _____ Time _____ Weather _____

1. Location

Ground Elevation at Surface of Hole: _____ Location (identify on plan): _____

2. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

Vegetation _____ Landform _____ Position on Landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area _____ feet

Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Parent Material: _____ Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____ inches _____ elevation



Commonwealth of Massachusetts

City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-10A

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-11	A	10YR/3/2	--	--	--	SL	0	0	SBK	FRIABLE	
11-20	Bw	7.5YR/5/3	--	--	--	SL	0	0	MASS	FRIABLE	
20-40	C1	7.5YR/7/4	--	--	--	Fine LS	0	0	MASS	FRIABLE	
40-48	C2	7.5YR/6/3	48	5YR/5/8	>5%	Very Fine LS	0	0	MASS	FRIABLE	
48-79	C3	5YR/5/4	48	5YR/5/8	>5%	MED SAND	0	0	SINGLE GRAIN	LOOSE	
79-120	C4	10YR/5/2	79	7.5YR/6/1	>5%	SILT LOAM	0	0	MASS	FIRM	

Additional Notes:

Heavy weeping = 82", ESHW = 48", water appears to be perched on top of silt loam (C4). 6" cobbles were removed from excavation at approximately 8-ft deep. Minor roots observed down to approximately 5-feet deep. C2 horizon included pockets of very fine sandy loam which was dense/firm in place. Based on additional excavation for perc testing the presence of sandy loam in the C2 horizon was inconsistent (pockets) therefore C2 was identified as loamy sand which is the dominant soil.



Commonwealth of Massachusetts

City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

☐ Depth observed standing water in observation hole

A. _____
inches

B. _____
inches

☐ Depth weeping from side of observation hole

A. _____
inches

B. _____
inches

☐ Depth to soil redoximorphic features (mottles)

A. _____
inches

B. _____
inches

☐ Groundwater adjustment (USGS methodology)

A. _____
inches

B. _____
inches

2.

Index Well Number _____

Reading Date _____

Index Well Level _____

Adjustment Factor _____

Adjusted Groundwater Level _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☐ No

b. If yes, at what depth was it observed?

Upper boundary: _____
inches

Lower boundary: _____
inches



Commonwealth of Massachusetts

City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

Date

Typed or Printed Name of Soil Evaluator / License #

Date of Soil Evaluator Exam

Name of Board of Health Witness

Board of Health

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).



Commonwealth of Massachusetts

City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

Attachment C
Mounding Calculations

Groundwater Mounding Analysis

Project: Wayland Town Offices
Performed By: KLK
Checked By: LR

Project #: W-1396
Description: Existing Leachfield
Calculated Mound Height: 2.7 feet

Input Parameters (input only shaded areas):

Recharge Period	<i>t</i>	<u>90</u> days	Time to equilibrium
Width of Field	<i>W</i>	<u>100</u> feet	
Length of Field	<i>L</i>	<u>226</u> feet	
Hydraulic Conductivity	<i>K</i>	<u>57</u> ft/day	
Specific Yield	<i>V</i>	<u>0.24</u> ft ³ /ft ³	
Saturated Thickness	<i>D</i>	<u>1.67</u> feet	
Daily Flow	<i>Q</i>	<u>13,600</u> gpd	

Calculated Parameters:

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

$$\gamma = \frac{KD}{V} = 395.8 \text{ ft}^2/\text{day}$$

$$\text{Dimensionless width } \alpha = \frac{a}{\sqrt{4\gamma t}} = 0.1325$$

$$\text{Dimensionless length } \beta = \frac{b}{\sqrt{4\gamma t}} = 0.2993$$

Solution:

From Table 1 of Hantush (1967), attached:

$$\text{Function } S^*(a, b) = \underline{0.1642} \quad \checkmark$$

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

$$h_m = 4.4 \text{ feet}$$

Therefore:

Mound Height =	$h_m - D =$	<u>2.7</u> feet
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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 (Rectangle) Project Location: Wayland, MA
Performed By: 290 / KLK Checked By: 290

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:	100	Width of recharge area. (ft)
L_n :	37	Distance between edge of recharge area and control area. (ft) ← Estimated extent of mound.
K:	57	Hydraulic conductivity. (ft/day)
b:	1.67	Saturated thickness. (ft)

Calculated Parameters:

T:	95.00	ft ² /day	Transmissivity
i:	0.08	gal/day/ft ²	Average infiltration rate in recharge area.
H_c :	2.63	Height of groundwater mound in center of recharge area. (ft)	

Where:
$$H_c = \left[\frac{iW}{2T} \left(\frac{W}{4} + L_n \right) \right] + H_n$$

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 rectangular infiltration basins with a length of at least five times the width.

**Seasonal High Groundwater
Determined By The Frimpter Method
Wayland: Town Office Ball Fields**

Well ID	Reference Point Elevation ft	Measured Depth to Groundwater ft	Calculated Depth to Seasonal High Groundwater ft	Calculated Seasonal High Groundwater Elevation ft (NAVD29)
MW-1	127.89	3.75	2.43	125.46
MW-2	127.17	2.61	1.29	125.88
MW-3	127.8	3.3	1.98	125.82
MW-4	127.68	3.86	2.54	125.14
MW-5	130.18	7.48	6.16	124.02
MW-6	130.1	7.66	6.34	123.76
MW-7	128.02	4.09	2.77	125.25
MW-8	127.46	5.63	4.31	123.15

S_h :	See Table	Probable depth to high groundwater. (ft)
S_c :	See Table	Measured depth to groundwater on site. (ft)
ow_c :	15.37	Measured depth to groundwater in USGS observation well. (ft)
ow_{max} :	14.75	Maximum water level (i.e. minimum depth to groundwater) recorded in USGS observation well during period of record. (ft)
ow_r :	1.97	Maximum range of water levels in USGS observation well. (ft)
S_r :	4.2	Range of water levels at project site based on 95% confidence interval for appropriate lithology. (Sand & gravel in valley flats assumed.) (See Frimpter, 1981)

Note 1: Calculations based on USGS Open File Report 80-1205, Probable High Groundwater Levels In Massachusetts. Michael H. Frimpter. March, 1981.

Note 2: Observed water levels on January 24, 2012

Note 3: Analysis based on real time data for USGS well designated MA-WKW 2 WAYLAND, MA (USGS Well ID: 421852071220501).

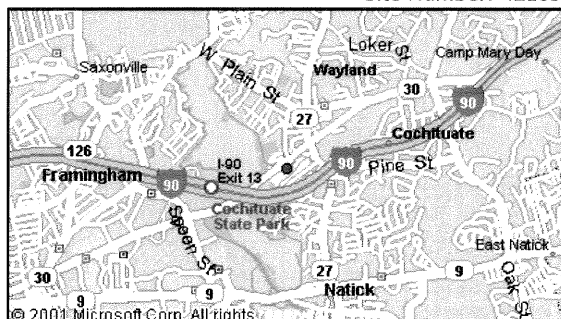


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Contact USGS
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Groundwater Watch

Latest News...

Site Number: 421852071220501 - MA-WKW 2 WAYLAND, MA



DESCRIPTION:

Latitude 42°18'52", Longitude 71°22'05" NAD27
Middlesex County, Massachusetts, Hydrologic Unit 01070005
Well depth: 33.0 feet
Hole depth: 37.5 feet
Land surface altitude: 153.78feet above NGVD29.
Well completed in "Sand and gravel aquifers (glaciated regions)" (N100GLCIAL) national aquifer.
Well completed in "Outwash" (112OTSH) local aquifer

AVAILABLE DATA FROM NWISWeb:

Current / Historical Observations 2010 2012
-10- -07-
13 22

Daily Data
Field groundwater-level measurements
Field/Lab water-quality samples

Additional Data Sources

	Begin Date	End Date	Count
Annual Water-Data Report (pdf)	2005	2009	5
Groundwater Watch	1965	2012	1182

OPERATION:

Record for this site is maintained by the USGS Massachusetts Water Science Center
Email questions about this site to Massachusetts Water Science Center Water-Data Inquiries

Site Statistics

Most recent data value: 16.64 on 8/29/2012
Period of Record Monthly Statistics for 421852071220501
Depth to water level, feet below land surface
All Approved Continuous & Periodic Data Used In Analysis

Note: Bold values in the table indicate closest statistic to the most recent data value.

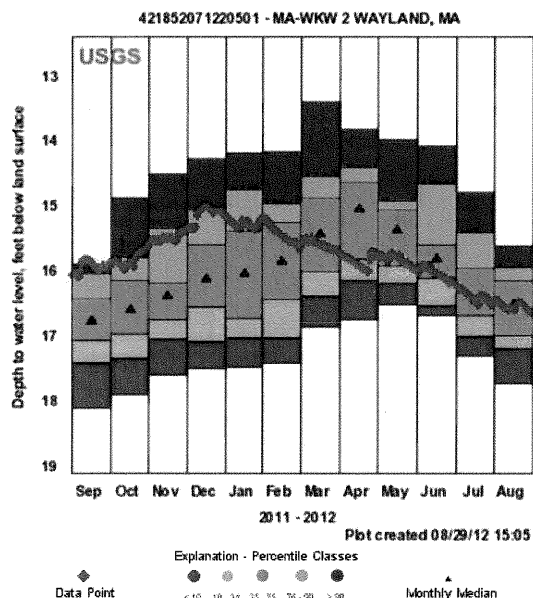
Month	Lowest Median	10th %ile	25th %ile	50th %ile	75th %ile	90th %ile	Highest Median	Number of Years
Jan	17.47	17.01	16.73	16.04	15.38	14.74	14.20	46
Feb	17.41	17.01	16.43	15.85	15.25	14.96	14.17	47
Mar	16.85	16.39	16.01	15.43	14.87	14.56	13.39	47
Apr	16.75	16.14	15.80	15.04	14.65	14.40	13.82	47
May	16.50	16.19	15.91	15.37	15.07	14.91	13.99	46
Jun	16.68	16.54	16.11	15.81	15.59	14.67	14.08	48
Jul	17.29	16.99	16.68	16.44	15.95	15.41	14.78	47
Aug	17.71	17.19	16.97	16.52	16.15	15.94	15.62	45
Sep	18.10	17.40	17.07	16.76	16.42	16.04	15.90	47
Oct	17.90	17.34	16.96	16.59	16.14	15.79	14.88	47
Nov	17.60	17.05	16.74	16.39	16.19	15.34	14.52	47
Dec	17.48	17.09	16.55	16.13	15.60	15.1	14.29	46

As of 8/26/2012 19:57-2

Statistics Options



View month/year statistics



Daily Groundwater Data

There are no approved daily data for this well.



Daily Data Options



View latest data from NWISWeb



View data in calendar format



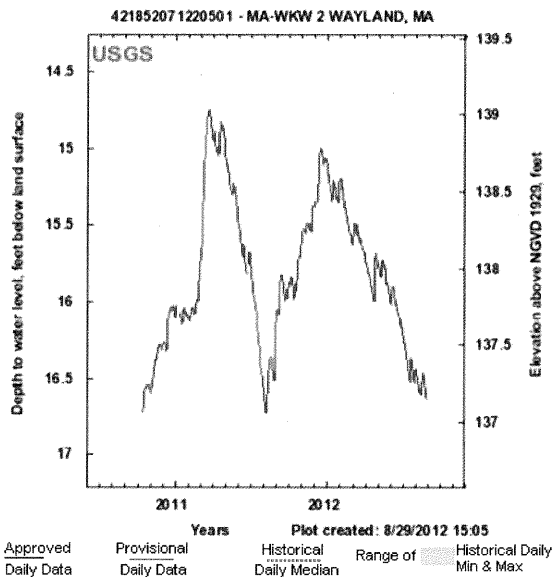
Download data in text format



View daily medians



Groundwater
Watch Help Page



Periodic Groundwater Data

Summary for Period of Record Periodic Water Levels

Depth to water level, feet below land surface

Approved Periodic Water Level Values

Begin Date		End Date		Number of Values	
01/29/65		07/23/12		568	
Highest WL	Date of Highest WL		Lowest WL	Date of Lowest WL	
13.39	03/26/10		18.1	09/26/95	



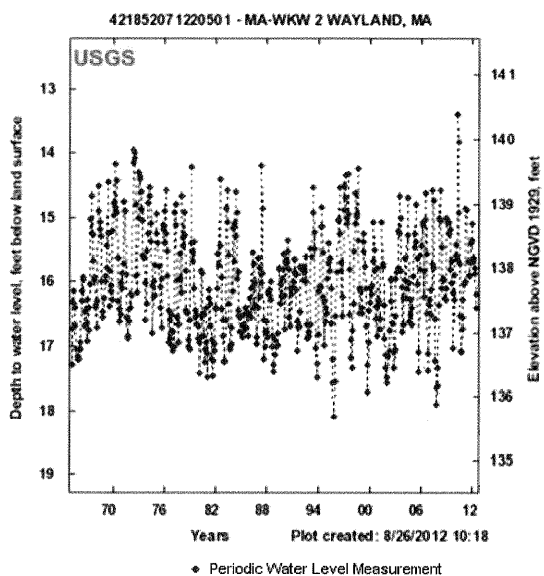
Groundwater Levels Options



View NWISWeb Groundwater levels page



Download Groundwater levels in text format



Period of Record - All Data Types

Summary for Period of Record - All Data Types

Depth to water level, feet below land surface

Begin Date	End Date	Number of Values	
01/29/65	08/29/12	1,886	
Highest WL	Date of Highest WL	Lowest WL	Date of Lowest WL
13.39	03/26/10	18.1	09/26/95



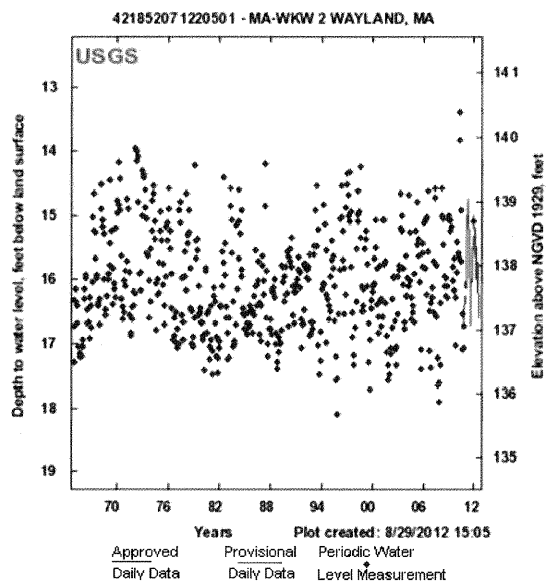
Period of Record Options



View annual monthly statistics for all data types



Download Groundwater levels in text format of all data types



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*References to non-Department of the Interior (DOI) products do not constitute an endorsement by the DOI.
By viewing the Google Maps API on this web site the user agrees to these TERMS.

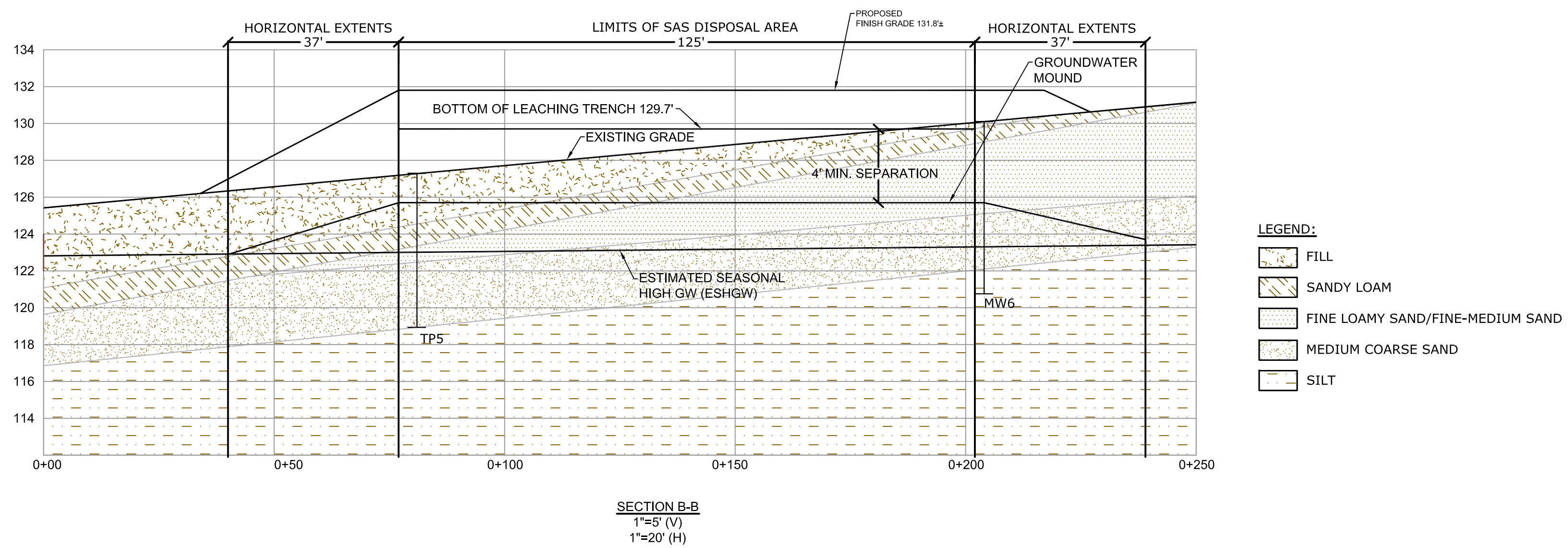
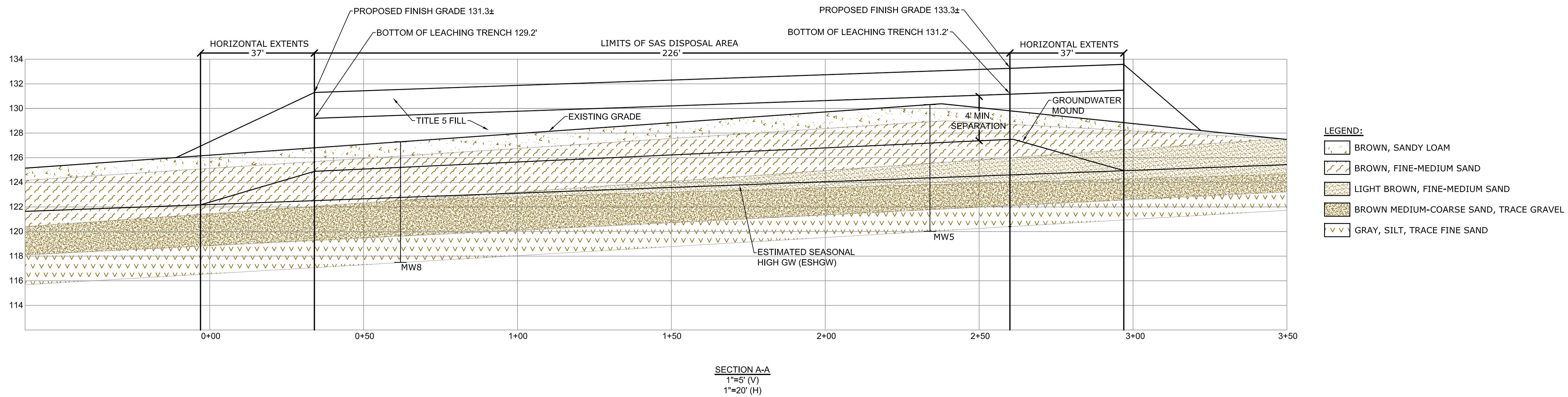
Accessibility FOIA Privacy Policies and Notices
U.S. Department of the Interior | U.S. Geological Survey
URL: <http://groundwaterwatch.usgs.gov/AWLSites.asp>
Page Contact Information: OGW Webmaster
Last update: Friday, May 25, 2012 at 09:59

Page displayed in 1.078 seconds.



Attachment D
Updated Plan and Profile Figures

O:\Projects\W\W1396\Town Hall\W-1396_TownHall-2012_FIG 4-2.dwg Sep 07, 2012--8:31am Plotted By: bjl



**Town Office
Building
Groundwater
Discharge**

41 Cochituate Road

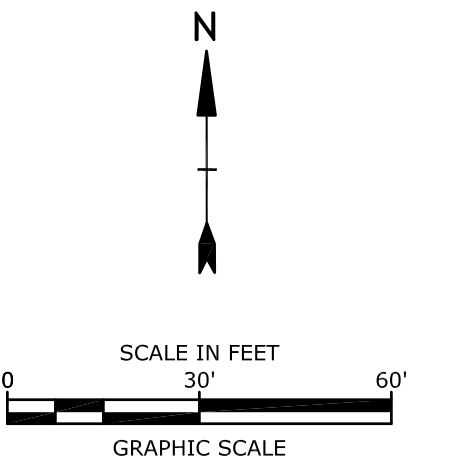
Wayland,
Massachusetts

Mark	Date	Description
PROJECT NO:		W1396
FILE:		TownHall_2012
DRAWN BY:		BJL
CHECKED BY:		KLK
APPROVED BY:		IBC

GEOLOGIC CROSS-SECTIONS

SCALE: AS SHOWN

FIGURE 4-2R

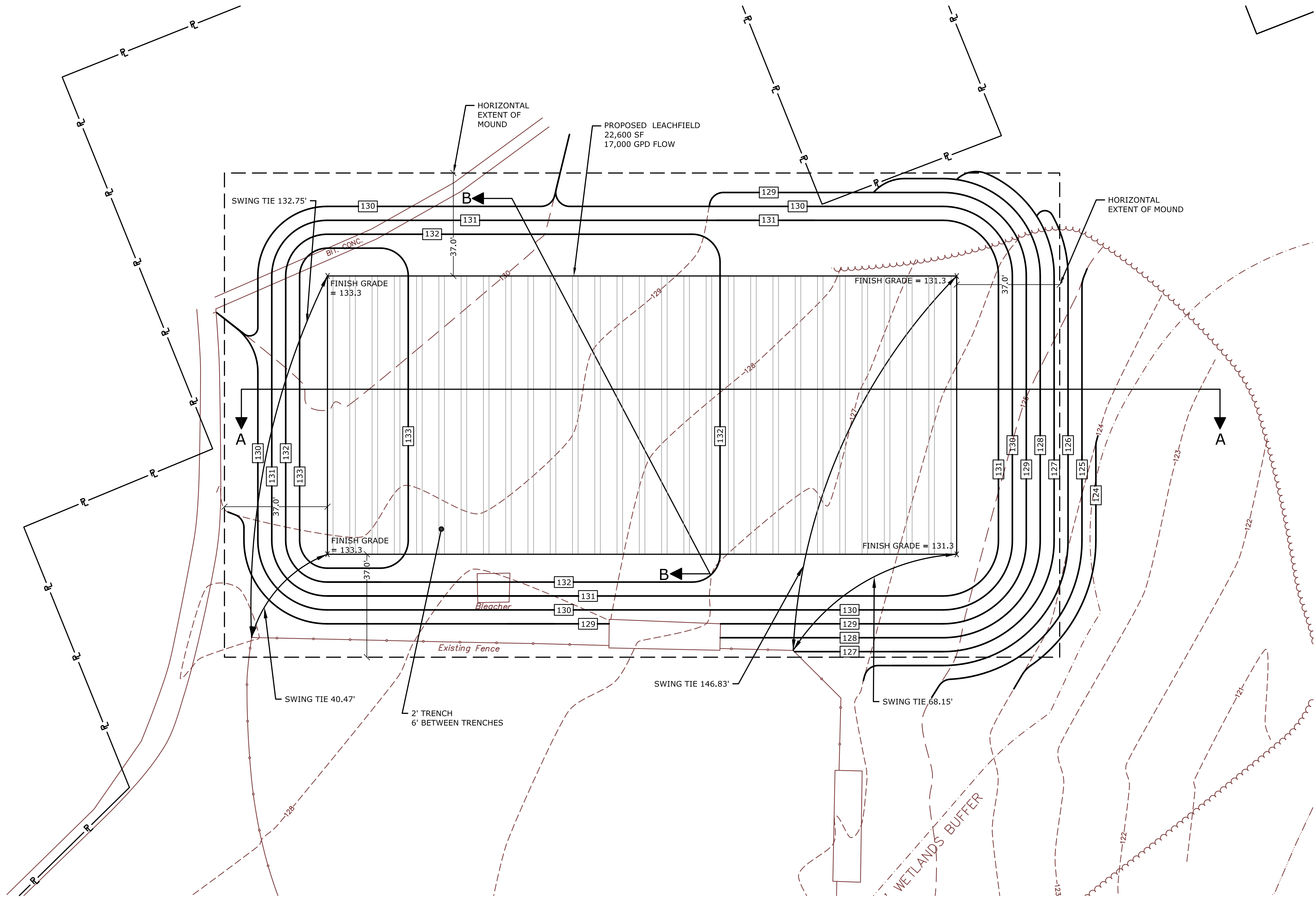


41 Cochituate Road
Wayland,
Massachusetts

Mark	Date	Description
PROJECT NO:		W1396
FILE:	TownHall_2012	
DRAWN BY:	BJL	
CHECKED:	KLK	
APPROVED BY:	IBC	

SCALE: 1"=30'

FIGURE 4-3R



**Town Office
Building
Groundwater
Discharge**

41 Cochituate Road

Wayland,
Massachusetts

Mark	Date	Description
		PROJECT NO: W1396
		FILE: TownHall_2012
		DRAWN BY: BJL
		CHECKED: KLK
		APPROVED BY: IBC

EFFLUENT DISPOSAL LAYOUT

SCALE: 1"=20'

FIGURE 5-1R

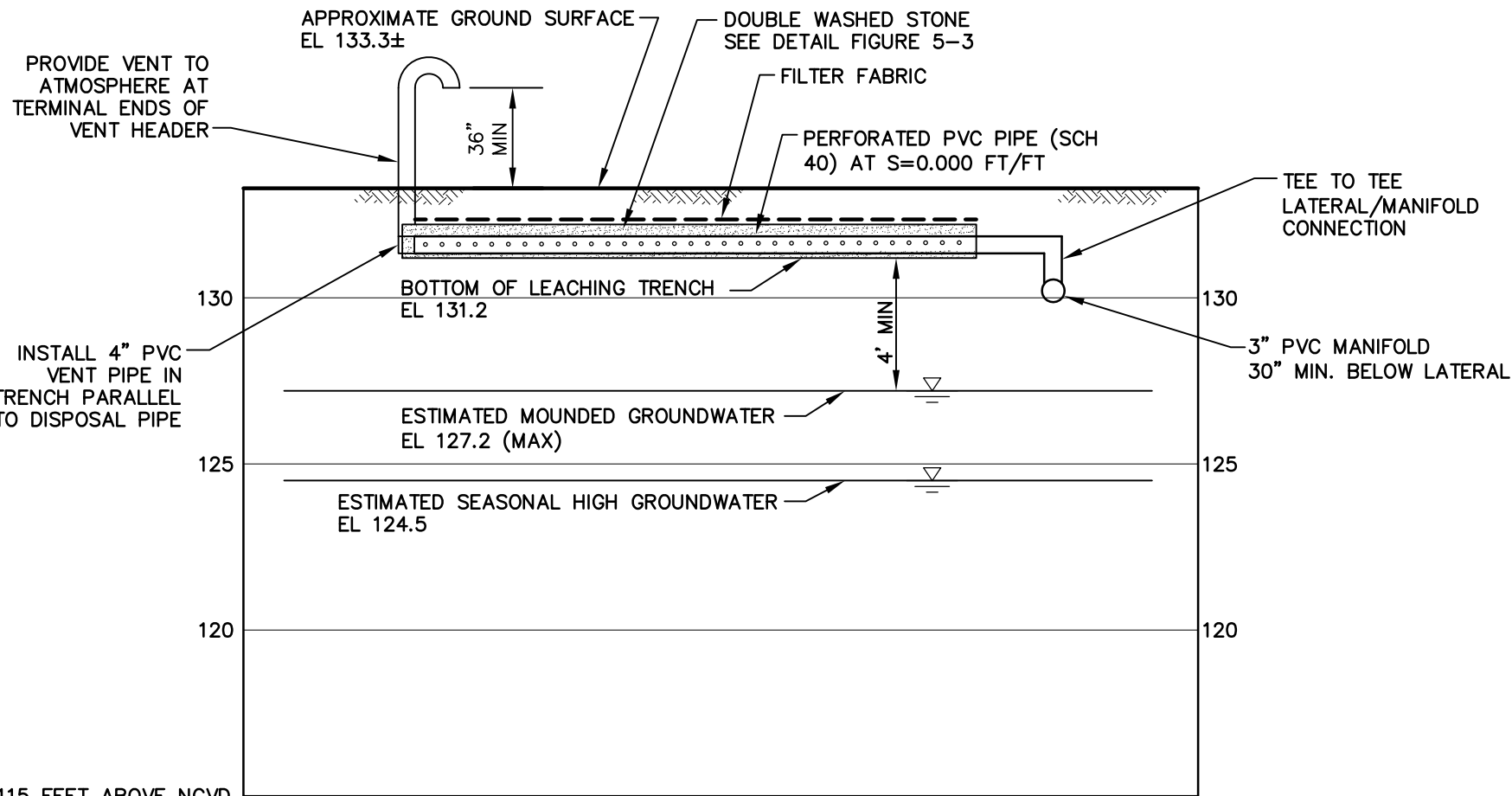


FIGURE 5-2R

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: August 2012

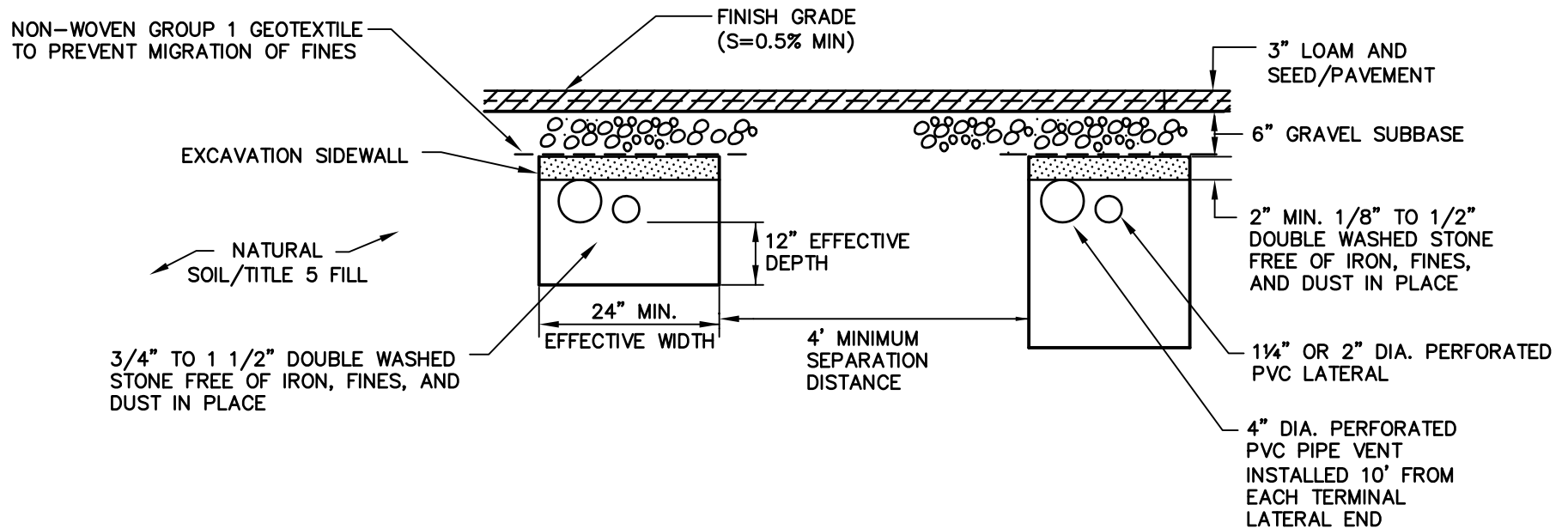


FIGURE 5-3R

DISPOSAL TRENCH DETAIL

TOWN OFFICE BUILDING
GROUNDWATER DISCHARGE
41 COCHITUATE ROAD
WAYLAND, MASSACHUSETTS

Tighe&Bond Consulting Engineers
www.tighebond.com

NO SCALE

DATE: August 2012

Attachment E

Section 6 – Conclusion of Report

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 57 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 as much as possible. 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 2.7 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 127.2' and the bottom of the system will be at 131.2'. With the perforated pipe, 6" gravel, and 3" loam and seed, the approximate surface elevation will be 133.28.

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 37'. 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