Hydrogeologic Evaluation Report

For

The Village at Norfolk
25 Rockwood Road, Norfolk

August 11, 2017

D'AMORE ASSOCIATES, INC.
1135 Stafford Road
Tiverton, RI 02878

Environmental Engineering / Ground Water Consulting

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Executive Summary

A hydrogeological field investigation was undertaken at 25 Rockwood Road, Norfolk that characterizes the hydrogeology of the site and underlying aquifer. Numerous test pits and three monitoring wells were installed across the property to evaluate soil properties and saturated thickness of the aquifer, results from perc tests were used in conjunction with soil boring logs and test hole logs to determine the hydraulic characteristics of the aquifer and water level measurements were made to assess the direction of ground water flow and hydraulic gradient across the site. The findings and conclusions of this report are that:

1. There are no environmental resources in the vicinity of the site. There is one public water supply protection area located approximately 1,500 feet southeast of the site. There are no private wells in the vicinity to the site.
2. To characterize site hydrogeology, 71 test pits and three monitoring wells were installed across the property; two wells on the hillslope and one at the base of the hill. Soils were generally found to be sand and loamy sand with numerous boulders in some areas. Groundwater was typically not encountered in test pits at higher elevations.
3. Bedrock refusal varied from 23 feet at the base of the hill to 17 feet at the top of the hill. Bedrock depth on the side of the hill was 14.5 feet.
4. Water level measurements taken at different times of the year reveal that during seasonally wet periods there is less than two feet of water in the unconsolidated aquifer material on the side and top of the hill. During seasonally dry periods, there is no ground water in the unconsolidated materials on the hillslope.
5. Water level measurements obtained during Spring 2017 were made to assess the direction of ground water flow and hydraulic gradient across the site. During these conditions, ground water flows in a northeasterly direction under a uniform hydraulic gradient of 0.039 ft./ft. and advective groundwater flow velocity was estimated to be 4.6 ft./day.
6. Because there was insufficient water in the hillslope wells to conduct slug tests, percolation rates from test pits were converted to hydraulic conductivity using a published empirical formula.
7. This data was used to construct an analytical model using the Hantush solution to determine the degree of mounding that would occur beneath the each of the six leach fields. Using the Method of Superposition, the maximum mound height for each leach

field was increased due to the mounding influence from nearby leach fields. Mound heights varied from 0.45 to 1.3 feet above ESHGW.

1 Introduction

The following hydrogeological report has been prepared in support of a 40B permit application that is being prepared by Outback Engineering, Inc. (Outback) of Middleborough, Massachusetts for a 32 condominium units identified as The Village at Rockwood that is being proposed for 25 Rockwood Road, Norfolk. The 32-unit, 85-bedroom development will be serviced by municipal water but will require on-site disposal of primary-treated septic wastewater (9,350 gpd) that will be discharged to a series of six leach fields.

Hydrogeological data developed during the field investigation was used to construct an analytical model (Hantush) to determine the degree of mounding that would occur beneath the each of the six leach fields. Using the Method of Superposition, the maximum mound height for each leach field was increased due to the mounding influence from nearby leach fields.

2 Existing Site Conditions

2.1.1 Site Description

The condominium project is located at 25 Rockwood Road (**Figure 1**), and is identified by the Town of Norfolk Assessors Office as Assessors map 14 block 49 lot 11. **Figure 2** is a plan depicting existing site conditions. There is an existing home with a long, paved driveway on the site that will be razed to construct the project. The project site is 6.56 acres and located in the town's Business B-1 (Outside Core) zoning district. The property is on the west side of Rockwood Road, bordered by apartments owned by the Norfolk Housing Authority to the North, single family homes to the North, South and East, and the MBTA commuter rail line running along the southern property line.

2.1.2 Topography

Site topography is characterized by slopes, ranging from 2%-13%. Rockwood Road is at a relatively gentle slope in front of the site driveways at an elevation of approximately 197 ft. The highest elevation on site is near the northwest property corner located in the central area of the site at el. 227. The lowest elevation on site is 195 at the east portion of the site. The site has three onsite low spots where there is no outlet for runoff (each side of existing driveway near entrance off Rockwood Road and at back portion of site behind the town's apartment buildings) and no wetlands present indicating low water table and permeable soils. The central portion of the site where the existing homestead is drains offsite to the east to a concrete-lined channel on the Gross property, that has a culvert draining under Rockwood Road; this channel appears to be dry. The rear portion of the site slopes offsite to the west and towards an existing infiltration basin on the town property.

2.1.3 Soil Characteristics

Initially, ten observation holes were excavated by Outback in April 2016 to depths varying from six to ten feet below grade throughout the site to document general soil conditions. Based on these test pits, D'Amore Associates installed three monitoring wells to bedrock refusal at depths of; 23 feet at the base of the slope near Rockwood Road (MW-1), 17 feet at the top of the slope (MW-2) and 14.5 feet at roughly the middle of the slope (MW-3). (Refer to Figure 2 for monitoring well locations. To assess soil and groundwater conditions for both

septic and drainage systems, additional soil test pits were excavated in April, May and July 2017.

Soils were generally found to be sand and loamy sand with some areas of slightly sandy loam with some boulders. Groundwater was typically not encountered at higher elevations, but was encountered at MW-1 with groundwater at a depth of 14' below grade (or elev. 184.5') on June 20, 2016, and TP-2 which had water weeping into the hole at 6' below grade on April 28, 2016. Per the most recent Natural Resources Conservation Service (NRCS) soil maps, soils onsite consist of Canton Fine sandy loam (map unit 420B; hydrologic soil group B) in the eastern portion of the site area, and Hinckley loamy sand, (map unit 245B; hydrologic soil group A) in the western portion of the site behind the existing house (**Figure 3**). The NCRS report is included as **Appendix 1**.

2.2 Environmental Resources

Inspection of the Mass GIS map, which has been included as **Figure 4**, indicates that there are no environmental resources in the vicinity of the site. There is one public water supply protection area located approximately 1,500 feet southeast of the site. There are no private wells in the vicinity to the site.

The proposed development is located in a small watershed (approximately 0.3 sq. mi., refer to **Figure 5**) that is part of sub-basin to the Stop River, a northward flowing tributary to the Charles River.

2.3 Proposed Project

The existing home will be razed and 32 new condominium units shall be constructed along approximately 1,900 ft. of new roadway. A figure depicting the proposed subdivision plan is included as **Figure 6**. The homes include a variety of single-family detached homes and 2 triplex buildings. The development will be serviced by municipal water and six on-site septic systems.

3 Field Investigation

Based upon concept plans prepared by Outback, a review of Outback test pit logs and a meeting with Outback at the site, a field investigation program was developed to acquire sufficient hydrogeological data to be able to calculate mounding that would occur beneath the leach fields. The field program consisted of:

1. Reviewing the test pit logs and walking the site with Outback to select well locations.
2. Installing three soil borings across the site that would be completed as monitoring wells.
3. Collecting synoptic rounds of water levels on three separate occasions and preparing representative water table maps.

Using this information, water table contour maps were prepared, a series of analytical models were constructed that evaluated the degree of mounding beneath the leach fields.

3.1 Drilling Procedure

Initial test borings were advanced Soil Tech of Gardner, Massachusetts utilizing 2-inch OD direct push tooling manufactured by GeoProbe®. Representative soil samples were continuously collected at 5-foot intervals of depth. The sampler was driven into undisturbed soil following the procedures and protocols as described in WSC-310-91 "Standard References for Monitoring Wells, Small Diameter Driven Well Supplement," dated 1999.

Given the stony nature of the soil only one soil boring/monitoring well (DA-1) was installed using this procedure. A visual interpretation of each soil sample was recorded. The soil samples were described following the "modified Burmister" Soil Classification as presented in WSC-310-91. The majority of each soil sample collected was placed into one (1) gallon zip lock bags for possible further evaluation. Test borings were terminated at the interface with a visually finer grained sized stratum of lower permeable glaciofluvial material or apparent denser material.

The remaining two wells (DA-2 and DA-3) were installed by New England Test Borings using a track mounted drill rig equipped with air rotary (ODEX ®) tooling capable of borehole advancement through boulders and bedrock. New England Test Boring also

mobilized conventional air hammers for advancement into the boulder field and bedrock as necessary.

Test boring logs that present a description of the materials encountered are included in **Appendix 2**.

3.2 Groundwater Monitoring Well Installations

Each of the test borings were completed as groundwater monitoring wells, which consisted of 5 to 8 feet of 2-inch I.D. #10 slot Schedule 40 PVC wells screen. The "filter pack" around the screened portion of the groundwater monitoring well consisted of uniformly graded sand. The screened portion of each groundwater monitoring well is attached to a length of 2-inch I.D. threaded Schedule 40 PVC riser to the ground surface. The filter pack extends approximately 1-foot above the top of the well screen in each of the installations. Above the filter pack, the backfill consists of a 1-foot layer of hydrated bentonite. The remainder of the backfill consisted uniform grade sand. A protective locked stand-pipe was grouted in-place with a concrete pad to complete each of the groundwater monitoring well installations. The groundwater monitoring wells were installed in accordance with WSC-310-91. Groundwater monitoring well installation diagrams are included on the test boring logs in Appendix 2.

The GeoProbe monitoring well (DA-1) was installed on June 17, 2016. Groundwater was encountered at a depth of 14 feet. The boring was advanced to refusal on presumed bedrock at a depth of 23 feet. Stratigraphy consisted of sequences of coarse to fine sand with gravel layers. A 23-foot well was installed with 8-feet of screen.

The wells installed with the air rotary drilling technique (DA-2 and DA-3) were installed on July 20, 2016.

- DA-2 was advanced to a total depth of 35 feet below ground surface. Bedrock was encountered at depth of 17 feet below ground surface. To confirm this, the boring was advanced 18 feet into bedrock. Above the bedrock, the drilling encountered Glacial Till that contained numerous boulders and nests of boulders. The monitoring well was installed at the Glacial Till/bedrock interface at a depth of 17 feet below ground surface. The monitoring well consisted on 5 feet of well screen and was completed at the ground surface with protective casing that extends above the ground

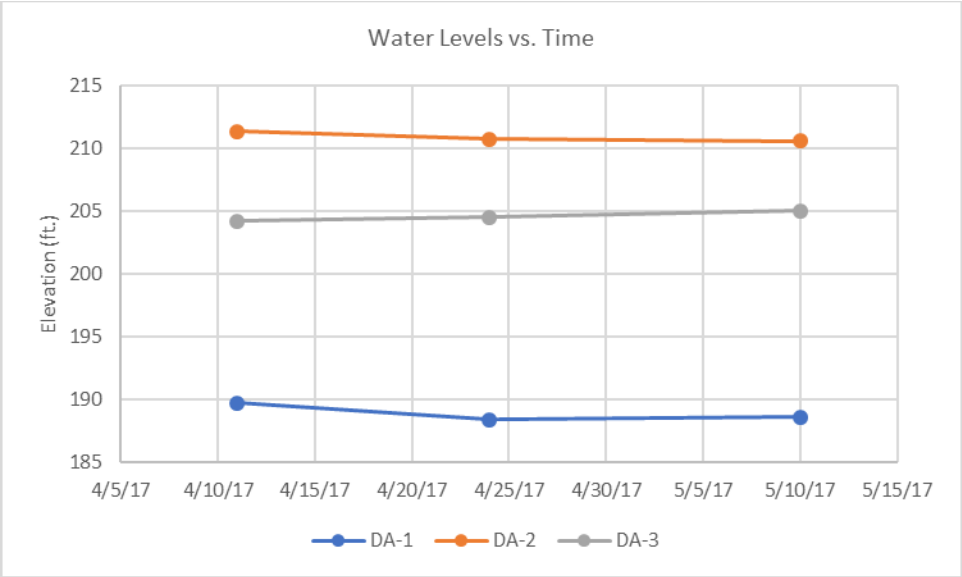
surface. Prior to installing the well, the bedrock borehole was backfilled with a slurry of bentonite and concrete.

- DA-3 was advanced to a total depth of 29 feet below ground surface. Bedrock was encountered at a depth of 14.5 feet below ground surface. This was confirmed by drilling 14.5 feet into bedrock. The deposit overlying the bedrock was again Glacial Till that contained numerous boulders and nests of boulders. A groundwater monitoring well was installed at a total depth of 15 feet below ground surface and consisted of a 5-foot length of well screen. A protective casing was installed at the ground surface. Prior to installing the well, the bedrock borehole was backfilled with a slurry of bentonite and concrete.

Monitoring well construction details are included in Appendix 2.

3.3 Monitoring Well Survey and Water Level Measurements

The monitoring wells were surveyed for horizontal location and elevation to a 1988 NGVD Datum by Outback. Water levels were measured on four separate occasions, July 27, 2016 (DA-2 and DA-3 were dry at this time), April 11 and 24, 2017 and May 10, 2017. Water level data and elevations are summarized in **Table 1** along with well construction details. A graph of water level vs. time for the April-May 2017 data is presented below. Water levels are gradually declining at the top of the hill (DA-2), slightly increasing at the middle of the hill and overall decreasing at the base of the hill.



3.4 Water Table Maps, Hydraulic Gradient and Ground Water Flow Direction

The ground water elevation data for the April 11 and May 10, 2017 data were contoured using Surfer 11.0®. The data, which are depicted on **Figure 7** (April 11) and **Figure 8** (May 10), show ground water flowing in a northeasterly direction under a uniform hydraulic gradient of 0.039 ft./ft. for both dates.

3.5 Hydraulic Conductivity Estimation

When water levels were measured on April 11, 2017, there was 1.35 feet of standing water in DA-2 and 0.81 feet of water in DA-3. Because there was insufficient water in these wells to conduct slug tests, hydraulic conductivity of the soil was determined from an empirical formula developed from percolation rate data obtained from 34 sites exhibiting a wide range of soil properties. The procedure is discussed in detail in Septic Tank Systems, A Consultant's Tool Kit Vol. 1; John Winneberger, Ann Arbor Science, 1984. The conversion of perc rate to hydraulic conductivity is expressed by the following formula:

$$\log k = -4.76 + \log p$$

Where: k, the hydraulic conductivity, is expressed in cm/sec; and
p, the percolation rate, is expressed in inches/hr.

The conversion of perc rate to hydraulic conductivity for the perc tests conducted in the six leach fields are summarized in the following table along with a description of the soil in the C horizon and the presence/absence of mottles:

SAS #	Test Pits associated with leach field	C Horizon Description	Mottles	Perc Rate (mpi)	K (ft/d)
1	TP 1-2, TP 1-4	Med. Sand, fine loamy sand/Fine med. Sand	None	(1.4)(0.7)	16/28 (Avg 22)
2	TP 3-2, TP 3-3	Med. Sand, sandy loam/Sandy loam, loamy sand, med. Sand, sandy loam	24"/28 " (Avg. 26 ")	(2)(14)	9.2/0.42 (Avg 4.8)

3	TP 7-4, TP 7-5	Coarse sand & gravel, med. Sand/Coarse sand & gravel, med. Sand	None	1.0	9.2
4	TP 4-2, TP 4-3	Med. Coarse sand, loamy sand/loamy sand	None	(1)(6)	28/16 (Avg. 22)
5	TP 5-1, TP 5-3	Sandy loam/Loamy sand	None	(1)(3)	28/4.8 (Avg. 16.4)
6	TP-26	Fine sand/med. Sand	None	3.3	4.35

The saturated thickness for the purpose of the mounding analysis is the difference between the average mottle depth (26 in, (2.17ft.)) and the depth to bedrock beneath each leach field, which was interpolated from the bedrock depths identified in the three soil borings.

3.6 Ground Water Flow Velocity

The advective velocity (v) of ground water across the site was calculated from the following equation v = KJ/n by multiplying the average hydraulic conductivity beneath the six leach fields, K (17.6 ft./d), times the average hydraulic gradient across the site, J (0.039 ft./ft.), divided by the porosity, n, (which was estimated to be 0.15). When there is ground water present beneath the hill slope, the advective velocity has been estimated to be 4.6 ft./day.

4 Leach Field Mounding Analysis

Groundwater mounding analyses were performed to determine the mound that would occur beneath the leach field under the continuous application of the design loading rate for a period of 90 days to simulate steady state conditions. The analysis was performed using an analytical computer code, which estimates the mound height that was written by GeoHydroCycle, Inc. of Newton, Massachusetts. The model is a two-dimensional transient model using Glover's solution to Hantush's Method. The input parameters to the model include:

- The hydraulic conductivity of the saturated zone beneath each leach field, which was estimated from the perc test results using the above referenced formula.
- The saturated thickness, which varied from 12.3 feet to 20.8 feet depending upon location.
- The porosity of the soil, which is a poorly sorted mixture of sand silt and gravel (i.e., glacial till), was assumed to be 0.15. This value is consistent with mounding evaluations for prior projects using the same approach (i.e. Hantush).
- The loading rate for each leach field, which is based upon the Title V load (cu. ft./day) divided by the limit of excavation for the leach field.
- The duration of application of the discharge was established at 90 days to ensure near-steady state conditions were achieved.

The input data to the model is summarized in the following table:

SAS #	# of Units	# of BR	L (ft.)	W (ft.)	Area (sq ft.)	Load (gpd)	Load (cu. ft.)	Loading Rate (cu. ft./sq. ft.)	Test Pits associated with leach field	K (ft/d)	BR Depth (ft)	Saturated Thickness (ft.) (based on mottles at 26")
1	4	12	50	34	1700	1320	176	0.1038	TP 1-2, TP 1-4	(16.65) (48.75) Avg = 32.7	23	20.8
2	3	7	58	26	1508	770	103	0.0683	TP 3-2, TP 3-3	(9.58) (0.47) Avg = 5.03	19	16.8
3	9	25	103	25	2575	2750	368	0.1428	TP 7-4, TP 7-5	28.1	17	14.8
4	6	14	92	17	1564	1540	206	0.1316	TP 4-2, TP 4-3	(28.1) (1.74) Avg = 14.9	14.5	12.3
5	7	20	83	29	2366	2200	294	0.1243	TP 5-1, TP 5-3	(28.1) (2.47) Avg = 15.26	14.5	12.3
6	3	7	60	26	1560	770	103	0.0660	TP-26	4.35	17	14.8
Total	32	85				9350						

The maximum mound height that develops above the estimated seasonal high groundwater (ESHGW) (i.e., the mottled horizon) under these conditions beneath each leach field is summarized in the following table, which includes the mound influence from adjacent leach fields:

SAS #	Maximum Mound Height (ft) without interference	Influence from Adjacent leach Fields on maximum mound height			Maximum Mound Height (ft) with Interference
1		on 1 from 2 (250 ft)	on 1 from 5 (418 ft)	on 1 from 4 (413 ft)	
	0.17	0.1	0.1	0.08	0.45
2		on 2 from 1 (250 ft)	on 2 from 4 (250 ft)	on 2 from 5 (300 ft)	
	0.61	0.05	0.15	0.18	0.99
3		on 3 from 4 (313)	on 3 from 5 (313 ft)	on 3 from 6 (415 ft)	
	0.49	0.1	0.23	0.04	0.86
4		on 4 from 1 (413 ft)	on 4 from 5 (88 ft)	on 4 from 3 (313 ft)	
	0.58	0.04	0.4	0.14	1.16
		on 5 from 1 (418 ft)	on 5 from 4 (88 ft)	on 5 from 3 (313 ft)	
5	0.82	0.04	0.32	0.12	1.3
		on 6 from 3 (415 ft)	on 6 from 4 (675 ft)	on 6 from 5 (625 ft)	
6	0.76	0.1	0.02	0.02	0.91

The two-dimensional shape of the mound and the transient response that develops under continuous loading for 90 days for each leach field are included as two graphs (mound height vs. distance and mound height vs. time) in **Appendix 3**. The flattening of the transient curve indicates that a near-steady state condition has been achieved and that the mound has reached its maximum height. The input data and tabulated model results are presented on each figure.

5 Field Investigation and Modeling Conclusions

The following summarizes the findings and conclusions of the field investigations and modeling exercises for 25 Rockwood Road, Norfolk:

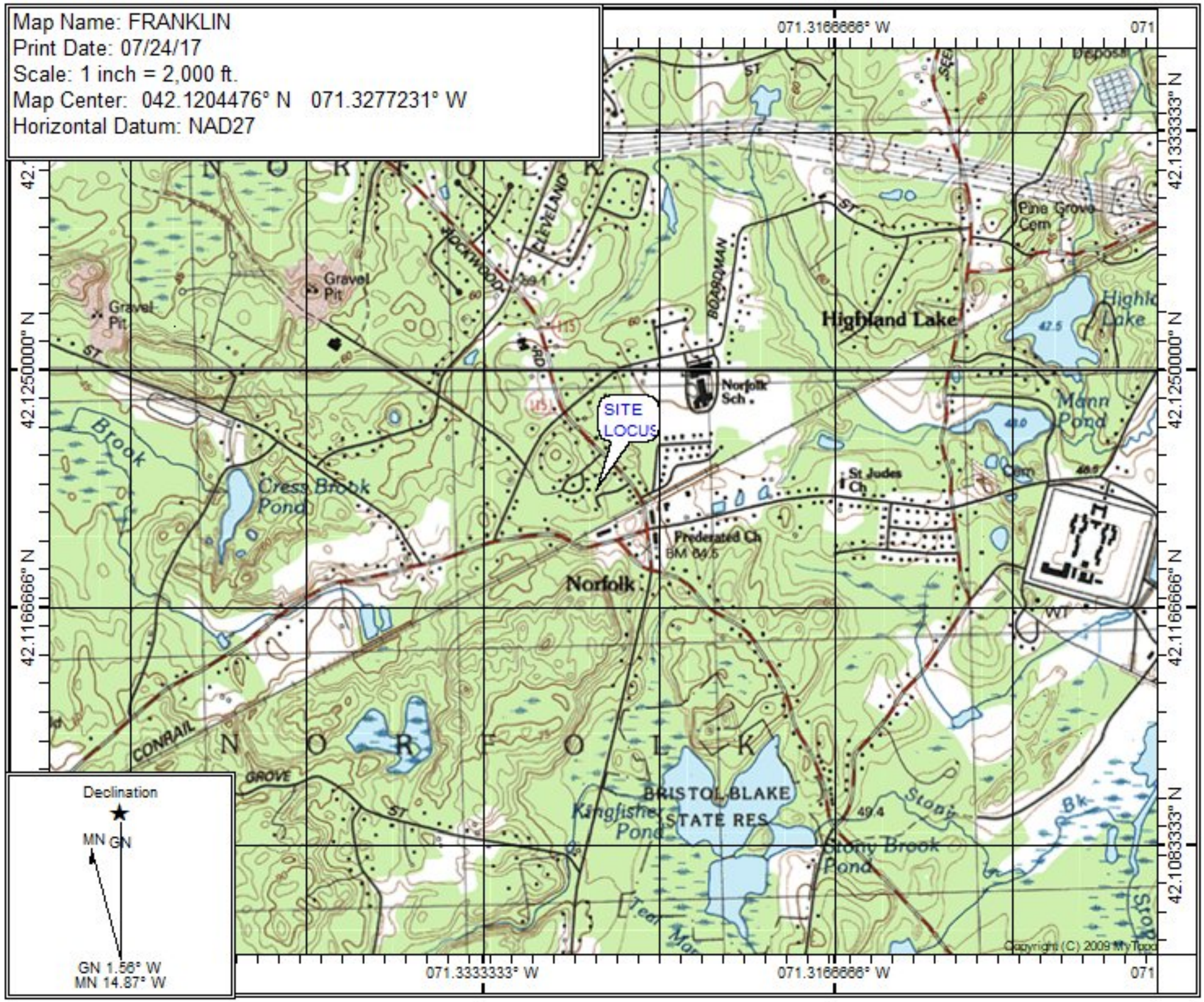
8. There are no environmental resources in the vicinity of the site. There is one public water supply protection area located approximately 1,500 feet southeast of the site. There are no private wells in the vicinity to the site.
9. To characterize site hydrogeology, 71 test pits and three monitoring wells were installed across the property; two wells on the hillslope and one at the base of the hill. Soils were generally found to be sand and loamy sand with numerous boulders in some areas. Groundwater was typically not encountered in test pits at higher elevations.
10. Bedrock refusal varied from 23 feet at the base of the hill to 17 feet at the top of the hill. Bedrock depth on the side of the hill was 14.5 feet.
11. Water level measurements taken at different times of the year reveal that during seasonally wet periods there is less than two feet of water in the unconsolidated aquifer material on the side and top of the hill. During seasonally dry periods, there is no ground water in the unconsolidated materials on the hillslope.
12. Water level measurements obtained during Spring 2017 were made to assess the direction of ground water flow and hydraulic gradient across the site. During these conditions, ground water flows in a northeasterly direction under a uniform hydraulic gradient of 0.039 ft./ft. and advective groundwater flow velocity was estimated to be 4.6 ft./day.
13. Because there was insufficient water in the hillslope wells to conduct slug tests, percolation rates from test pits were converted to hydraulic conductivity using a published empirical formula.
14. This data was used to construct an analytical model using the Hantush solution to determine the degree of mounding that would occur beneath the each of the six leach fields. Using the Method of Superposition, the maximum mound height for each leach field was increased due to the mounding influence from nearby leach fields. Mound heights varied from 0.45 to 1.3 feet above ESHGW.

6 Limitations

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client and their successors and assigns, advisors, counsel, lenders and prospective lenders, and prospective buyers and lenders. To the extent that any additional parties intend to rely upon this report, they may do so only upon a written request to and approval from D'Amore Associates, Inc., which approval shall not be reasonably withheld.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

Figures



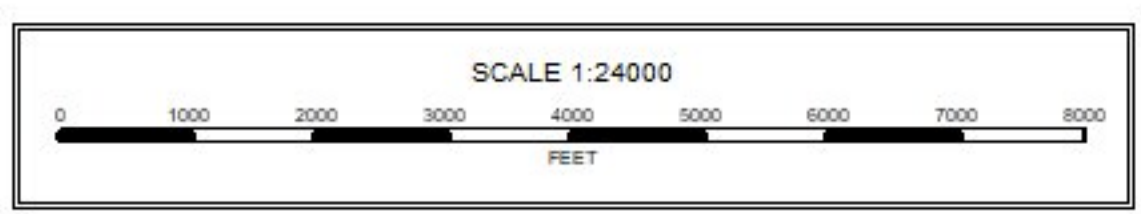
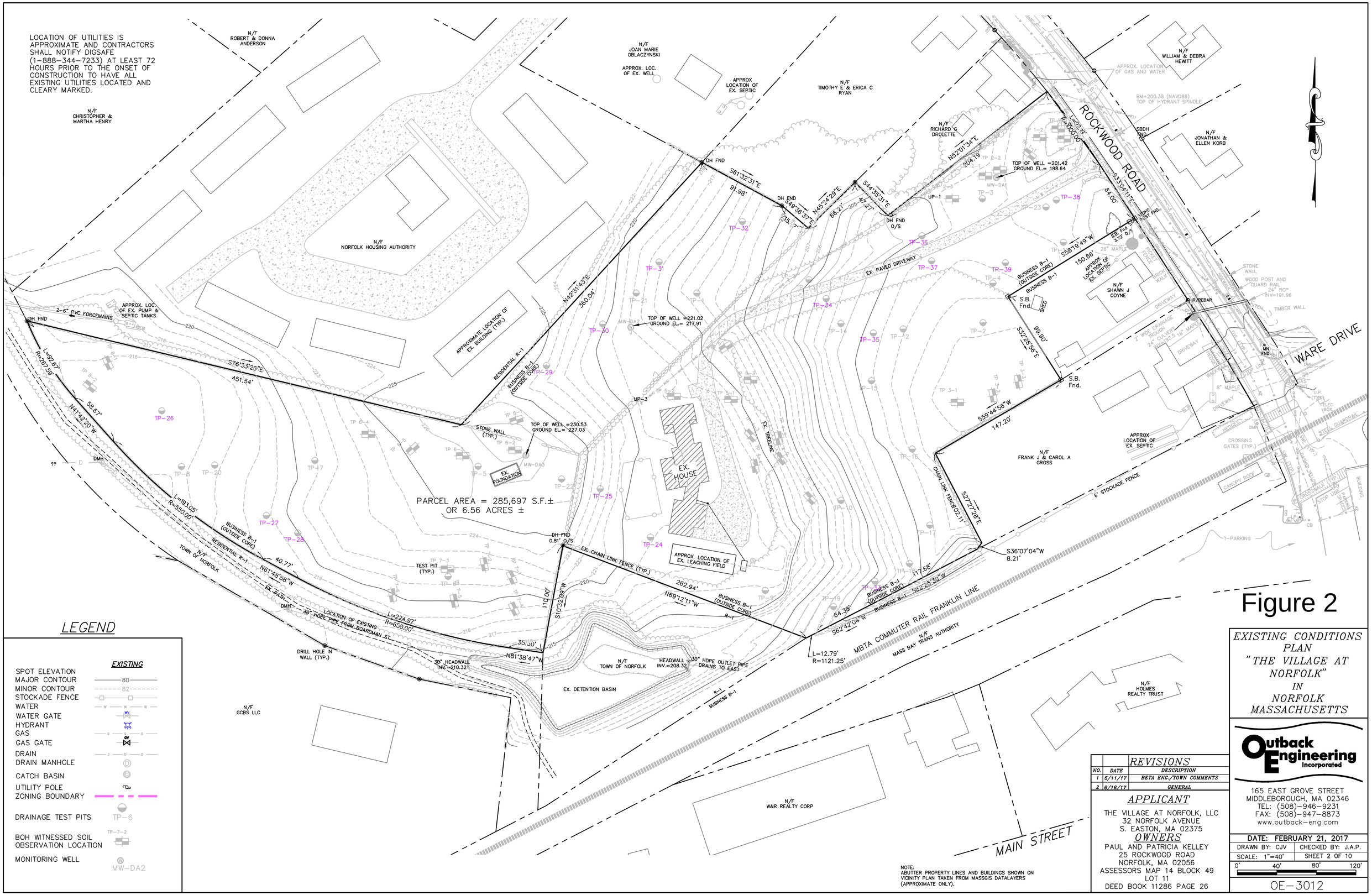


Figure 1

Site Locus Map
25 Rockwood Road, Norfolk

LOCATION OF UTILITIES IS APPROXIMATE AND CONTRACTORS SHALL NOTIFY DIGSAFE (1-888-344-7233) AT LEAST 72 HOURS PRIOR TO THE ONSET OF CONSTRUCTION TO HAVE ALL EXISTING UTILITIES LOCATED AND CLEARY MARKED.



LEGEND

	EXISTING
SPOT ELEVATION	
MAJOR CONTOUR	80
MINOR CONTOUR	82
STOCKADE FENCE	
WATER	W
WATER GATE	WV
HYDRANT	
GAS	G
GAS GATE	GV
DRAIN	D
DRAIN MANHOLE	D
CATCH BASIN	CB
UTILITY POLE	
ZONING BOUNDARY	
DRAINAGE TEST PITS	TP-6
BOH WITNESSED SOIL OBSERVATION LOCATION	TP-7-2
MONITORING WELL	MW-DA2

NOTE:
ABUTTER PROPERTY LINES AND BUILDINGS SHOWN ON VICINITY PLAN TAKEN FROM MASSGIS DATALAYERS (APPROXIMATE ONLY).

Figure 2

EXISTING CONDITIONS PLAN
"THE VILLAGE AT NORFOLK"
IN
NORFOLK
MASSACHUSETTS

REVISIONS

NO.	DATE	DESCRIPTION
1	5/11/17	BETA ENG./TOWN COMMENTS
2	6/16/17	GENERAL

APPLICANT

THE VILLAGE AT NORFOLK, LLC
32 NORFOLK AVENUE
S. EASTON, MA 02375

OWNERS

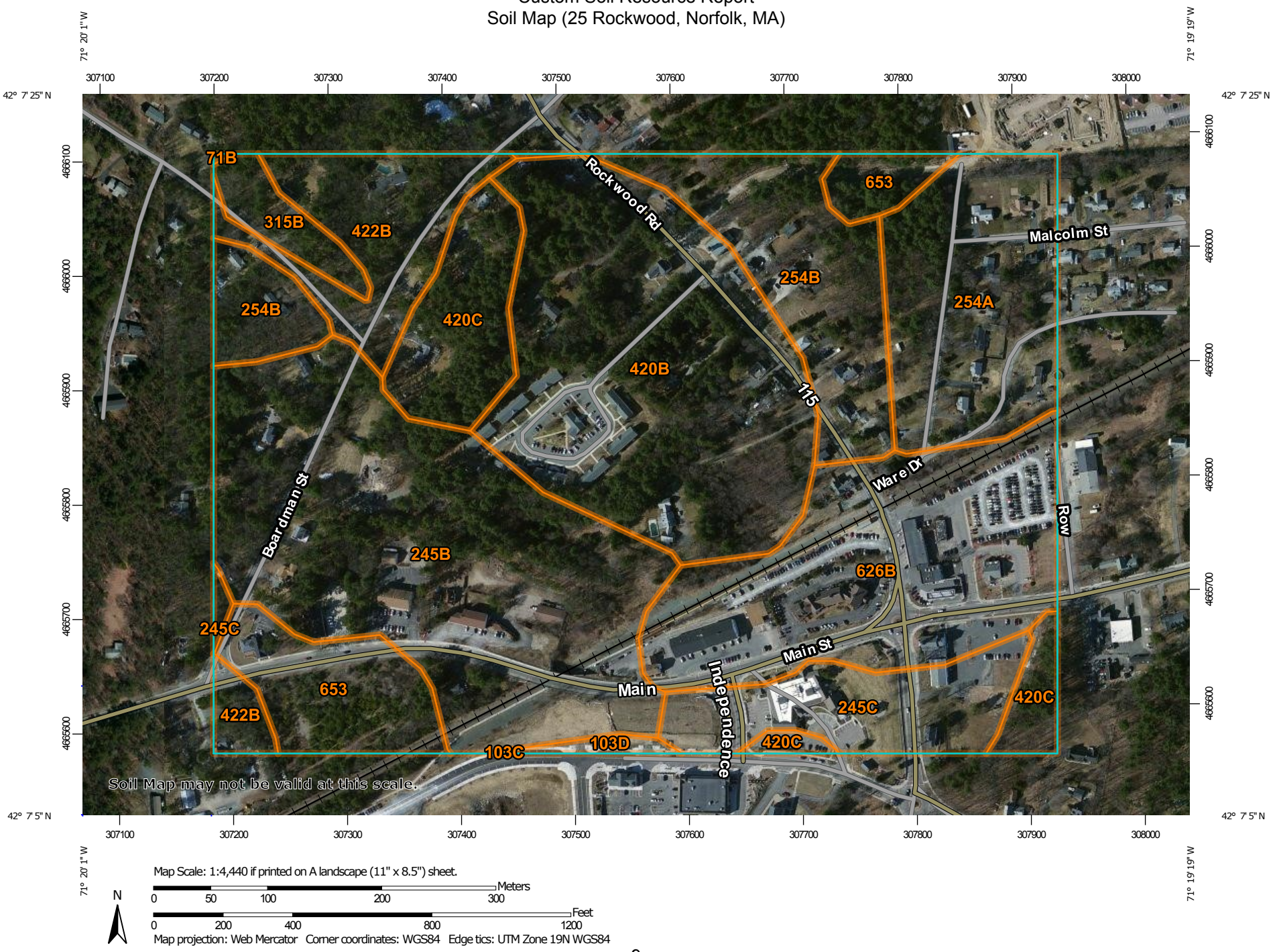
PAUL AND PATRICIA KELLEY
25 ROCKWOOD ROAD
NORFOLK, MA 02056
ASSESSORS MAP 14 BLOCK 49
LOT 11
DEED BOOK 11286 PAGE 26

Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)-946-9231
FAX: (508)-947-8873
www.outback-eng.com

DATE: FEBRUARY 21, 2017
DRAWN BY: CJV | CHECKED BY: J.A.P.
SCALE: 1"=40' | SHEET 2 OF 10
0' 40' 80' 120'

OE-3012

Custom Soil Resource Report
Soil Map (25 Rockwood, Norfolk, MA)



Map Scale: 1:4,440 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

Figure 3
NCRS Soil Map

MassDEP - Bureau of Waste Site Cleanup

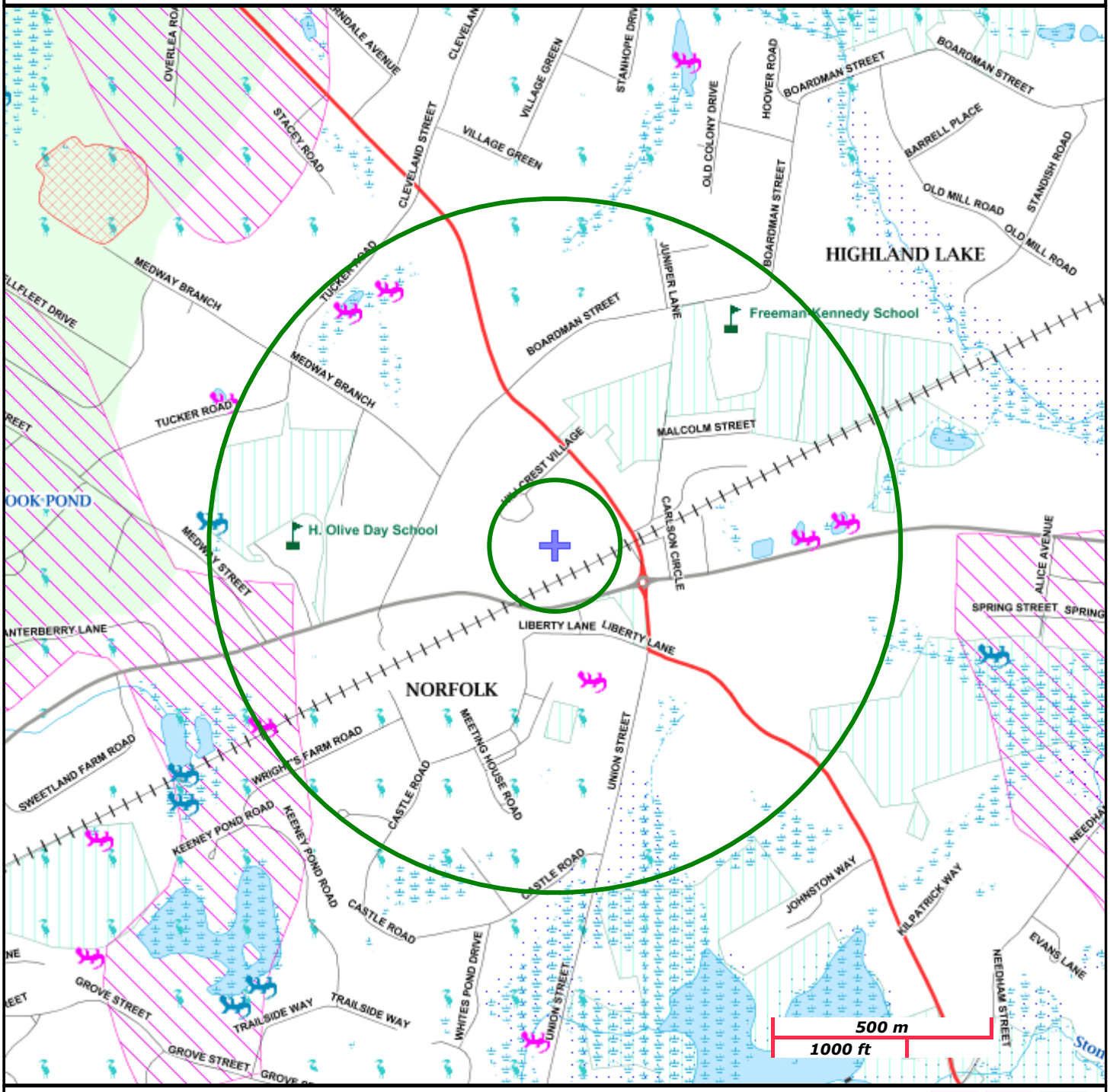
Phase 1 Site Assessment Map: 500 feet & 0.5 Mile Radii

Site Information:
THE VILLAGE AT NORFOLK
25 ROCKWOOD ROAD NORFOLK, MA

NAD83 UTM Meters:
4665769mN , 307587mE (Zone: 19)
July 24, 2017

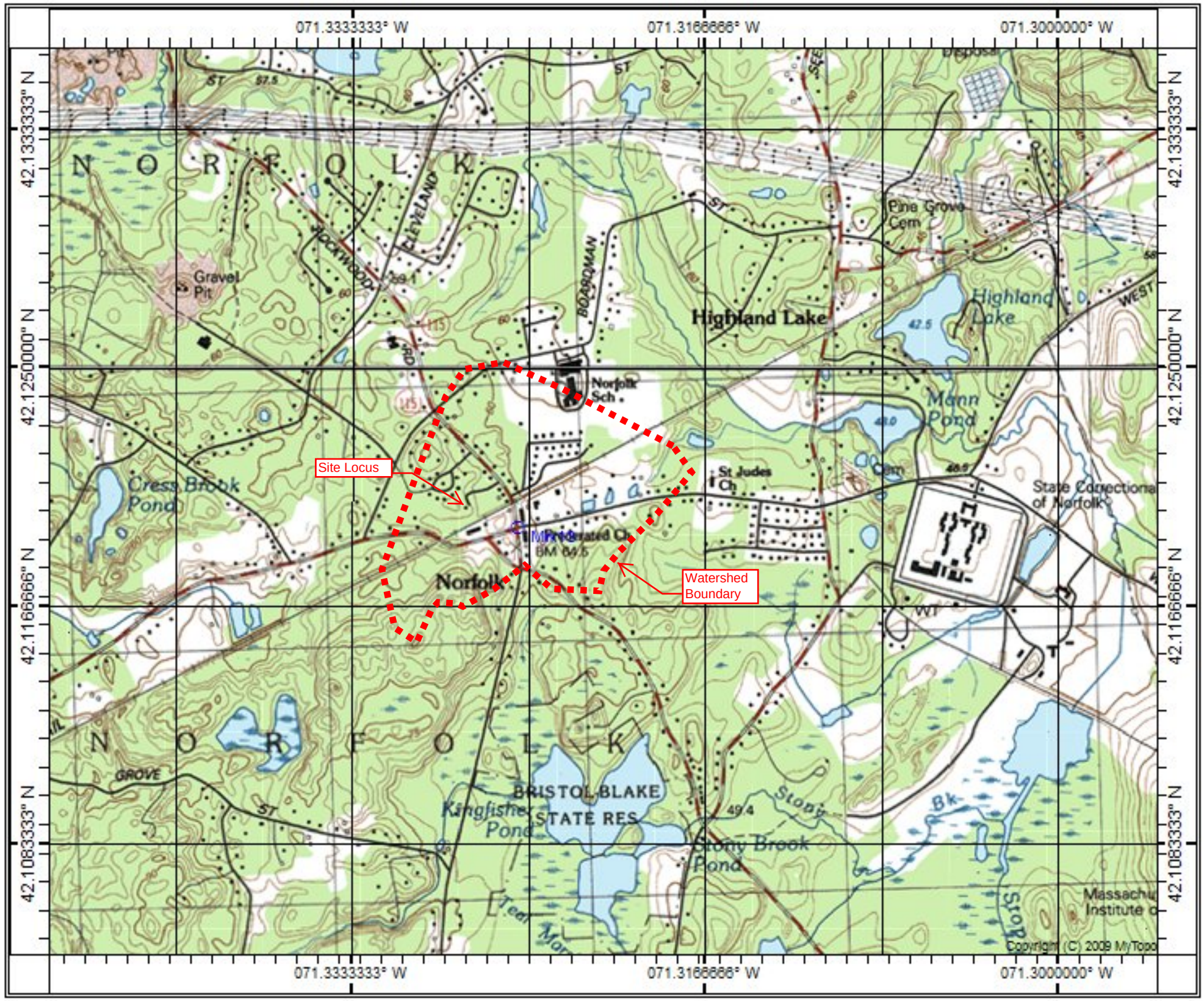
The information shown is the best available at the date of printing. However, it may be incomplete. The responsible party and LSP are ultimately responsible for ascertaining the true conditions surrounding the site. Metadata for data layers shown on this map can be found at: http://www.mass.gov/mgis/.

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection



Roads: Limited Access, Divided, Other Hwy, Major Road, Minor Road, Track, Trail
Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct
Basins: Major, PWS; Streams: Perennial, Intermittent, Man Made Shore, Dam
Aquifers: Medium Yield, High Yield, EPA Sole Source
Non Potential Drinking Water Source Area: Medium, High (Yield)
PWS Protection Areas: Zone II, IWPA, Zone A
Hydrography: Open Water, PWS Reservoir, Tidal Flat
Wetlands: Freshwater, Saltwater, Cranberry Bog
FEMA 100yr Floodplain; Protected Open Space; ACEC
Est. Rare Wetland Wildlife Hab; Vernal Pool: Cert., Potential
Solid Waste Landfill; PWS: Com.GW,SW, Emerg., Non-Com.

Figure 4


071.3333333° W
071.3166666° W
071.3000000° W
42.1333333° N
42.1250000° N
42.1166666° N
42.1083333° N
N O R F O L K
Gravel Pit
Highland Lake
Pine Grove Cem
Norfolk Sch
Mann Pond
Cress Brook Pond
St Judes Ch
State Correctional of Norfolk
Site Locus
Watershed Boundary
Norfolk
BRISTOL BLAKE STATE RES
Kingfisher Pond
Stony Brook Pond
Copyright (C) 2009 MyTopo

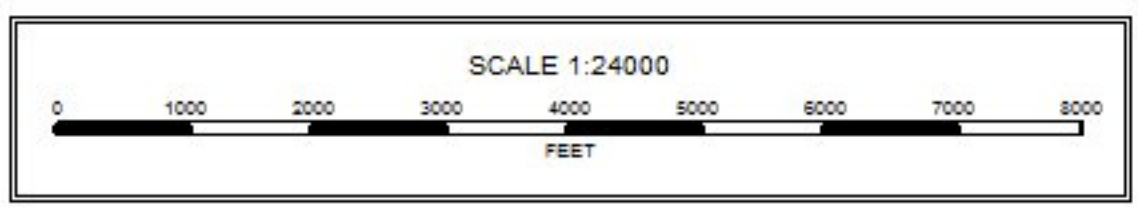

SCALE 1:24000
0
1000
2000
3000
4000
5000
6000
7000
8000
FEET

Figure 5

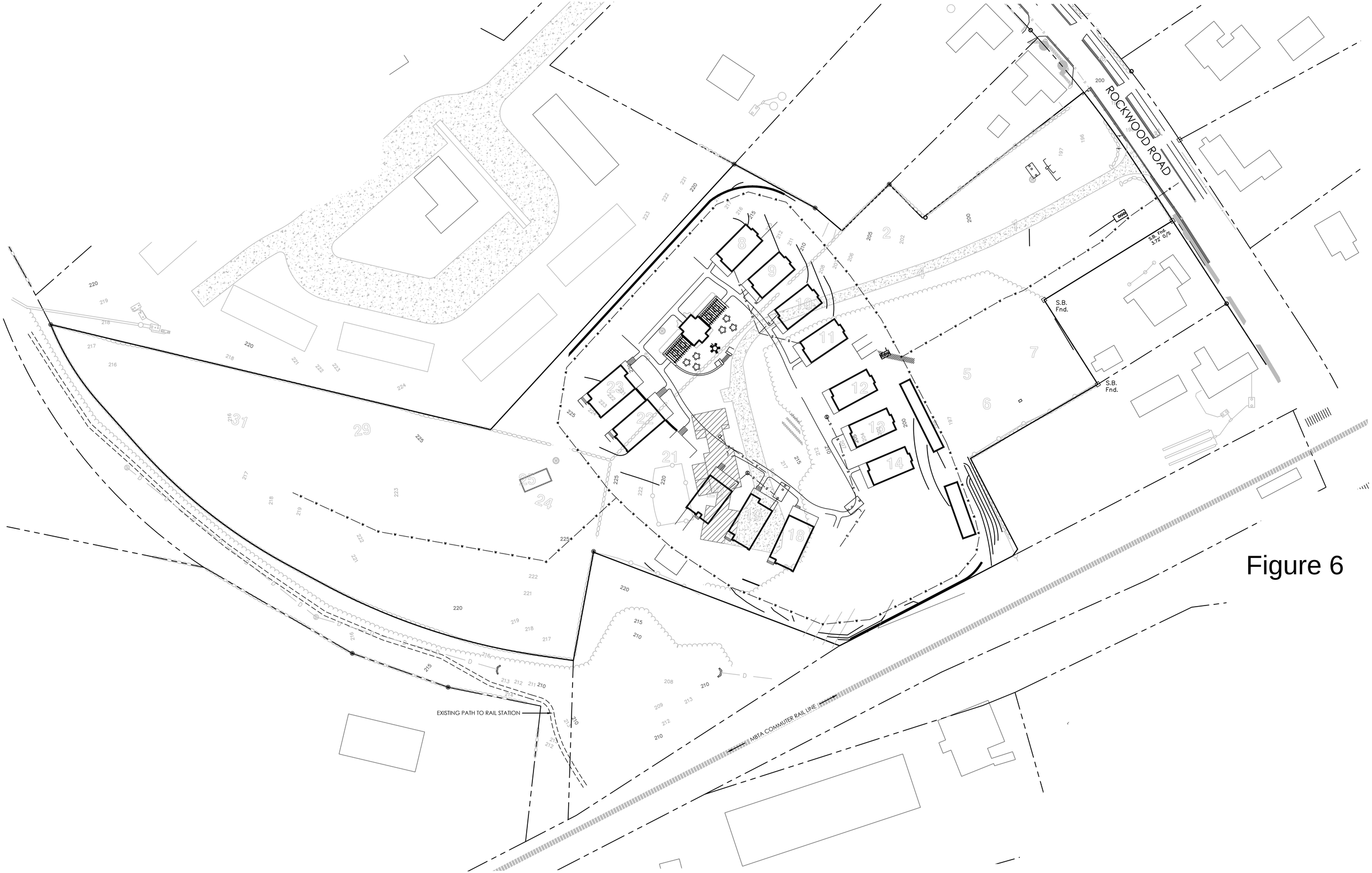
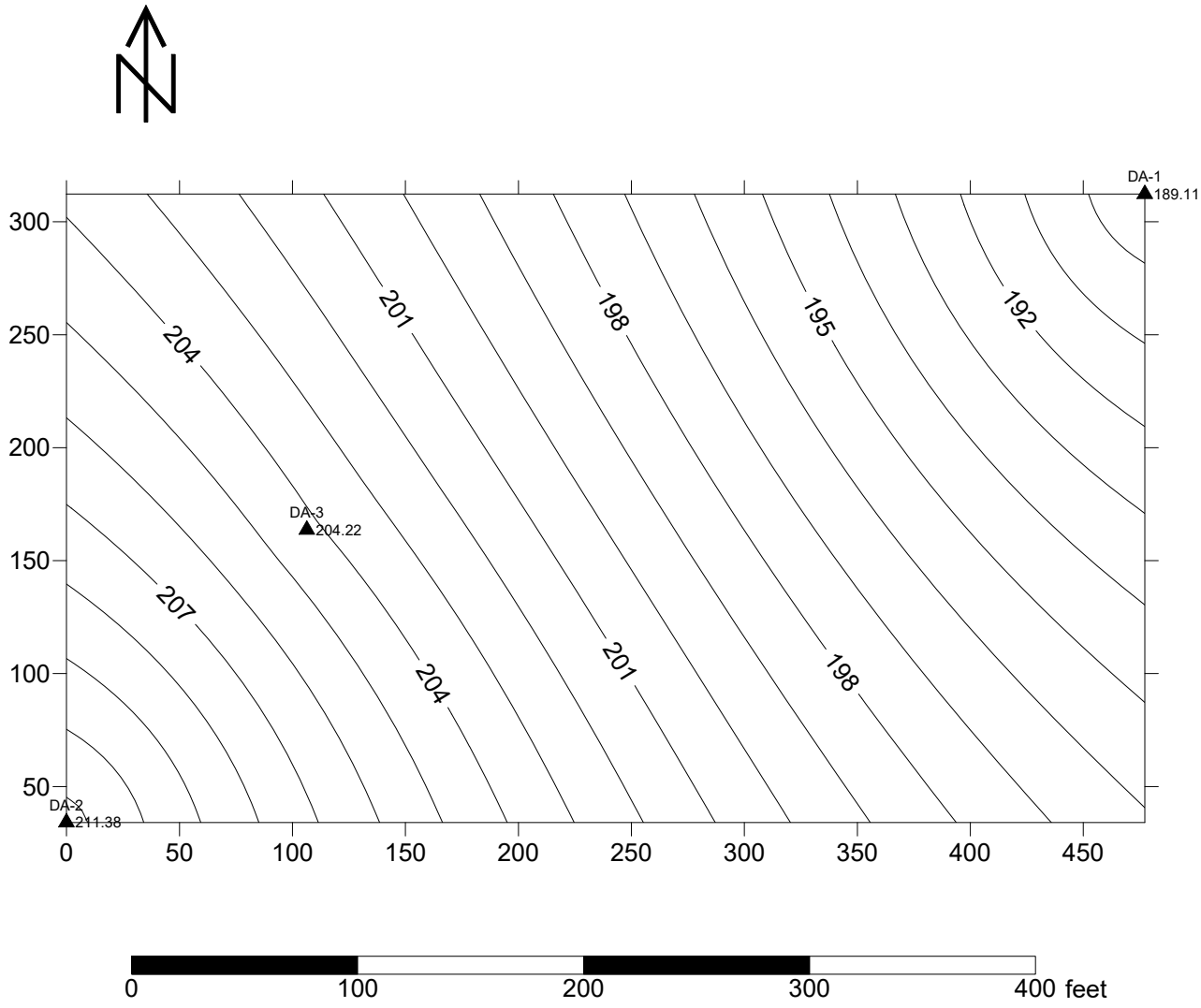

ROCKWOOD ROAD
S.B. Fnd.
S.B. Fnd.
S.B. Fnd.
3/2 o/s
EXISTING PATH TO RAIL STATION
MBTA COMMUTER RAIL LINE

Figure 6

Figure 7

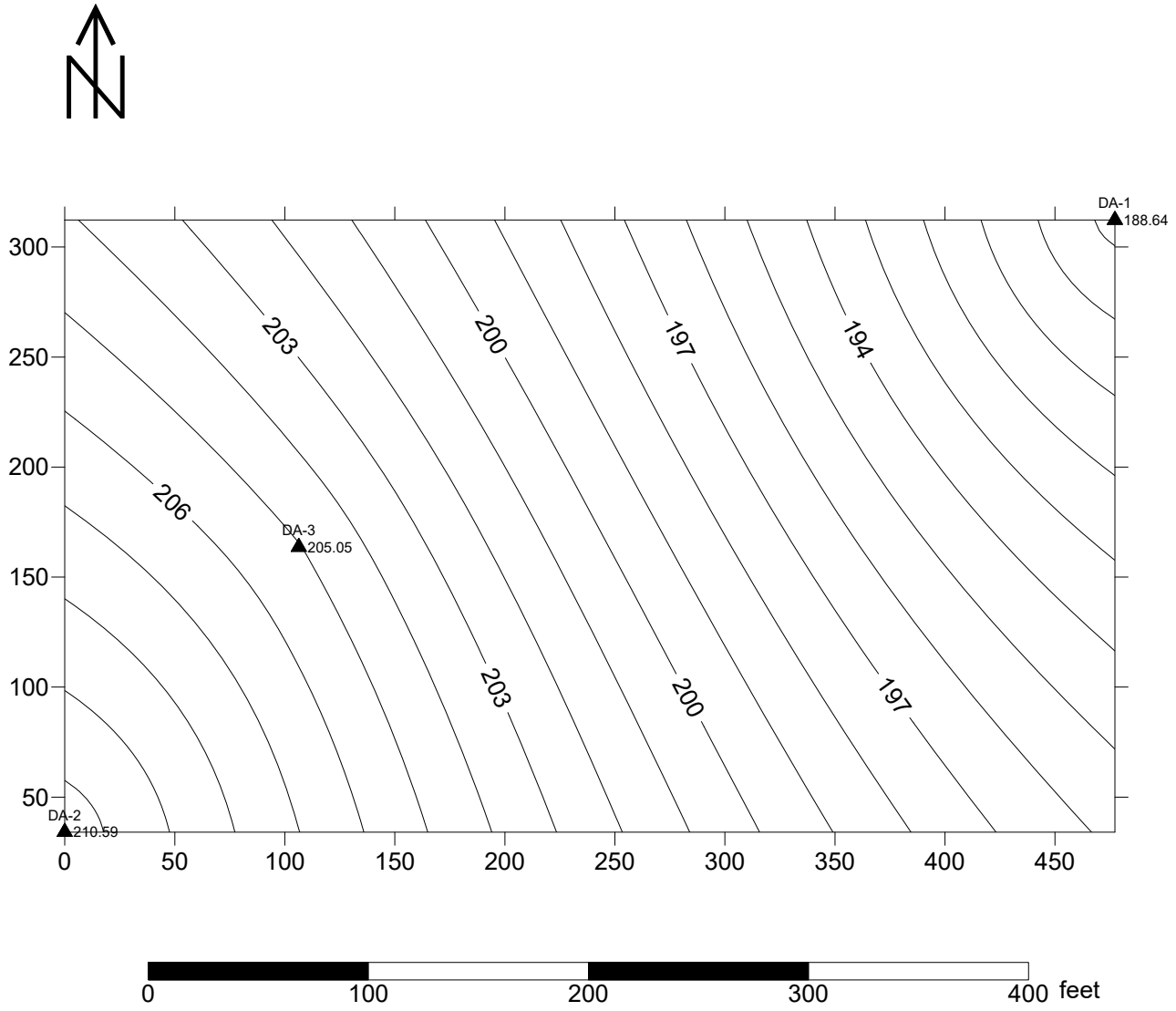
Water Table Map, April 11, 2017
25 Rockwood Road, Norfolk



Contour Interval: 1 foot

Figure 8

Water Table Map, May 10, 2017
25 Rockwood Road, Norfolk



Contour Interval: 1 foot

Tables

Table 1

Water Level Summary

25 Rockwood Lane, Norfolk

Monitoring Well	Rim Elev.	Ground Surface Elev.	Monitoring Well Depth below Ground Surface	Well Botom Elev.	Depth of Screened Interval			7/27/2016		4/11/17		4/24/17		5/10/17	
								Depth to Groundwater	Elev.	Depth to Groundwater	Elev.	Depth to Groundwater	Elev.	Depth to Groundwater	Elev.
DA-1	201.42	198.64	23	175.64	15	to	23	14	187.42	11.65	189.77	12.97	188.45	12.78	188.64
DA-2	230.53	227.03	17	210.03	12	to	17	Dry		19.15	211.38	19.79	210.74	19.94	210.59
DA-3	221.02	217.91	14.5	203.41	10.5	to	14.5	Dry		16.8	204.22	16.5	204.52	15.97	205.05

Note: All units are expressed in feet

Appendices

Appendix 1

NCRS Soil Report

United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Norfolk and Suffolk Counties, Massachusetts

July 24, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

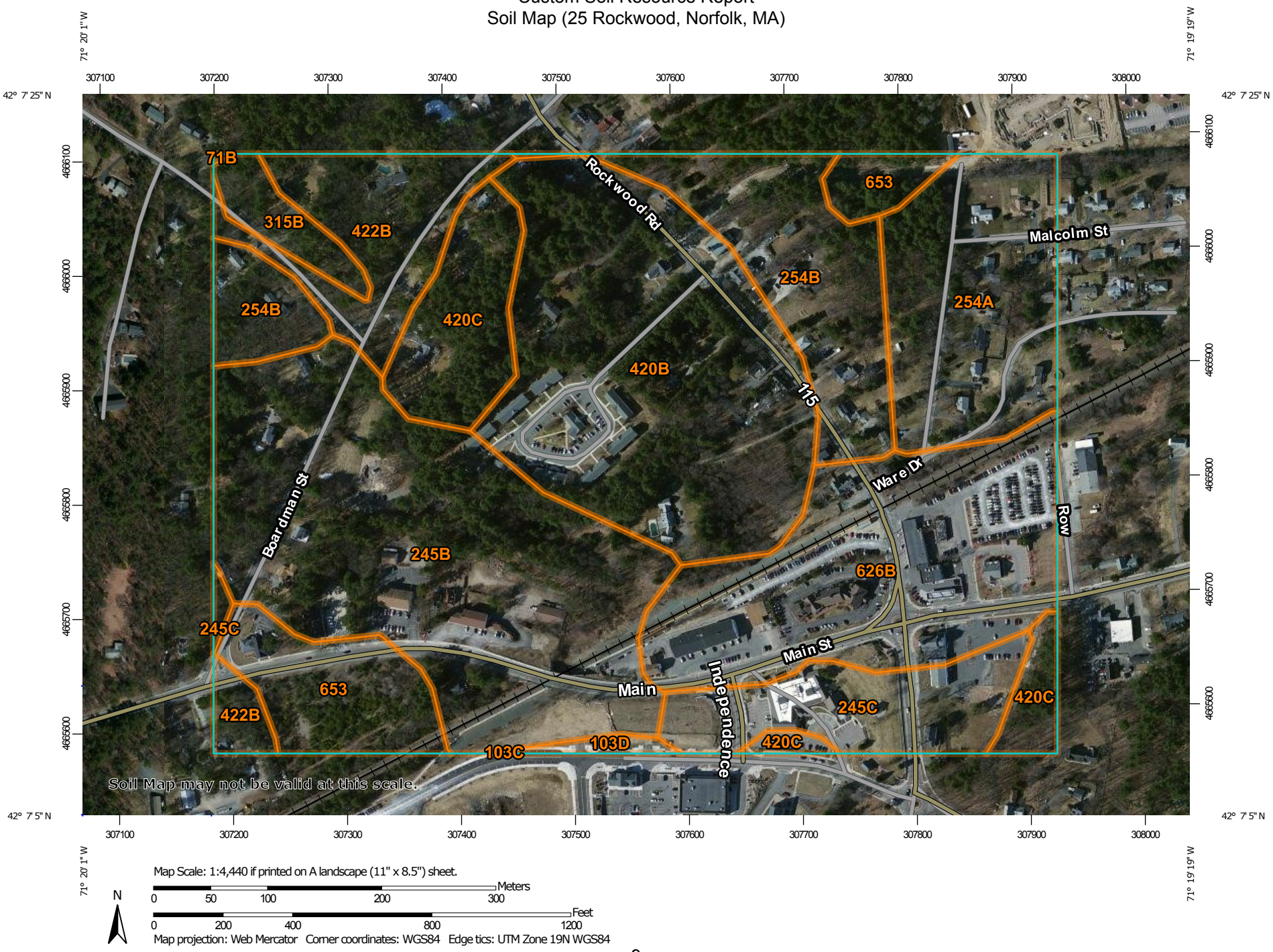
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (25 Rockwood, Norfolk, MA)



Map Scale: 1:4,440 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 12, Sep 15, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 30, 2011—Apr 9, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (25 Rockwood, Norfolk, MA)

Norfolk and Suffolk Counties, Massachusetts (MA616)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	0.0	0.0%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	0.0	0.0%
103D	Charlton-Hollis-Rock outcrop complex, 15 to 25 percent slopes	0.4	0.4%
245B	Hinckley loamy sand, 3 to 8 percent slopes	21.9	22.8%
245C	Hinckley loamy sand, 8 to 15 percent slopes	5.3	5.5%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	8.8	9.2%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	9.1	9.5%
315B	Scituate fine sandy loam, 3 to 8 percent slopes	1.6	1.6%
420B	Canton fine sandy loam, 3 to 8 percent slopes	18.3	19.1%
420C	Canton fine sandy loam, 8 to 15 percent slopes	5.5	5.8%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	6.1	6.3%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	13.8	14.3%
653	Udorthents, sandy	5.4	5.6%
Totals for Area of Interest		**96.3**	**100.0%**

Map Unit Descriptions (25 Rockwood, Norfolk, MA)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic

class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Norfolk and Suffolk Counties, Massachusetts

71B—Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w69c
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Ridgebury, extremely stony, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ridgebury, Extremely Stony

Setting

Landform: Depressions, drumlins, ground moraines, drainageways, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: fine sandy loam
Bw - 6 to 10 inches: sandy loam
Bg - 10 to 19 inches: gravelly sandy loam
Cd - 19 to 66 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

Woodbridge, extremely stony

Percent of map unit: 10 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Footslope, summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Whitman, extremely stony

Percent of map unit: 8 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton, extremely stony

Percent of map unit: 2 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Hydric soil rating: No

103C—Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2wzp1
Elevation: 0 to 1,390 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton, extremely stony, and similar soils: 50 percent
Hollis, extremely stony, and similar soils: 20 percent
Rock outcrop: 10 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton, Extremely Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope

Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Hollis, Extremely Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Ridges, hills
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Woodbridge, extremely stony

Percent of map unit: 8 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Chatfield, extremely stony

Percent of map unit: 5 percent
Landform: Ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Canton, extremely stony

Percent of map unit: 5 percent

Landform: Ridges, hills, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 2 percent
Landform: Depressions, drumlins, ground moraines, drainageways, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

103D—Charlton-Hollis-Rock outcrop complex, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: vktk
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 35 percent
Hollis and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable coarse-loamy ablation till derived from granite

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 36 inches: fine sandy loam
H3 - 36 to 60 inches: fine sandy loam

Properties and qualities

Slope: 15 to 25 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Hollis

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Shallow, friable loamy ablation till derived from igneous rock

Typical profile

H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 14 inches: gravelly fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Igneous and metamorphic rock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Canton

Percent of map unit: 8 percent
Hydric soil rating: No

Chatfield

Percent of map unit: 8 percent
Hydric soil rating: No

Montauk

Percent of map unit: 4 percent
Hydric soil rating: No

245B—Hinckley loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svm8
Elevation: 0 to 1,430 feet
Mean annual precipitation: 36 to 53 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Eskers, kames, kame terraces, outwash plains, outwash terraces, moraines, outwash deltas
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, tread, riser
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave

Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 8 percent
Landform: Eskers, kames, kame terraces, outwash plains, outwash terraces, moraines, outwash deltas
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, tread, riser
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Kame terraces, outwash plains, outwash terraces, moraines, outwash deltas
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope, head slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent

Landform: Eskers, kames, kame terraces, outwash plains, outwash terraces, moraines, outwash deltas
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, tread, riser
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

245C—Hinckley loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svm9
Elevation: 0 to 1,480 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Eskers, kames, kame terraces, outwash plains, outwash terraces, moraines, outwash deltas
Landform position (two-dimensional): Shoulder, toeslope, footslope, backslope
Landform position (three-dimensional): Crest, head slope, nose slope, side slope, riser
Down-slope shape: Convex, concave, linear
Across-slope shape: Concave, linear, convex
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Eskers, kames, kame terraces, outwash plains, outwash terraces, moraines, outwash deltas
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Convex, concave, linear
Across-slope shape: Concave, linear, convex
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Kame terraces, outwash plains, outwash terraces, moraines, outwash deltas
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Eskers, kames, outwash plains, outwash terraces, moraines
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, head slope, nose slope, crest, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

254A—Merrimac fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyqr
Elevation: 0 to 1,100 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Eskers, kames, outwash plains, outwash terraces, moraines
Landform position (two-dimensional): Backslope, footslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Sudbury
Percent of map unit: 5 percent
Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley
Percent of map unit: 5 percent
Landform: Deltas, eskers, kames, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Agawam
Percent of map unit: 3 percent
Landform: Eskers, kames, outwash plains, outwash terraces, moraines, stream terraces
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor
Percent of map unit: 2 percent
Landform: Deltas, dunes, outwash plains, outwash terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

254B—Merrimac fine sandy loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2tyqs
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Eskers, kames, outwash plains, outwash terraces, moraines
Landform position (two-dimensional): Backslope, footslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, eskers, kames, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Windsor

Percent of map unit: 3 percent
Landform: Deltas, dunes, outwash plains, outwash terraces
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Eskers, kames, outwash plains, outwash terraces, moraines, stream terraces
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

315B—Scituate fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: vky0
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Scituate and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scituate

Setting

Landform: Drumlins
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Concave

Parent material: Friable coarse-loamy eolian deposits over dense sandy lodgment till derived from granite and gneiss

Typical profile

H1 - 0 to 4 inches: fine sandy loam
H2 - 4 to 24 inches: sandy loam
H3 - 24 to 60 inches: loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 34 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Montauk

Percent of map unit: 5 percent
Hydric soil rating: No

Ridgebury

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Woodbridge

Percent of map unit: 5 percent
Hydric soil rating: No

420B—Canton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w81b
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Canton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Ridges, hills, moraines
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 10 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Footslope, backslope, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Montauk

Percent of map unit: 5 percent
Landform: Drumlins, ground moraines, hills, moraines
Landform position (two-dimensional): Backslope, shoulder, summit

Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Charlton

Percent of map unit: 4 percent
Landform: Ground moraines, ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 1 percent
Landform: Bogs, depressions, kettles, marshes, swamps
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

420C—Canton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w817
Elevation: 0 to 1,330 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Canton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Ridges, hills, moraines
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam

2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Montauk

Percent of map unit: 6 percent
Landform: Drumlins, ground moraines, hills, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Scituate

Percent of map unit: 6 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Newfields

Percent of map unit: 4 percent
Landform: Ground moraines, hills, moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Charlton

Percent of map unit: 4 percent
Landform: Ground moraines, ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex

Hydric soil rating: No

422B—Canton fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w818
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Canton, extremely stony, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton, Extremely Stony

Setting

Landform: Ridges, hills, moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
Bw1 - 5 to 16 inches: fine sandy loam
Bw2 - 16 to 22 inches: gravelly fine sandy loam
2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Scituate, extremely stony

Percent of map unit: 6 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Footslope, backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Charlton, extremely stony

Percent of map unit: 6 percent
Landform: Ground moraines, ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Montauk, extremely stony

Percent of map unit: 4 percent
Landform: Drumlins, ground moraines, recessionial moraines, hills
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 4 percent
Landform: Bogs, depressions, kettles, marshes, swamps
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days

Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Eskers, kames, outwash plains, outwash terraces, moraines
Landform position (two-dimensional): Backslope, footslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Urban Land

Typical profile

H - 0 to 6 inches: material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, eskers, kames, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, crest, head slope, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Deltas, dunes, outwash plains, outwash terraces
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

653—Udorthents, sandy

Map Unit Setting

National map unit symbol: vky8
Elevation: 0 to 3,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Riser, tread

Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Excavated and filled sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Urban land

Percent of map unit: 5 percent
Hydric soil rating: Unranked

Swansea

Percent of map unit: 2 percent
Landform: Bogs
Hydric soil rating: Yes

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Appendix 2

Boring Logs/Monitoring Well Construction Details

Log of Borehole: DA-1

Project: 25 Rockwood Street

Client:

Location: Norfolk, MA

Geologist/Engineer: Jim O'Brien

SUBSURFACE PROFILE				SAMPLE			Volatile Organic Concentration (ppm, 600 / 1200 / 1800)	Well Data	Remarks
Depth (ft / m)	Symbol	Description	Elev.	Number	N-Value	Recovery			
0		Ground Surface	0						
		Topsoil Topsoil	-0.6						
		Subsoil Orange brown fine SAND, litle silt	-1.2						Protective casing installed; Concrete seal
		Glacial Outwash Gray to brown fine SAND, trace silt		S-1	NA				
		Glacial Till Gray coarse to fine SAND, trace medium to fine gravel, trace silt	-5						Formation backfill
		Glacial Till Gray to brown coarse to fine SAND, trace medium to fine gravel, trace silt w/ gravel layers	-10	S-2	NA				
		Glacial Till Gray coarse to fine SAND, little medium to fine gravel, trace silt	-15	S-3	NA				Bentonite; Filter sand

Drill Method: Direct Push

D'Amore Associates

Datum: NA

Drill Date: 17 June 2016

Driller: Soil Tech

Borehole Size: 3-inch

Sheet: 1 of 2

Log of Borehole: DA-1

Project: 25 Rockwood Street

Client:

Location: Norfolk, MA

Geologist/Engineer: Jim O'Brien

SUBSURFACE PROFILE				SAMPLE			Volatile Organic Concentration (ppm)	Well Data	Remarks
Depth	Symbol	Description	Elev.	Number	N-Value	Recovery	600 1200 1800		
16									
5									
17									
				S-4	NA				
18									2-inch diameter well
		Glacial Till Gray medium to fine GRAVEL, trace coarse to fine sand, trace silt							
19									
6									
20									Filter sand
21									
				S-5	NA				
22									
23			-23						
7		End of Borehole							
24									
25									
26									
8									
27									
28									
29									
9									
30									

Drill Method: Direct Push

D'Amore Associates

Datum: NA

Drill Date: 17 June 2016

Driller: Soil Tech

Borehole Size: 3-inch

Sheet: 2 of 2

Log of Borehole: DA-2

Project: 25 Rockwood Street

Client:

Location: Norfolk, MA

Geologist/Engineer: Jim O'Brien

SUBSURFACE PROFILE				SAMPLE			Volatile Organic Concentration	Well Data	Remarks
Depth (ft / m)	Symbol	Description	Elev.	Number	N-Value	Recovery	ppm 600 1200 1800		
0 / 0		Ground Surface	0						
		Forest Material Forest Material							
1									Protective casing installed
2									Concrete seal
3 / 1									
4									
5									Formation backfill
6									
7 / 2		***Glacial Till*** Glacial Till Boulder Till-advance borehole with ODEX (Air Rotary) Nests of boulders 3-4 feet thick Boulder @ 3-5 feet Boulder @ 8-11 feet Boulder @ 12-16-feet							
8									Bentonite
9									
10 / 3									
11									
12									
13 / 4									Filter sand
14									2 inch diameter well
15									

Drill Method: Air Rotary

D'Amore Associates

Datum: NA

Drill Date: 20 July 2016

Driller: NHTest Boring

Borehole Size: 3-inch

Sheet: 1 of 3

Log of Borehole: DA-2

Project: 25 Rockwood Street

Client:

Location: Norfolk, MA

Geologist/Engineer: Jim O'Brien

SUBSURFACE PROFILE				SAMPLE			Volatile Organic Concentration (ppm) 600 1200 1800	Well Data	Remarks
Depth	Symbol	Description	Elev.	Number	N-Value	Recovery			
16, 17 (5)			-17						Filter sand
18, 19, 20, 21, 22, 23 (6, 7)		***Bedrock*** Bedrock Adance into bedrock with ODEX (Air Roraty)	-24						Bedrock backfilled with bentonite and concrete
24, 25, 26, 27, 28, 29, 30 (8, 9)		***Bedrock*** Bedrock Advance into bedrock with conventional Air Rotary	-30						

Drill Method: Air Rotary

D'Amore Associates

Datum: NA

Drill Date: 20 July 2016

Driller: NHTest Boring

Borehole Size: 3-inch

Sheet: 2 of 3

Log of Borehole: DA-2

Project: 25 Rockwood Street

Client:

Location: Norfolk, MA

Geologist/Engineer: Jim O'Brien

SUBSURFACE PROFILE				SAMPLE			Volatile Organic Concentration ppm (600, 1200, 1800)	Well Data	Remarks
Depth	Symbol	Description	Elev.	Number	N-Value	Recovery			
31									
32		***Bedrock*** Advance into bedrock with conventional Air Rotary							
33 (10)									
34									
35			-35						
		End of Borehole							
36 (11)									
37									
38									
39 (12)									
40									
41									
42									
43 (13)									
44									
45									

Drill Method: Air Rotary

D'Amore Associates

Datum: NA

Drill Date: 20 July 2016

Driller: NHTest Boring

Borehole Size: 3-inch

Sheet: 3 of 3

Log of Borehole: DA-3

Project: 25 Rockwood Street

Client:

Location: Norfolk, Ma

Geologist/Engineer: Jim O'Brien

SUBSURFACE PROFILE				SAMPLE			Volatile Organic Concentration	Well Data	Remarks
Depth (ft / m)	Symbol	Description	Elev.	Number	N-Value	Recovery	ppm 600 1200 1800		
0 / 0		Ground Surface	0						
		Forest Material Forest Material							
1									Protective casing installed
2									Concrete seal
3 / 1									
4									
5									Formation backfill
6									
7 / 2		***Glacial Till*** Glacial Till Advance borehole into bouilder till with ODEX (Air Rotary) Cobbles and Bouilders < 1-foot diameter Boulder @ 7-9.5 feet							Bentonite
8									
9									
10 / 3									
11									
12									Filter sand
13 / 4									2-inch diameter well
14			-14.5						
15									

Drill Method: Air Rotary

D'Amore Associates

Datum: NA

Drill Date: 21 July 2016

Driller: NH Test Boring

Borehole Size: 3-inch

Sheet: 1 of 2

Log of Borehole: DA-3

Project: 25 Rockwood Street

Client:

Location: Norfolk, Ma

Geologist/Engineer: Jim O'Brien

SUBSURFACE PROFILE				SAMPLE			Volatile Organic Concentration (ppm) 600 1200 1800	Well Data	Remarks
Depth	Symbol	Description	Elev.	Number	N-Value	Recovery			
16									
5									
17		***Bedrock*** Bedrock Advance into bedrock with ODEX (Air Rotary)							
18									
19			-19.5						
6									
20									
21									
22									
23									Bedrock backfilled with bentonite and concrete
7									
24		***Bedrock*** Advance into bedrock with conventional Air Roraty							
25									
26									
8									
27									
28									
29			-29						
		End of Borehole							
9									
30									

Drill Method: Air Rotary

D'Amore Associates

Datum: NA

Drill Date: 21 July 2016

Driller: NH Test Boring

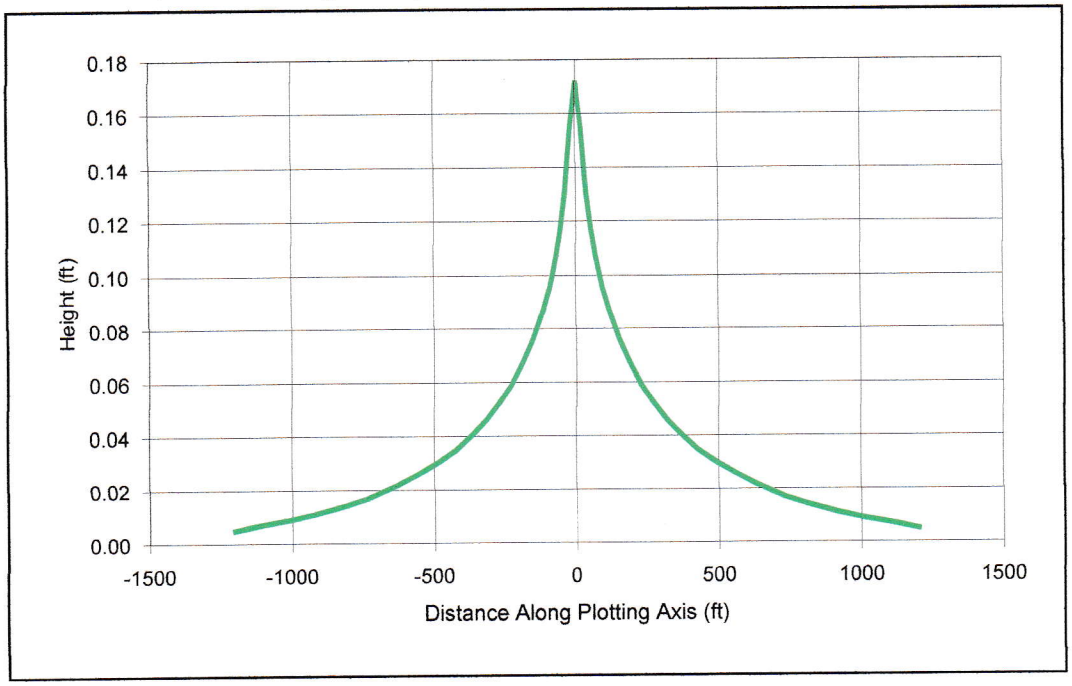
Borehole Size: 3-inch

Sheet: 2 of 2

Appendix 3

Leach Field Mounding Graphs

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: DDA

PROJECT: 25 Rockwood SAS-1

ANALYST: DDA

DATE: 7/26/2017 TIME: 2:21:34 PM

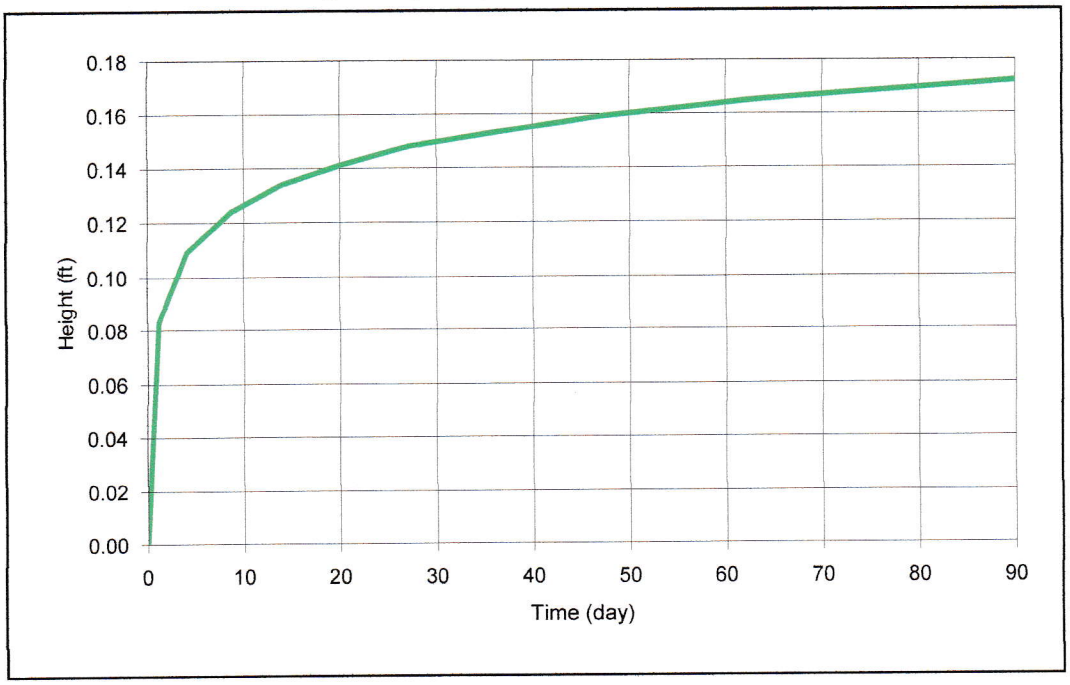
INPUT PARAMETERS

Application rate: 0.1038 c.ft/day/sq. ft
Duration of application: 90 days
Fillable porosity: 0.15
Hydraulic conductivity: 32.7 ft/day
Initial saturated thickness: 20.8 ft
Length of application area: 50 ft
Width of application area: 34 ft
No constant head boundary used
Plotting axis from Y-Axis: 89 degrees
Edge of recharge area:
positive X: 17 ft
positive Y: 0.3 ft
Total volume applied: 15881.4 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-1199.8	-20.9	-1200	0
-1009	-17.6	-1009	0.01
-818.2	-14.3	-818	0.01
-627.4	-11	-627	0.02
-477.4	-8.3	-477	0.03
-361.1	-6.3	-361	0.04
-266.1	-4.6	-266	0.05
-185.9	-3.2	-186	0.07
-116.3	-2	-116	0.09
-69.6	-1.2	-70	0.11
-37.8	-0.7	-38	0.13
0	0	0	0.17
37.8	0.7	38	0.13
69.6	1.2	70	0.11
116.3	2	116	0.09
185.9	3.2	186	0.07
266.1	4.6	266	0.05
361.1	6.3	361	0.04
477.4	8.3	477	0.03
627.4	11	627	0.02
818.2	14.3	818	0.01
1009	17.6	1009	0.01
1199.8	20.9	1200	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: DDA

PROJECT: 25 Rockwood SAS-1

ANALYST: DDA

DATE: 7/26/2017 TIME: 2:21:47 PM

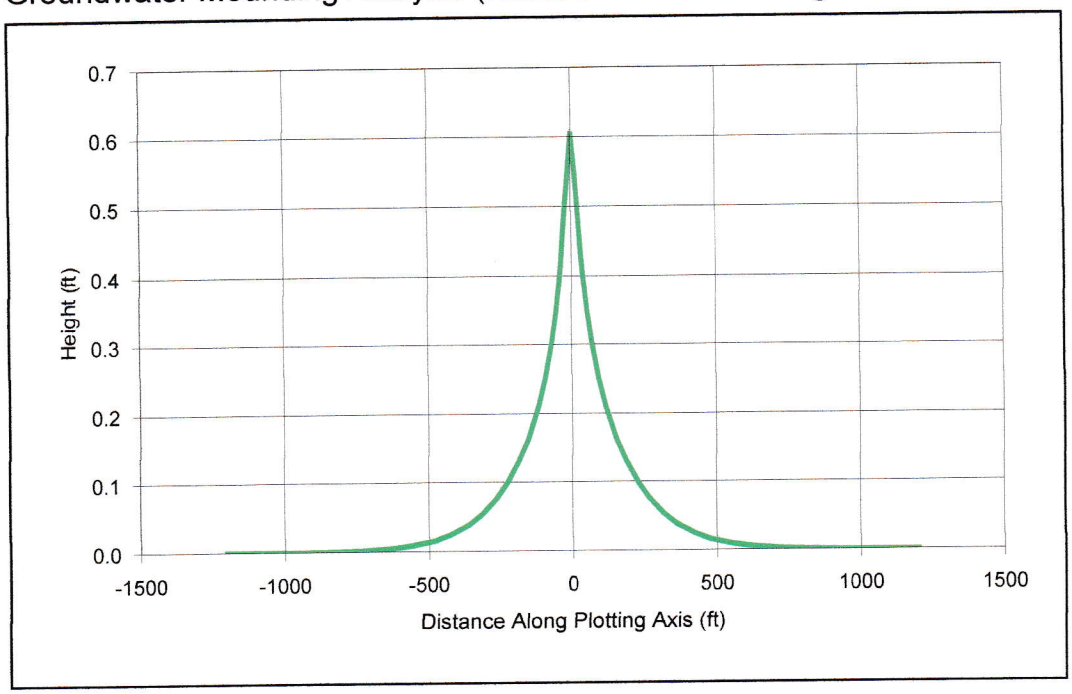
INPUT PARAMETERS

Application rate: 0.1038 c.ft/day/sq. ft
Duration of application: 90 day
Total simulation time: 90 day
Fillable porosity: 0.15
Hydraulic conductivity: 32.7 ft/day
Initial saturated thickness: 20.8 ft
Length of application area: 50 ft
Width of application area: 34 ft
No constant head boundary used
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 15881.4 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
1	0.08
4	0.11
9	0.12
14	0.13
20	0.14
27	0.15
36	0.15
47	0.16
63	0.16
90	0.17

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: DDA

PROJECT: 25 Rockwood SAS-2

ANALYST: DDA

DATE: 7/26/2017 TIME: 2:22:43 PM

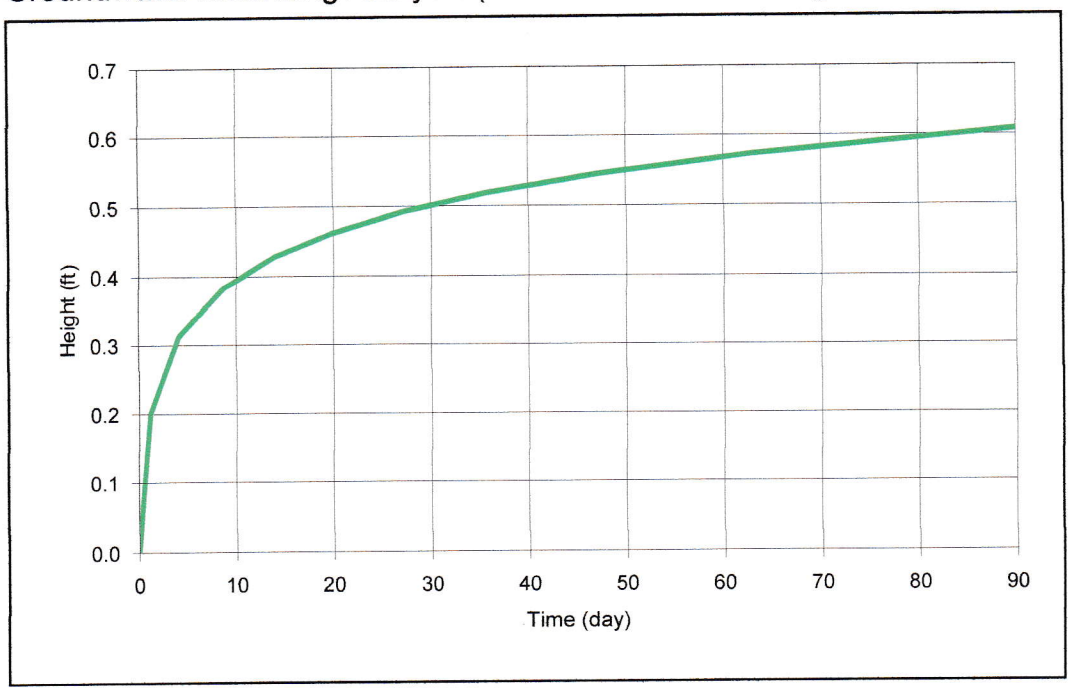
INPUT PARAMETERS

Application rate: 0.0683 c.ft/day/sq. ft
Duration of application: 90 days
Fillable porosity: 0.15
Hydraulic conductivity: 5.03 ft/day
Initial saturated thickness: 16.8 ft
Length of application area: 58 ft
Width of application area: 26 ft
No constant head boundary used
Plotting axis from Y-Axis: 89 degrees
Edge of recharge area:
positive X: 13 ft
positive Y: 0.2 ft
Total volume applied: 9269.676 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-1199.8	-20.9	-1200	0
-1009	-17.6	-1009	0
-818.2	-14.3	-818	0
-627.4	-11	-627	0
-477.4	-8.3	-477	0.02
-361.1	-6.3	-361	0.04
-266.1	-4.6	-266	0.08
-185.9	-3.2	-186	0.13
-116.3	-2	-116	0.21
-69.6	-1.2	-70	0.3
-37.8	-0.7	-38	0.41
0	0	0	0.61
37.8	0.7	38	0.41
69.6	1.2	70	0.3
116.3	2	116	0.21
185.9	3.2	186	0.13
266.1	4.6	266	0.08
361.1	6.3	361	0.04
477.4	8.3	477	0.02
627.4	11	627	0
818.2	14.3	818	0
1009	17.6	1009	0
1199.8	20.9	1200	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: DDA

PROJECT: 25 Rockwood SAS-2

ANALYST: DDA

DATE: 7/26/2017 TIME: 2:22:55 PM

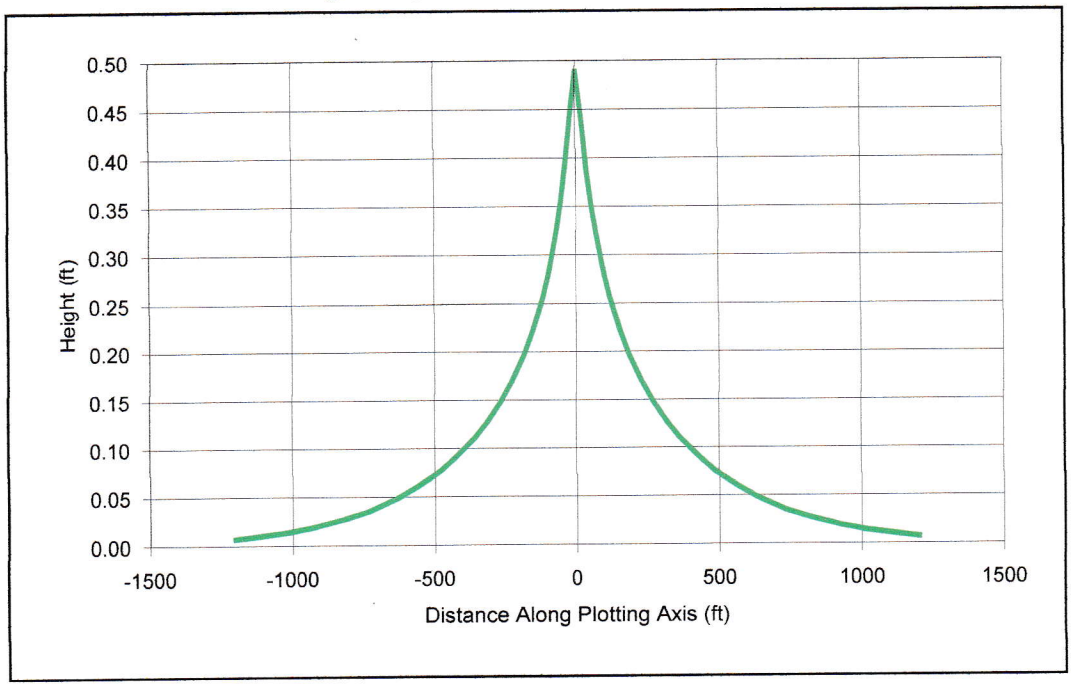
INPUT PARAMETERS

Application rate: 0.0683 c.ft/day/sq. ft
Duration of application: 90 day
Total simulation time: 90 day
Fillable porosity: 0.15
Hydraulic conductivity: 5.03 ft/day
Initial saturated thickness: 16.8 ft
Length of application area: 58 ft
Width of application area: 26 ft
No constant head boundary used
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 9269.676 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
1	0.2
4	0.31
9	0.38
14	0.43
20	0.46
27	0.49
36	0.52
47	0.55
63	0.57
90	0.61

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: DDA

PROJECT: 25 Rockwood SAS-3

ANALYST: DDA

DATE: 7/26/2017 TIME: 2:23:57 PM

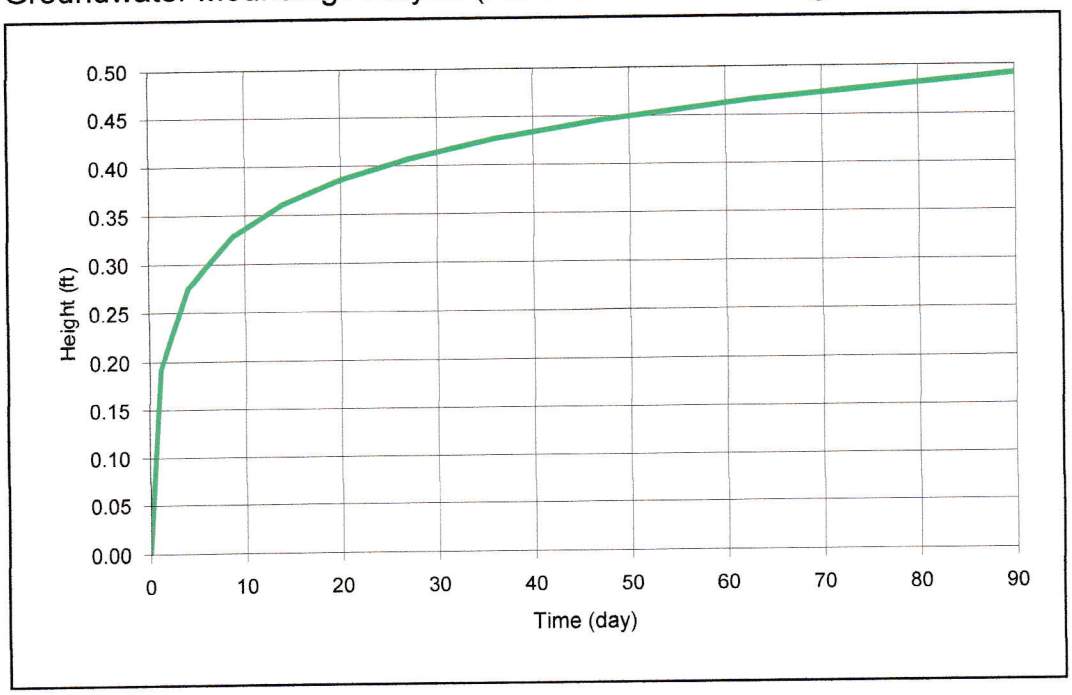
INPUT PARAMETERS

Application rate: 0.1428 c.ft/day/sq. ft
Duration of application: 90 days
Fillable porosity: 0.15
Hydraulic conductivity: 28.1 ft/day
Initial saturated thickness: 14.8 ft
Length of application area: 103 ft
Width of application area: 25 ft
No constant head boundary used
Plotting axis from Y-Axis: 89 degrees
Edge of recharge area:
positive X: 12.5 ft
positive Y: 0.2 ft
Total volume applied: 33093.9 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-1199.8	-20.9	-1200	0.01
-1009	-17.6	-1009	0.01
-818.2	-14.3	-818	0.03
-627.4	-11	-627	0.05
-477.4	-8.3	-477	0.08
-361.1	-6.3	-361	0.11
-266.1	-4.6	-266	0.15
-185.9	-3.2	-186	0.2
-116.3	-2	-116	0.26
-69.6	-1.2	-70	0.32
-37.8	-0.7	-38	0.39
0	0	0	0.49
37.8	0.7	38	0.39
69.6	1.2	70	0.32
116.3	2	116	0.26
185.9	3.2	186	0.2
266.1	4.6	266	0.15
361.1	6.3	361	0.11
477.4	8.3	477	0.08
627.4	11	627	0.05
818.2	14.3	818	0.03
1009	17.6	1009	0.01
1199.8	20.9	1200	0.01

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: DDA

PROJECT: 25 Rockwood SAS-3

ANALYST: DDA

DATE: 7/26/2017 TIME: 2:24:08 PM

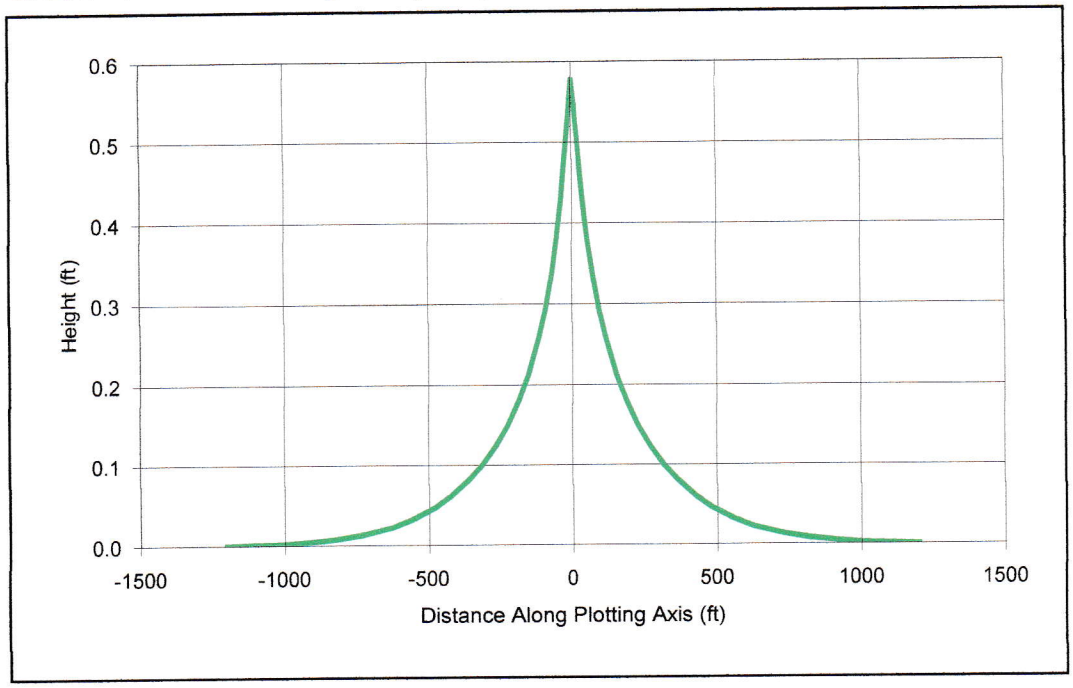
INPUT PARAMETERS

Application rate: 0.1428 c.ft/day/sq. ft
Duration of application: 90 day
Total simulation time: 90 day
Fillable porosity: 0.15
Hydraulic conductivity: 28.1 ft/day
Initial saturated thickness: 14.8 ft
Length of application area: 103 ft
Width of application area: 25 ft
No constant head boundary used
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 33093.9 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
1	0.19
4	0.28
9	0.33
14	0.36
20	0.39
27	0.41
36	0.43
47	0.45
63	0.47
90	0.49

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: DDA

PROJECT: 25 Rockwood SAS-4

ANALYST: DDA

DATE: 7/26/2017 TIME: 2:25:05 PM

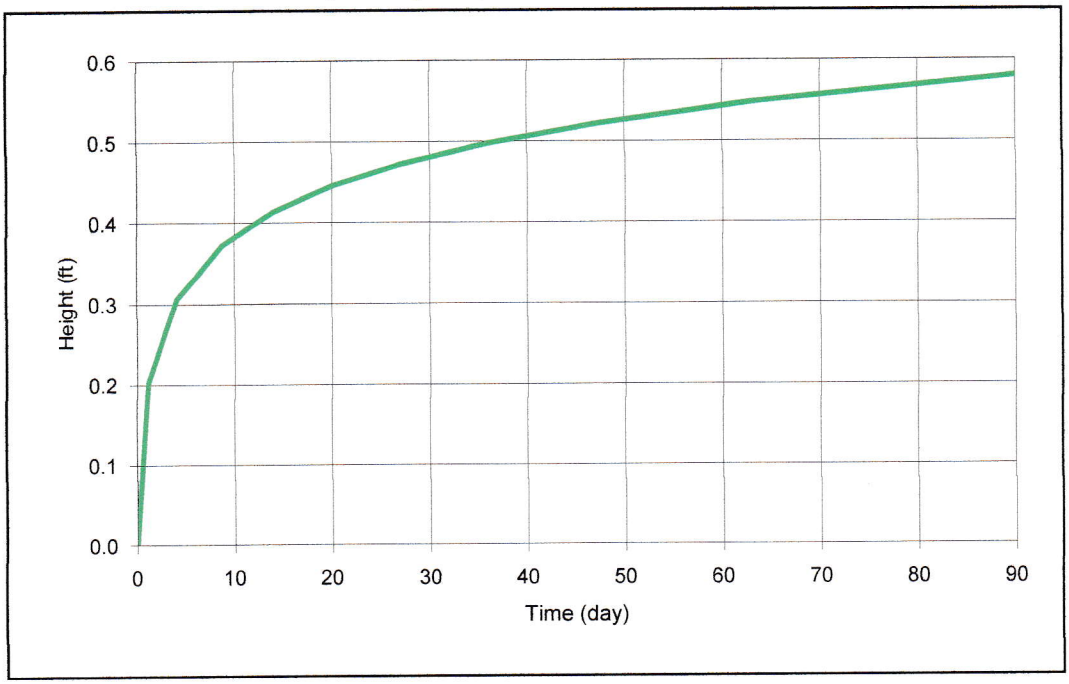
INPUT PARAMETERS

Application rate: 0.1316 c.ft/day/sq. ft
Duration of application: 90 days
Fillable porosity: 0.15
Hydraulic conductivity: 14.9 ft/day
Initial saturated thickness: 12.3 ft
Length of application area: 92 ft
Width of application area: 17 ft
No constant head boundary used
Plotting axis from Y-Axis: 89 degrees
Edge of recharge area:
positive X: 8.5 ft
positive Y: 0.1 ft
Total volume applied: 18524.02 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-1199.8	-20.9	-1200	0
-1009	-17.6	-1009	0
-818.2	-14.3	-818	0.01
-627.4	-11	-627	0.02
-477.4	-8.3	-477	0.05
-361.1	-6.3	-361	0.08
-266.1	-4.6	-266	0.12
-185.9	-3.2	-186	0.18
-116.3	-2	-116	0.26
-69.6	-1.2	-70	0.34
-37.8	-0.7	-38	0.43
0	0	0	0.58
37.8	0.7	38	0.43
69.6	1.2	70	0.34
116.3	2	116	0.26
185.9	3.2	186	0.18
266.1	4.6	266	0.12
361.1	6.3	361	0.08
477.4	8.3	477	0.05
627.4	11	627	0.02
818.2	14.3	818	0.01
1009	17.6	1009	0
1199.8	20.9	1200	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: DDA

PROJECT: 25 Rockwood SAS-4

ANALYST: DDA

DATE: 7/26/2017 TIME: 2:25:16 PM

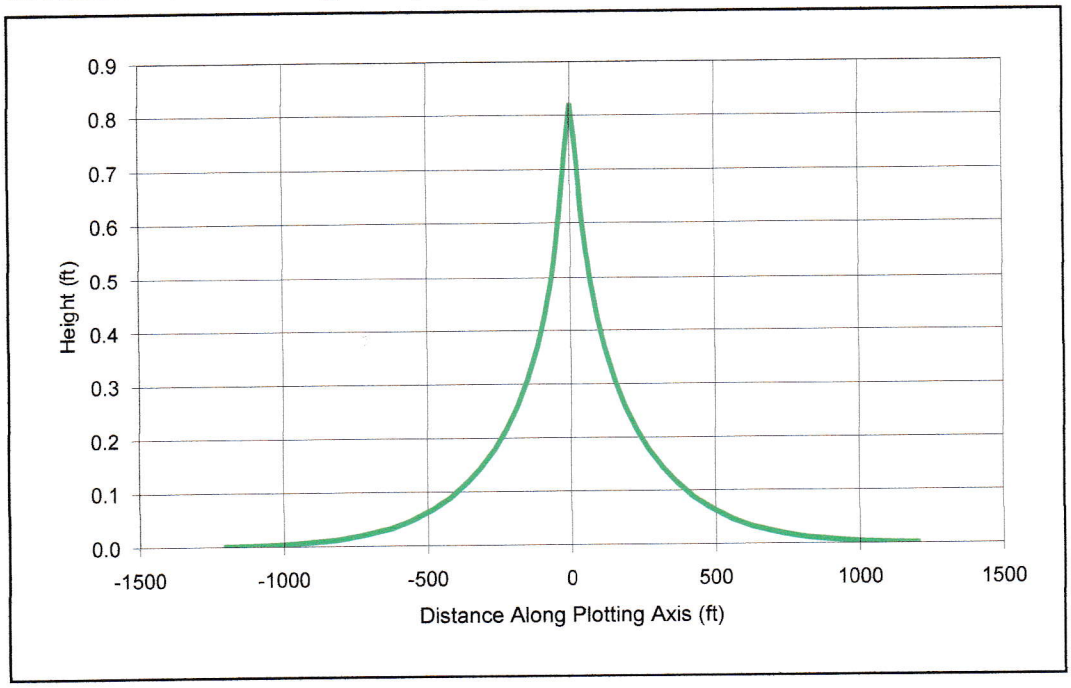
INPUT PARAMETERS

Application rate: 0.1316 c.ft/day/sq. ft
Duration of application: 90 day
Total simulation time: 90 day
Fillable porosity: 0.15
Hydraulic conductivity: 14.9 ft/day
Initial saturated thickness: 12.3 ft
Length of application area: 92 ft
Width of application area: 17 ft
No constant head boundary used
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 18524.02 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
1	0.2
4	0.31
9	0.37
14	0.41
20	0.44
27	0.47
36	0.5
47	0.52
63	0.55
90	0.58

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: DDA

PROJECT: 25 Rockwood SAS-5

ANALYST: DDA

DATE: 7/26/2017 TIME: 2:26:10 PM

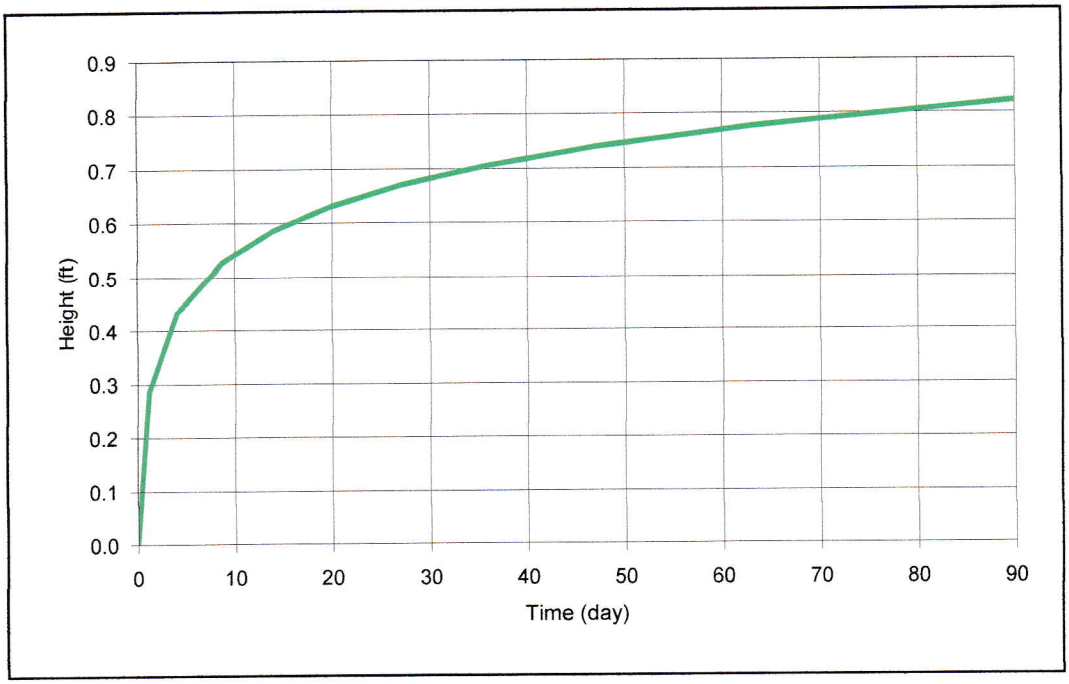
INPUT PARAMETERS

Application rate: 0.1243 c.ft/day/sq. ft
Duration of application: 90 days
Fillable porosity: 0.15
Hydraulic conductivity: 15.26 ft/day
Initial saturated thickness: 12.3 ft
Length of application area: 83 ft
Width of application area: 29 ft
No constant head boundary used
Plotting axis from Y-Axis: 89 degrees
Edge of recharge area:
positive X: 14.5 ft
positive Y: 0.3 ft
Total volume applied: 26927.11 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-1199.8	-20.9	-1200	0
-1009	-17.6	-1009	0
-818.2	-14.3	-818	0.01
-627.4	-11	-627	0.03
-477.4	-8.3	-477	0.07
-361.1	-6.3	-361	0.12
-266.1	-4.6	-266	0.18
-185.9	-3.2	-186	0.26
-116.3	-2	-116	0.37
-69.6	-1.2	-70	0.49
-37.8	-0.7	-38	0.62
0	0	0	0.82
37.8	0.7	38	0.62
69.6	1.2	70	0.49
116.3	2	116	0.37
185.9	3.2	186	0.26
266.1	4.6	266	0.18
361.1	6.3	361	0.12
477.4	8.3	477	0.07
627.4	11	627	0.03
818.2	14.3	818	0.01
1009	17.6	1009	0
1199.8	20.9	1200	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: DDA

PROJECT: 25 Rockwood SAS-5

ANALYST: DDA

DATE: 7/26/2017 TIME: 2:26:20 PM

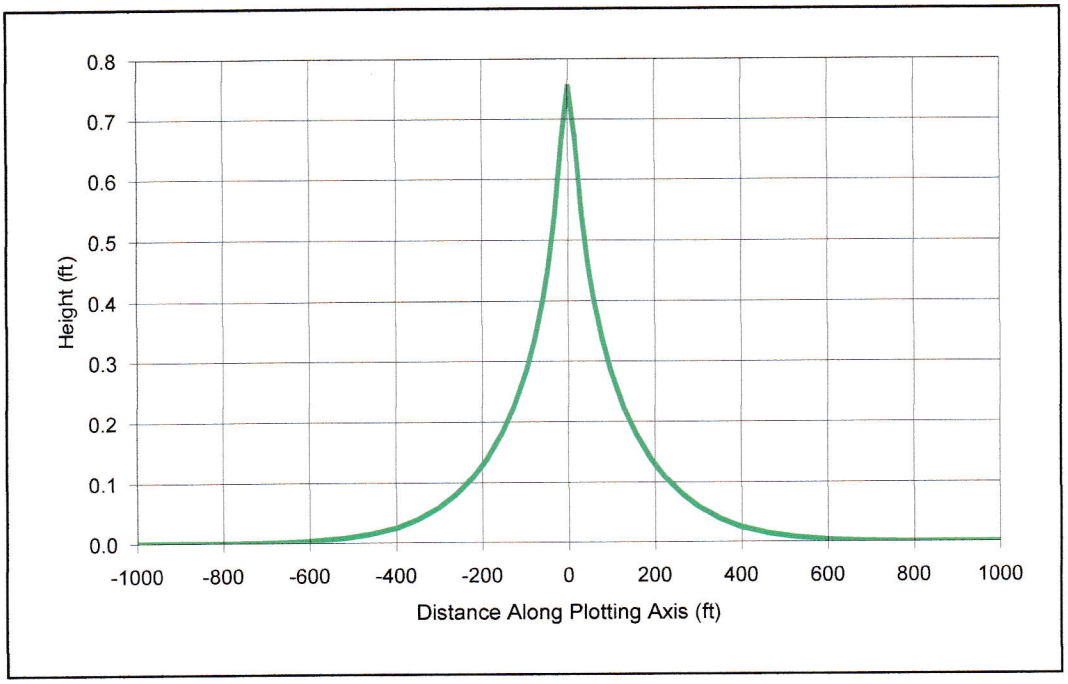
INPUT PARAMETERS

Application rate: 0.1243 c.ft/day/sq. ft
Duration of application: 90 day
Total simulation time: 90 day
Fillable porosity: 0.15
Hydraulic conductivity: 15.26 ft/day
Initial saturated thickness: 12.3 ft
Length of application area: 83 ft
Width of application area: 29 ft
No constant head boundary used
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 26927.11 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
1	0.29
4	0.43
9	0.53
14	0.59
20	0.63
27	0.67
36	0.7
47	0.74
63	0.78
90	0.82

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: DDA

PROJECT: 25 Rockwood SAS-6

ANALYST: DDA

DATE: 8/10/2017 TIME: 5:12:10 PM

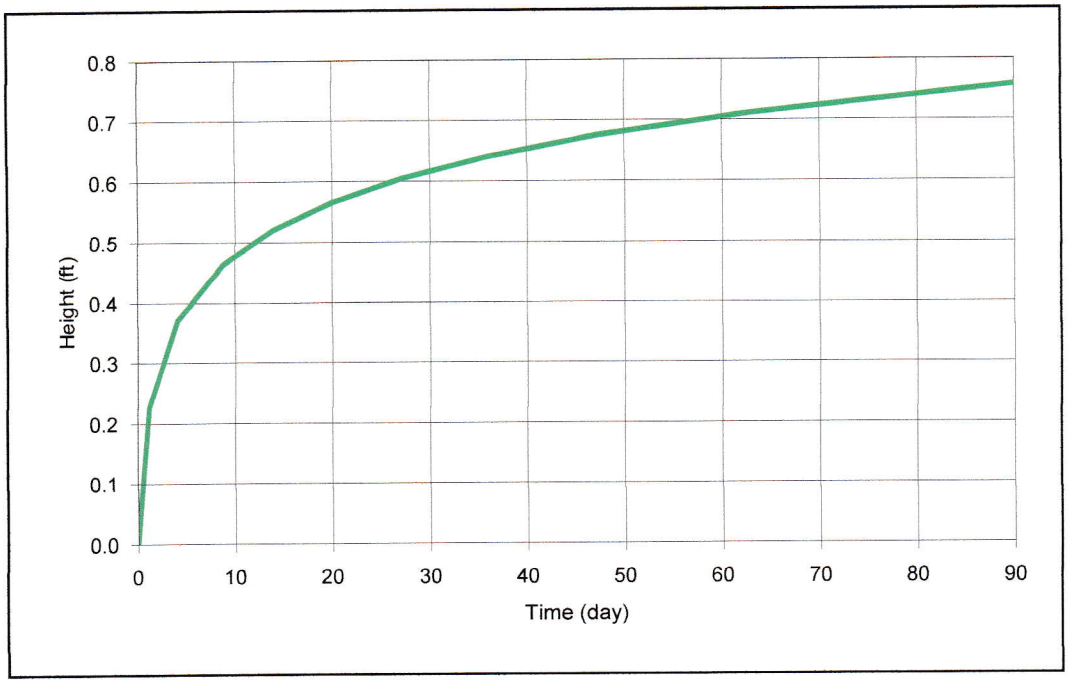
INPUT PARAMETERS

Application rate: 0.066 c.ft/day/sq. ft
Duration of application: 90 days
Fillable porosity: 0.15
Hydraulic conductivity: 4.35 ft/day
Initial saturated thickness: 14.8 ft
Length of application area: 60 ft
Width of application area: 26 ft
No constant head boundary used
Plotting axis from Y-Axis: 89 degrees
Edge of recharge area:
positive X: 13 ft
positive Y: 0.2 ft
Total volume applied: 9266.4 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-999.8	-17.5	-1000	0
-840.9	-14.7	-841	0
-681.8	-11.9	-682	0
-522.8	-9.1	-523	0.01
-397.8	-6.9	-398	0.02
-301	-5.3	-301	0.06
-221.8	-3.9	-222	0.11
-154.9	-2.7	-155	0.18
-96.9	-1.7	-97	0.29
-58	-1	-58	0.41
-31.5	-0.5	-32	0.54
0	0	0	0.76
31.5	0.5	32	0.54
58	1	58	0.41
96.9	1.7	97	0.29
154.9	2.7	155	0.18
221.8	3.9	222	0.11
301	5.3	301	0.06
397.8	6.9	398	0.02
522.8	9.1	523	0.01
681.8	11.9	682	0
840.9	14.7	841	0
999.8	17.5	1000	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: DDA

PROJECT: 25 Rockwood SAS-6

ANALYST: DDA

DATE: 8/10/2017 TIME: 5:12:30 PM

INPUT PARAMETERS

Application rate: 0.066 c.ft/day/sq. ft
Duration of application: 90 day
Total simulation time: 90 day
Fillable porosity: 0.15
Hydraulic conductivity: 4.35 ft/day
Initial saturated thickness: 14.8 ft
Length of application area: 60 ft
Width of application area: 26 ft
No constant head boundary used
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 9266.4 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
1	0.23
4	0.37
9	0.46
14	0.52
20	0.57
27	0.6
36	0.64
47	0.68
63	0.71
90	0.76