Report on Water Level Monitoring in the Vicinity of the Brookhaven Landfill, 2014

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Abstract

Water level measurements were made four times in the fall 2014 in the vicinity of the Town of Brookhaven landfill (Brookhaven hamlet, Long Island, New York) to re-establish a long-standing comprehensive monitoring program. Water table maps constructed from these data indicated that flow in the Upper Glacial aquifer was consistently from northwest to southeast. Water levels were lower than is often seen. Flows in the Upper Glacial aquifer appear to increase in velocity close to Beaverdam Creek, and slow between the salt water reaches of Beaverdam Creek and Carmans River. This suggests that most discharge from the Upper Glacial aquifer is to the fresh portions of Beaverdam Creek, Little Neck Run, and Yaphank Creek, along with portions of tidal Beaverdam Creek north of Beaverdam Road, and tidal Carmans River north of Squassux Landing. Some variability was found in the overall patterns of water table elevations across the four months of sampling, but most of the differences were minor, driven by differences in response to rainfall from northwest to southeast. Differences were found in the head in the Upper Glacial aquifer and the underlying Magothy aquifer and confining layer. These data suggest the landfill area is a transition zone from the potential for recharge to the two deeper aquifers in the areas north of the landfill and potential for discharge from the Magothy aquifer into the Upper Glacial aquifer south of the landfill.

Introduction

Environmental monitoring, generally, is an activity most noted in its absence than its occurrence. When unusual events happen, it is often an important element of understanding the events by determining differences from typical conditions. So when there was a mass mortality of lobsters in the mid-1980s in Long Island Sound, managers were perturbed to find there was no baseline record for water quality conditions to help find a cause. When West Nile virus appeared in the Queens, NY in 1999, the lack of mosquito monitoring data hindered the development of effective and appropriate responses to the outbreak. On the other hand, when there was unusual flooding in the summer of 2014 in parts of Long Island in August, the presence of comprehensive and long-standing weather records enabled pin-pointing of unusual (and locally magnified) rainfall as the cause.

Measuring water levels at wells in aquifer systems is a common monitoring effort. Water level records exist for some locations from the early 1900s. Such records enable understandings of the responses of the aquifer systems to changes in precipitation and other weather phenomenon, and to long-term climatic events such as sea level rise. Monitoring a network of wells allows for the construction of head level mappings (most commonly, contour maps of the water table and equi-potential pressure heads in other elements of the aquifer systems). Measurements like these make calibration of flow models possible.

The Town of Brookhaven has a landfill site in Brookhaven hamlet, just north of Sunrise Highway, west of Carmans River (Figure 1). One of the first lined landfill modules was constructed here in 1971 by New York State Environmental Facilities Corporation. The Town began operations at the site in 1974. The landfill has been operated here continuously since 1974. To accord with the Long Island Landfill law, it no longer manages municipal solid waste, but rather accepts about 1 million tons per year of construction and demolition debris and incinerator ash and some other wastes deemed acceptable under the law.

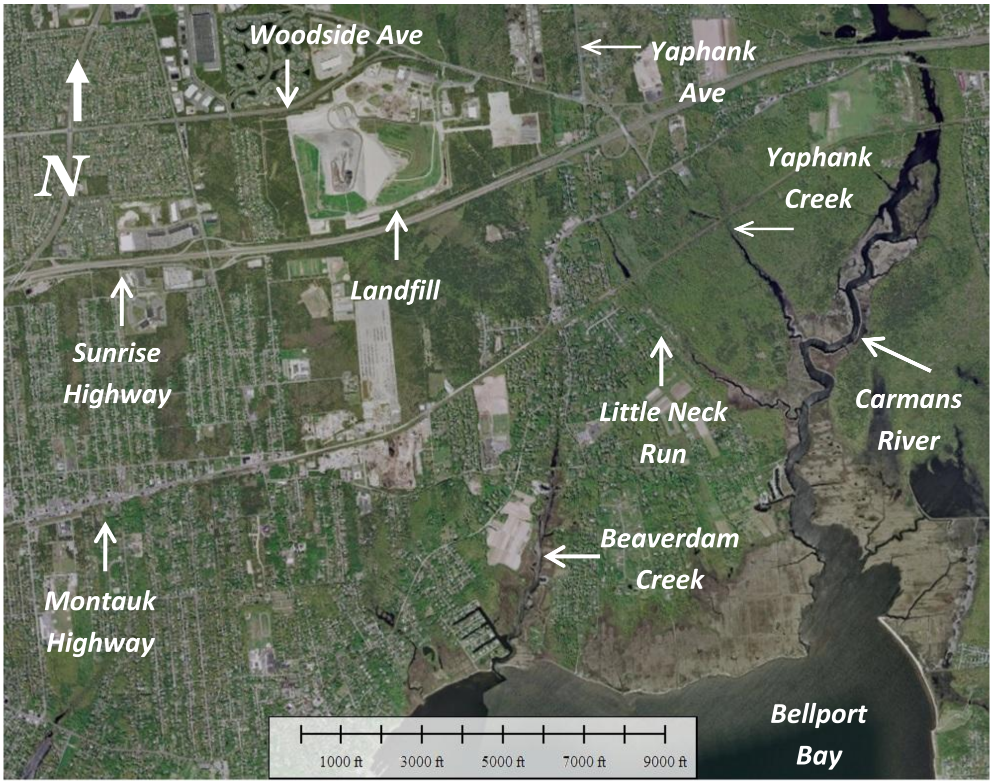

Figure 1. Aerial view of the vicinity of the Brookhaven landfill

The landfill installed a small network of shallow wells around its perimeter in the early 1970s. When, despite the liner system, groundwater contamination was discovered in 1980 the Town expanded its monitoring program. USGS worked with the Town and installed wells that covered the downgradient flow from the site throughout the Upper Glacial aquifer and included some wells in the shallow Magothy aquifer (Wexler 1988, Pearsall and Aufderheide 1995). State (and federal) regulations regarding landfills were modified in the late 1980s, and the Town expanded its landfill in the 1990s into the new millennium, leading to the installation of more wells (Dvirka and Bartilucci 2011). Suffolk County also led investigations in the area, one focused on the landfill and another on a nearby compost site. This also resulted in more wells being installed (SCDHS 2008, Dvirka and Bartilucci 2011, NYSDEC and SCDHS 2013). In this fashion a hodge-podge network of wells grew around the landfill. Not all of the wells still exist. Many were lost or destroyed over time. However, something of a network still remains (Plate 1, at the end of the report) and many of these were used in various water level monitoring efforts. Some were conducted by USGS (in the 1980s and early 1990s). The Town's consultants also have taken measurements of water levels at various times (see Table 1 for the number of "largescale" synoptic water level events since 1981). The summary of the network still remaining for water level purposes is shown in Table 2.

1980s		**1990s**		**2000s**		**2010s**	
1982	5	1990	3	2000	12	2010	1
1983	1	1993	3	2001	7	2011	1
1989	4	1995	21	2002	2	2014	4
		1996	6	2009	2		
		1997	6				
		1998	2				
		1999	9				
Total	**10**		**50**		**23**		**6**

Table 1. Record of synoptic water level measurements (at least 40 wells per round)

Category	**Surface water**	**Well clusters**	**Shallow**	**Mid-depth**	**Deep**	**Confining layer-Magothy**	**Total**
Upgradient (north & east)		5	5	4			**9**
On-site		27	25	11	11	4	**51**
Sunrise Hwy.	2	11	11	5	7		**25**
Woods	3	6	6	5		1	**15**
Montauk Hwy.	1	4	5	2	2		**9**
S. of Montauk Hwy.	1	12	15	8	7	2	**33**
S. of Beaverdam Rd.		9	9	1	1		**11**
Totals	**7**	**74**	**76**	**36**	**28**	**7**	**163**

Table 2. Monitoring network summary description

Suffolk County and USGS have also included one or more landfill wells in the County-wide groundwater level monitoring program at various levels of intensity ranging from annually to quarterly to monthly since the early 1940s. Figure 2 shows the long-term water levels measured at one well on site.

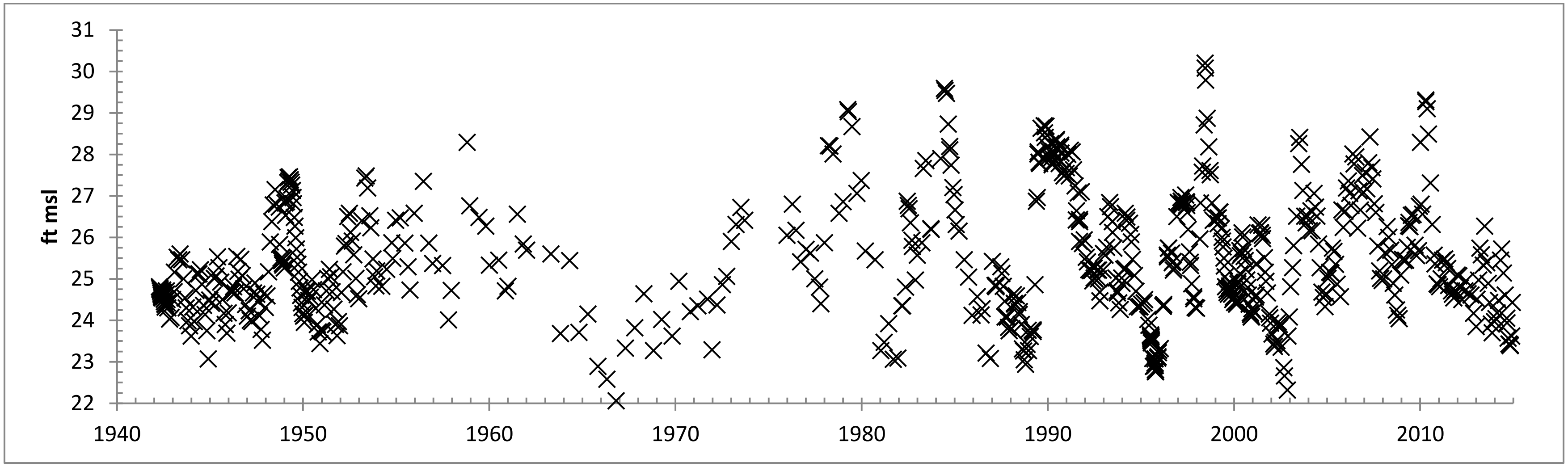

Figure 2. S-3529 water levels (combines the original well data with its replacement)

Materials and Methods

In September 2014 regular monitoring of the groundwater network was re-instituted. A permit was obtained to access wells on Wertheim National Wildlife Refuge property was obtained. Sampling was always conducted in one day so that the data could be considered to be synoptic.

A Solinst Model 101 electronic water level meter was used, with a 100 foot tape. Data were recorded in a bound notebook at the moment of sampling, to the nearest 0.01'. The date and time of the measurement were also recorded. Each well cluster has a dedicated page in the notebook. For surface water points, the presence and estimated velocity of flow was recorded. At two surface water points (BD-2 and BD-3) the height of the surface water was determined (using a gage installed by USGS at BD-2, and measuring from a fixed, surveyed point on the culvert for BD-3).

The sampler(s) were familiar enough with the water well network that all wells intended to be sampled were located each time. A map of the well network (Plate 1) was referenced to ensure the correct identifier was used for each sampled well. Most wells located in clusters are labeled; relative attributes ("eastern," "taller," "blue cap," etc.) are included in the field book to help differentiate wells.

Water table maps were drawn by hand using whited out 11" x 17" copies of the well map. Linear interpolation was used to infer continuous one foot contours. Best professional judgement was used to resolve conflicts, and to determine which points could be used to develop the contours.

Results

Table 3 shows derived groundwater elevations relative to mean sea level made from the field measurements of depth to water.

Cluster	9/2/14	10/10/14	11/4/14	12/14/14	Max.	Min	Records
On-site							
MW5-S	26.50	26.20	26.31	26.64	33.53	25.50	145
MW5-I	26.47	26.20	26.29	26.60	33.53	25.47	118
MW5-D	26.62	26.18	26.26	26.59	33.49	25.47	132
MW6-S	24.96	24.62	24.67	25.00	32.14	24.16	127
MW6-D	24.94	24.58	24.64	24.97	32.10	24.15	115
72816-67	26.54	26.04	26.02	26.59	31.85	24.96	104

MW12-IR	26.58	26.07	26.06	26.57	31.84	25.11	43
Meth 18	24.81	24.32	**24.26**	25.21	28.46	**24.26**	49
3529-45*	23.94	23.43	23.39	24.38	30.20	22.32	503
72812M-198*	23.99	23.53	23.50	24.43	29.81	21.95	235
MRF-4	23.13	22.63	22.57	23.68	29.22	22.57	59
PZ-1	24.24	23.75	24.03	24.11	30.18	23.28	110
MW1-S	23.17	22.56	22.47	22.90	29.31	22.05	116
MW2-S	23.21	22.59	22.49	23.03	29.15	22.04	146
MW2-D	23.25	22.62	22.53	23.05	29.16	22.08	144
MW11-M	22.80	22.34	22.34	22.98	27.97	21.66	128
MW3-S	22.57	21.94	21.82	22.25	28.26	21.30	139
MW10-SR	22.97	22.35	22.23	22.61	26.12	21.87	22
MW10-IR	22.99	22.36	22.22	22.66	26.11	21.87	21
MW4-S	22.31	21.68	21.56	21.95	27.26	20.98	152
MW4-D	22.32	21.68	21.58	21.97	27.25	21.00	138
103140-120	21.78	21.17	21.04	21.45	26.53	20.46	69
73767-58	22.45	21.82	21.67	22.06	27.63	21.09	118
73768-79	22.45	21.81	21.69	22.06	27.64	21.09	118
73764-58	22.07	21.44	21.33	21.74	26.91	20.76	112
73765-78	22.07	21.46	21.32	21.73	26.91	20.76	82
73766-108	22.08	21.45	21.32	21.75	26.89	20.79	85
73760-65	21.66	21.07	20.95	21.50	26.53	20.41	152
73761-85	21.67	21.05	20.93	21.52	26.54	20.41	108
73761R-85	21.46	20.86	20.74	21.33	26.31	20.20	105
73763-140	21.69	21.09	20.96	21.54	26.57	20.37	116
72813M-219	21.64	21.21	21.17	21.77	26.49	20.51	240
73758-53	21.34	20.78	20.71	21.52	26.65	20.14	126
73757-73	21.34	20.79	20.70	21.52	26.65	20.14	92
73756-103	21.35	20.79	20.70	21.50	26.65	20.16	107
73759-123	21.34	20.78	20.72	21.51	26.64	20.12	103
MW13-SR	22.56	22.05	**22.02**	23.26	23.70	**22.02**	6
44581-22	22.38	21.87	**21.84**	23.06	28.43	**21.84**	50
Meth-5	22.11	21.70	**21.70**	24.07	28.40	**21.70**	47
73750-34	22.05	21.55	21.53	23.87	28.41	21.06	117
73751-55	22.00	21.47	21.41	22.59	27.53	20.70	96
73752-85	21.99	21.48	21.41	22.59	27.53	20.72	108
73753-34	21.53	21.00	20.94	22.04	27.71	20.41	99
73754-55	21.52	21.00	20.93	22.05	27.62	20.41	98
73755-85	21.62	20.99	20.92	22.04	27.54	20.39	99
MRF-1	21.45	20.95	20.91	22.19	26.47	20.41	70
MRF-3	21.67	21.17	21.16	22.54	26.82	20.63	71
73943-45	21.31	20.80	20.77	21.99	25.45	20.28	73
72818-8	20.23	19.77	**19.73**	20.93	23.38	**19.73**	77
72819-23	20.24	19.76	**19.72**	20.91	23.48	**19.72**	63
72820-43	20.23	19.77	19.74	20.89	23.61	19.71	66
Offsite							
Upgradient							
SCNYap2-S	15.92	16.43	16.49	15.60			4
SCNYap2-M	15.96	16.45	16.52	15.64			4
SCNYap1-S		14.66	14.65	13.74			4

SCNYap1-M		14.57	14.58	13.68			4
SCH-S SCH-M	13.40 13.51	13.86 13.99	13.90 14.00	12.85 12.98			4 4
SCSYap-S SCSYap-M	14.20 14.19	14.64 14.62	14.62 14.60	13.58 13.56			4 4
72159-45		17.16	17.16	18.21	21.60	16.85	16
South of Sunrise Hwy							
95319-75 95320-145	21.82 21.80	21.17 21.16	21.03 21.03	21.36 21.37	26.38 26.37	20.37 20.40	77 64
95307-80 95308-143	21.24 21.25	20.60 20.63	**20.47** 20.49	20.80 20.81	25.01 25.83	**20.47** 19.91	22 74
72836-54 72837-73 95303-105 95304-141	21.05 21.07 21.00 21.04	20.42 20.45 20.43 20.43	20.29 20.33 20.31 20.30	20.72 20.76 20.74 20.73	25.34 25.35 25.39 25.33	19.68 19.68 19.68 19.67	83 84 78 78
95305-107 85306-143	20.61 20.64	20.00 20.08	19.92 19.98	20.54 20.62	25.31 25.11	19.50 19.50	75 74
72834-34 73945-50 76400-69 76401-89	20.18 20.21 20.76 20.63	19.67 19.69 19.68 19.68	19.60 19.64 19.60 19.60	20.47 20.48 20.46 20.46	24.67 24.69 24.65 24.65	19.09 19.11 19.09 19.08	89 66 70 70
73946-42 73947-60	19.56 19.62	19.20 19.17	19.14 19.14	20.21 20.19	23.62 23.58	18.69 18.67	83 68
72821-21 72822-43 72136-63	18.95 19.91 18.95	18.52 18.53 18.51	18.51 18.51 18.50	19.71 19.69 19.69	23.35 23.18 23.34	18.04 18.03 18.04	82 72 73
47747-34	16.69	16.26	16.37	17.42	21.17	14.94	202
72154-45		**11.12**	11.42	12.37	14.23	**11.12**	16
72155-47	11.93	**11.65**	11.80	12.80	15.25	**11.65**	19
Yaphank Creek @CR-80	dry	dry	dry	dry			
72147-38	8.91	8.76	8.88	9.55	11.98	8.73	18
Woods							
72131-55 72833-72	18.81 18.77	18.31 18.26	18.22 18.18	 18.80	22.51 23.81	17.69 17.64	84 71
72823-6 72824-20	19.94 19.68	19.32 19.26	**19.27** **19.19**	20.20 20.07	21.96 21.149	19.27 19.19	9 7
73953-44 73954-64	17.31 17.35	16.94 17.01	16.99 17.02	18.15 18.18	21.47 21.51	16.54 16.58	80 68
BD-5	Dry	dry	dry	dry			
72827-14 72828-28 73955-63 95310-142	15.72 15.75 15.86 15.79	15.39 15.44 15.56 15.66	15.43 15.47 15.59 15.53	16.47 16.49 16.61 16.85	18.64 18.67 18.71 18.80	15.02 15.05 15.03 15.15	86 82 77 78
BD-4	dry	dry	dry	standing 0.20			
95312-75	16.70	16.24	16.16	16.50	20.16	15.59	74
95314-76	14.99	14.68	14.68	15.34	18.03	14.17	77
On CR-80							
72127-54	15.22	14.71	14.64	14.96	19.28	13.99	87
72149-46		12.13	12.26	13.01	14.51	11.87	24

BD-3	standing **11.10**	dry	dry	flowing 11.98	11.98	**11.10**	48
76380-24			**13.49**	14.37	15.40	**13.49**	11
76381-44			**13.57**	14.47	15.42	**13.57**	11
76382-64			**13.55**	14.34	15.54	**13.55**	11
76383-82			**13.53**	14.46	15.26	**13.53**	11
76384-102			**13.56**	14.47	15.43	**13.56**	11
76385-120			**13.55**	14.45	15.50	**13.55**	11
72150-47		13.56	13.66	14.54	15.89	13.36	17
South of CR-80							
72152-45		**11.85**	11.95	**13.05**	**13.05**	**11.85**	3
98442-50	12.06	11.82	11.92	13.02	15.18	11.60	70
98441-85	12.04	11.84	11.94	13.02	15.19	11.58	58
98438-44	11.71	11.50	11.61	12.49	14.59	11.25	71
72151-46		**11.60**	11.70	**12.55**	**12.55**	**11.60**	3
98440-84	11.74	11.53	11.64	12.52	14.64	11.26	58
98439-121	11.80	11.61	11.70	12.58	14.19	11.37	58
95323-35	10.66	10.51	10.62	11.45	13.26	10.23	75
98436-44	10.66	10.49	10.60	11.34	13.21	10.21	69
98437-85	10.70	10.51	10.62	11.40	13.28	10.23	69
72151M-164	14.40	14.58	14.41	14.89	17.23	13.52	77
MW101-S		**7.65**	7.78	**8.66**	8.66	7.65	4
98434-44		7.58	7.71	8.60	9.86	7.55	72
96201-75		7.58	7.72	8.56	8.82	7.51	74
96202-148		12.18	12.35	13.06	15.41	11.93	74
BD-2	flowing 8.27	flowing 8.27	standing 8.42	flowing 8.36	8.94	7.83	67
98435-121	7.58	7.51	7.65	8.59	10.00	7.37	59
MW102-S	**5.68**	5.69	5.82	**6.24**	**6.24**	**5.68**	5
72160-45		**5.75**	5.84	6.35	7.52	**5.75**	24
MW102-I	5.70	**5.68**	**6.36**		**6.36**	**5.68**	4
MW102-D	**5.68**	**5.68**	5.82	**6.48**	**6.48**	**5.68**	5
72170-33	2.93	3.14	3.19	3.99	7.03	2.65	17
MW105-S	2.70	2.87	3.10	**4.46**	**4.46**	2.61	5
MW105-I	2.65	2.88	3.11	**4.44**	**4.44**	2.53	5
MW105-D	2.71	2.88	3.09	**4.46**	**4.46**	2.66	5
72162—40	3.68	**3.64**	3.84	4.49	5.25	**3.64**	25
MW103-S		**3.56**	3.63	**4.23**	**4.23**	**3.56**	4
MW103-I		**3.56**	3.63	**4.26**	**4.26**	**3.56**	4
MW103-D3		**3.65**	3.74	**4.35**	**4.35**	**3.65**	4
MW104-S		**2.54**	2.64	**3.32**	**3.32**	**2.54**	4
MW104-I		**2.57**	2.62	**3.30**	**3.30**	**2.57**	4
MW104-D		**2.54**	2.62	**3.26**	**3.26**	**2.54**	4
72163-42	2.06	2.38	2.45	3.30	3.73	1.82	16
South of Beaverdam Rd.							
72167-45	2.83	2.98	3.23	4.56	5.65	2.51	16
72165-45	1.77	2.01	2.19	3.34	3.98	1.40	15
72164-48	2.09	2.27	2.43	3.23	3.52	1.67	17
MW106-S	2.50	2.62	2.57	**3.28**	**3.28**	2.41	5
MW106-I	2.23	2.63	2.58	**3.29**	**3.29**	**2.23**	5

MW106-D	2.14	2.62	2.56	**3.25**	**3.25**	**2.14**	5
72171-46	2.16	2.40	2.60	3.55	3.70	1.65	16
72168-45	2.20	2.45	2.75	3.95	4.33	1.72	16
72173-41	2.23	2.36	2.51	**3.06**	**3.06**	1.48	16
72172-42		2.34	2.31	**2.74**	**2.74**	1.49	16
Shoreline "Control"							
72175-44	4.60	4.61	4.66	5.06	5.71	3.98	16

*3529-45 is 200' SE of 72813M-198; using a water table gradient of 0.015 ft/ft, the head at 3529-45 should be increased by 0.30 to create comparable Upper Glacial aquifer and Magothy aquifer heads
Green: issues regarding MP elevation, Red: no MP elevation determined, Blue: historical max. or min.

Table 3. Sampling Results

Interpretation

Elevations tended to be in the lower portions of the historical record. 2014 was not an especially dry year on Long Island (Brookhaven National Laboratory annual rainfall records are shown in Figure 3), with annual rainfall above the long-term mean of 49.0 in/yr. However, monthly rainfall totals in the summer (June -September) were lower than usual (monthly rainfall is evenly distributed and tends to be 4 in/month); this may have reinforced high summer evapotranspiration (Table 4). Note that a historic 13.27 in. single day rainfall recorded at Islip Airport (the official Long Island national Weather Service station) on August 12 was not reflected in the Brookhaven National Laboratory data. A number of data locations set historic low records, and fewer set high records, but these tended to be those with very short sampling histories.

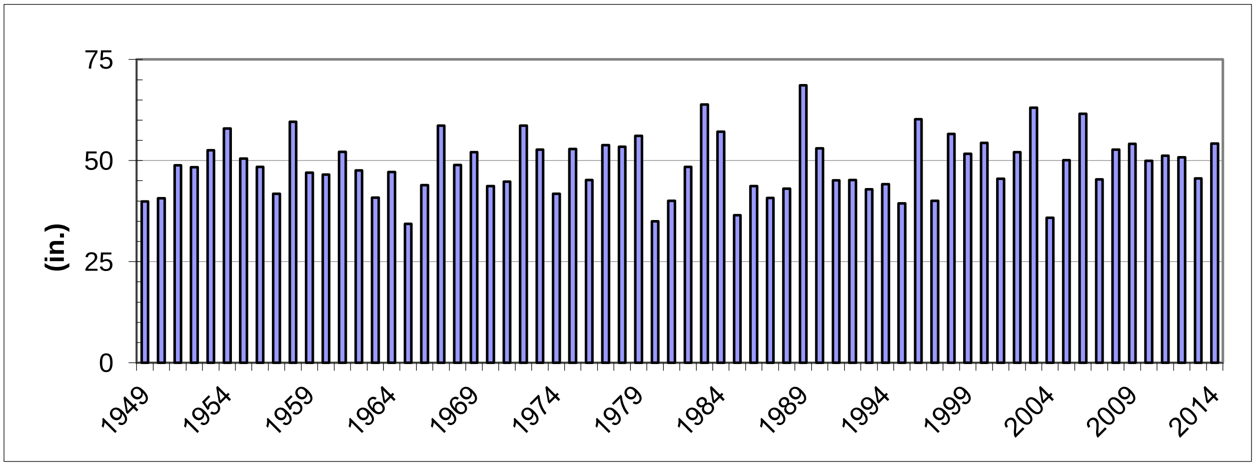

Figure 3. Annual rainfall data (in./yr), Brookhaven National Laboratory (Upton, NY), 1949-2014

Month	J	F	M	A	M	J
Precipitation (in.)	2.90	5.63	6.73	4.86	4.82	2.35
Month	J	A	S	O	N	D
Precipitation (in.)	2.58	3.67	2.66	5.23	5.79	7.03

Table 4. 2014 monthly rainfall data (BNL)

Figure 4 shows all measurements at long record well S-3529 from 2010. These data confirm that water levels were lower in the latter part of 2014 than generally measured at this well, although not to uncommon levels. Water level patterns in 2014 reflected the "typical" pattern of increasing levels through spring to an early summer peak, then declines through autumn to early winter when a lack of transpiration allowed the levels to begin increasing again.

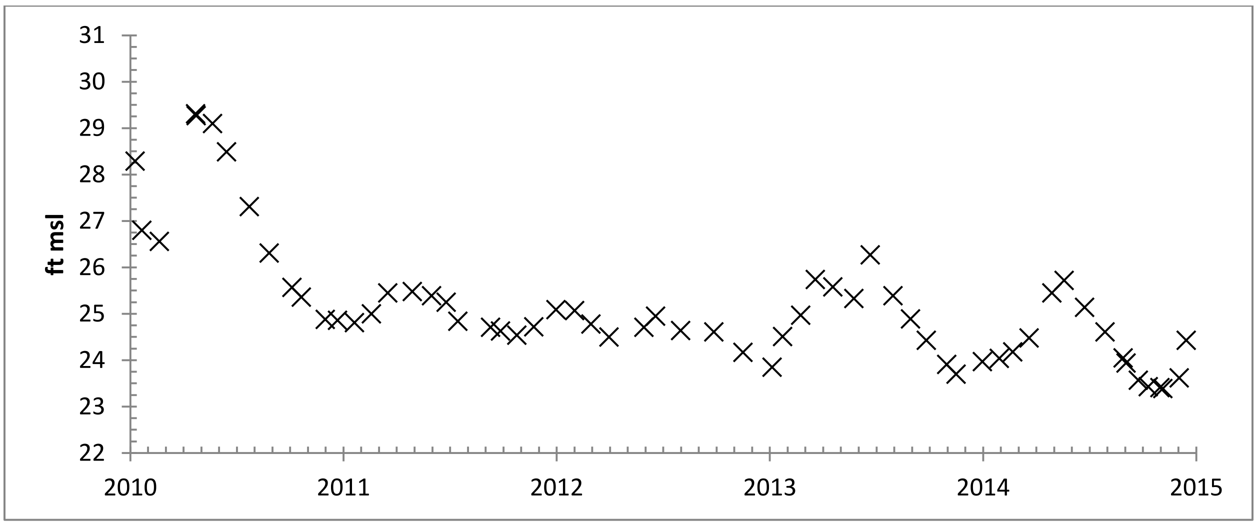

Figure 4. Water levels at S-3529, 2010-2014

Plates 2-5 (at the end of the report) are the water table contour maps generated from the elevation data, for September, October, November and December 2014 sampling events, respectively. There are similarities in each map. The general flow of groundwater across the site tends to be to the south east, because Carmans River is a regional groundwater discharge point. The sparse data to the north and north east of the landfill suggest that flow has more of an easterly component there. In the hamlet (between the salt water reaches of Carmans River and Beaverdam Creek) flow is more southerly. The contour lines compress in the vicinity of Beaverdam Creek (whether it has flow or not). In Brookhaven hamlet the lines are more widely spaced. If the hydraulic conductivity of sediments is similar across the study area, this suggests flow becomes faster near Beaverdam Creek and then slows a lot between the salt portions of the Beaverdam Creek and Carmans River. There appears to be a small groundwater divide in the neck, but it is not always well defined. In December, when sampling occurred within several days of a substantial rain storm, there was a small groundwater mound in the vicinity of the recharge basin east of the landfill. There is no evidence of a mound from leachate releases beneath the landfill, and, in fact, it would seem the water table is somewhat depressed beneath the landfill. There are some slight indications that flow into Beaverdam Creek drains the aquifer in its close vicinity.

The classic mapping of the Deep Recharge Zone made by Koppleman (1978) showed the edge of that zone to be at Horseblock Road and Woodside Avenue, just north of the landfill site. The Deep Recharge Zone is the approximation of the area where recharge from the ground surface may reach the deeper two aquifers, the Magothy and Lloyd aquifers. Comparisons were made of head measurements at the four Upper Glacial-Magothy aquifer pairs (Table 5). The S-3529 and S-72812 pair has a persistent (but slight) downward potential flow pattern, according to the differences in head pressure between the two wells. MW2 (Upper Glacial) wells and the MW11 well also had a persistent pattern of potential downward flow. The head difference was not great, and it is not clear whether recharge soaking into the ground at these locations would reach the Magothy aquifer. It is possible that water from the deeper part of the Upper Glacial aquifer flows downward through the confining layer into the upper portions of the Magothy aquifer, as analyses of well logs has shown the confining layer is relatively thin and composed of less robust clay north of Sunrise Highway (Aphale and Tonjes 2013). The well cluster directly south of the landfill (S-73760/S-73761/S-73761R/S-73763 are the Upper Glacial aquifer wells, and S-72813 is the Magothy aquifer well. The data here shows variable results: sometimes a small downward potential, and sometimes a small upward potential. This appears to be the transition zone for the potential for upward and downward flows across the confining layer. South of Montauk Highway, head is clearly greater in the Magothy aquifer than in the Upper Glacial aquifer, suggesting a strong potential for upward flow – although the well log data suggest the confining layer is thicker and composed of more solid clay (Aphale and Tonjes 2013), which would impede such flows. Two well clusters compare head in the Upper Glacial aquifer to head in the confining layer itself. North of Montauk Highway the data vary from month to month. South of Montauk Highway, the potential is for upward flow. These results are similar to data collected at these sites in previous decades (Aphale and Tonjes 2014)

Cluster	9/2/14	10/10/14	11/4/14	12/14/14
3529-45* 72812M-198*	0.15	0.10	0.09	0.15
MW2-S MW2-D MW11-M	0.41 0.45	0.25 0.28	0.15 0.19	0.05 0.07
73760-65 73761-85 73761R-85 73763-140 72813M-219	0.02 0.03 -0.18 0.05	-0.14 -0.16 -0.35 -0.12	-0.22 -0.24 -0.43 -0.21	-0.27 -0.25 -0.44 -0.23
72827-14 72828-28 73955-63 95310-142	-0.07 -0.04 0.07	-0.17 -0.22 -0.10	-0.10 -0.06 0.06	-0.37 -0.36 -0.24
95323-35 98436-44 98437-85 72151M-164	-3.74 -3.74 -3.70	-3.93 -3.91 -3.93	-3.79 -3.81 -3.79	-3.44 -3.45 -3.51
MW101-S 98434-44 96201-75 96202-148		-4.53 -4.60 -4.60	-4.57 -4.64 -4.63	-4.40 -4.46 -4.50

*3529-45 is 200’ SE of 72813M-198; using a water table gradient of 0.015 ft/ft, the head at 3529-45 was increased by 0.30 to create comparable Upper Glacial aquifer and Magothy aquifer heads

Table 5. Comparison of Upper Glacial aquifer well head data to Magothy aquifer-confining layer well head data

Overall change in head pressure at any location over the four months was not great, tending to be less than 1 foot. The changes were not necessarily consistent, however. Figure 5 shows the changes in head relative to the September 2 data for a set of wells selected along a transect from the northwest (MW5-S) across the landfill site (S-73760) to Sunrise Highway (S-95305) through the woods (S-72827) into the area south of Montauk Highway (S-95324) to Beaverdam Rd (MW105-S) and to its south (firewell S-72168). These data show geographic differences in the response of the aquifer over time. The wells furthest south tended to have increasing water levels all fall; those to the north declined early in the fall, and had increasing heads later in the year. It is unclear whether the pattern reflects an areal difference in recharge timing and rates, or differences associated with the size of the vadose zone. The distance from the ground surface to the water table is on the order of 50 ft north and west of the landfill. There is a distinct topographical break on the eastern edge of the landfill and south of Montauk Highway, so that distances to the water table tend to be on the order of 10 feet south and east. When the system is droughty, interstitial water becomes depleted in the vadose zone, and this needs to be replenished before recharge of the aquifer can occur.

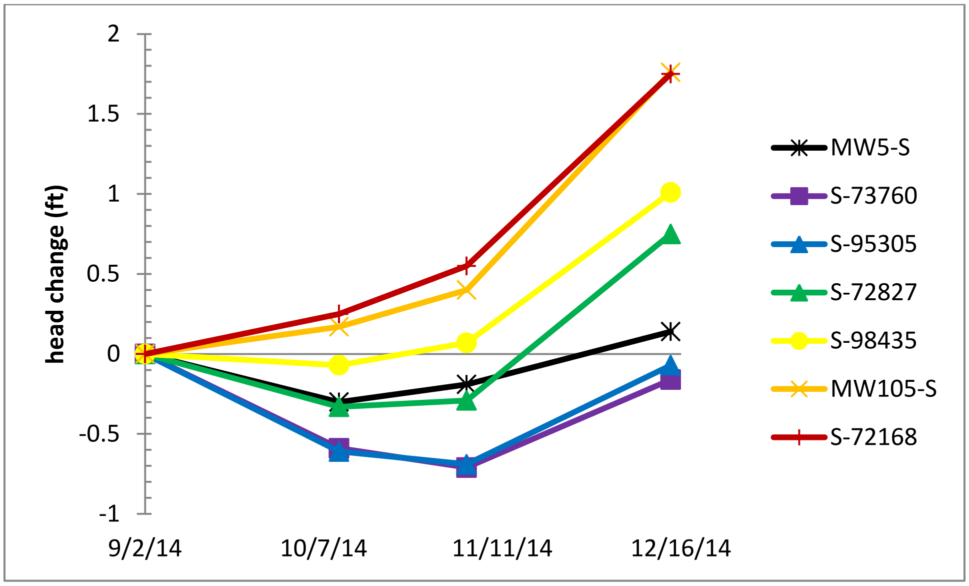

Figure 5. Relative changes in water levels from September 2, 2015

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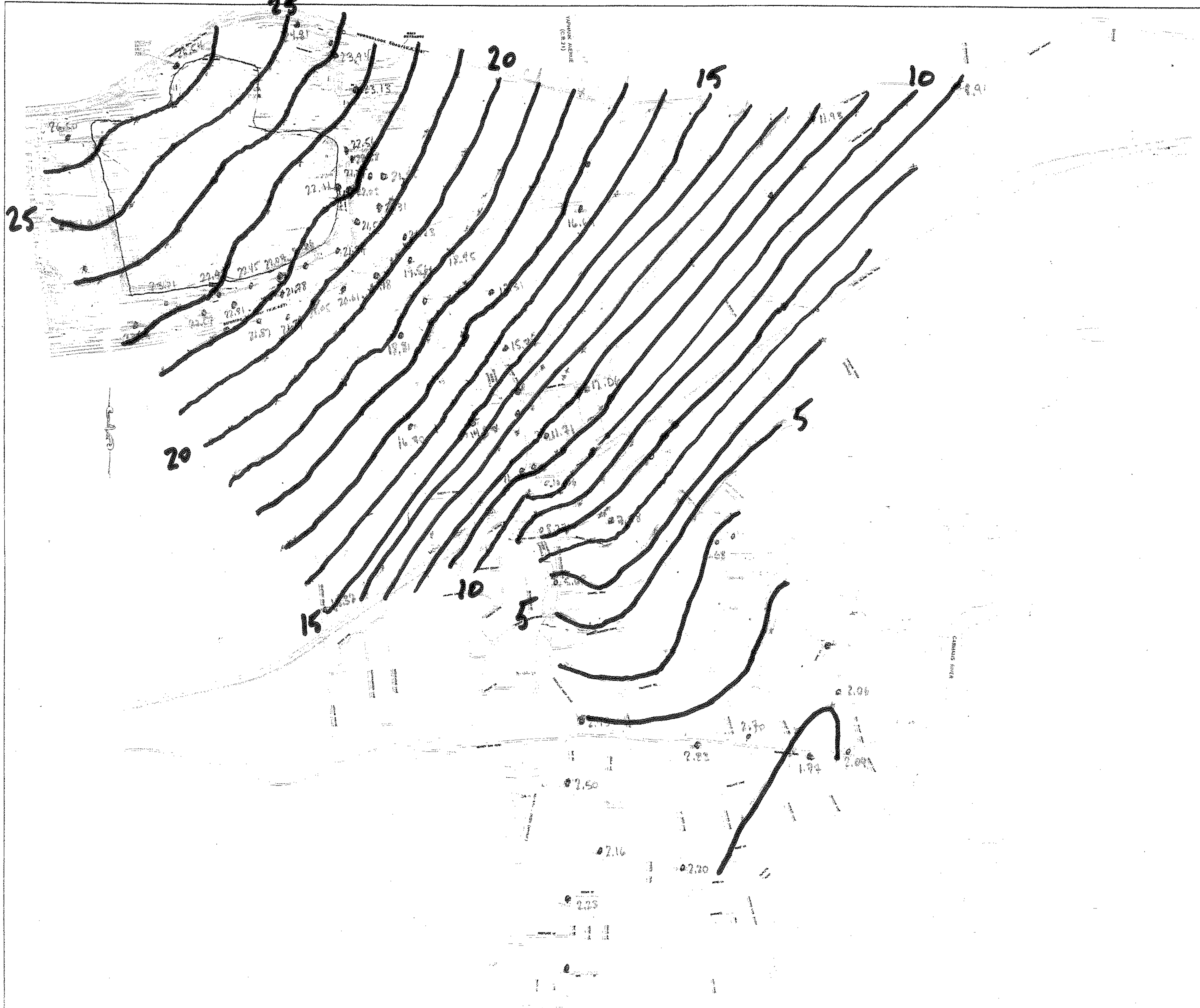
List of Plates:


Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.
LEGEND
MONITORING WELL LOCATION ACCORDING TO HISTORICAL REPORTS
MONITORING WELL LOCATED BY D&B DURING DECEMBER 2008/JANUARY 2009 ASSESSMENT
FIRE WELL LOCATON
COMPLETED GROUNDWATER PROBE
TOWN SURFACE WATER SAMPLING LOCATION
SCDHS SURFACE WATER SAMPLING STATION
NEW MONITORING WELL CLUSTER LOCATION
NEW SURFACE WATER SAMPLING LOCATION
NEW STREAM GAUGING STATION
NEW GROUNDWATER PROBE LOCATION
APPROXIMATE LOCATION OF H.O.G. FARM'S MAGOTHY IRRIGATION WELLS
APPROXIMATE LOCATION OF H.O.G. FARM'S SHALLOW UPPER GLACIAL IRRIGATION WELLS
TOWN OF BROOKHAVEN LANDFILL MONITORING WELL AND SAMPLE LOCATION MAP
FUTURE CELL #6 AREA
ACTIVE CELL #6 AREA
CELL #6 PHASE IV
CELL No.5
CELL #1 thru #4
HORSEBLOCK ROAD (C.R.#16)
SUNRISE HIGHWAY (S.R.#27)
MONTAUK HIGHWAY (C.R. 80)
YAPHANK AVENUE (C.R.21)
Approximate groundwater flow direction
WERTHEIM NATIONAL WILDLIFE REFUGE
H.O.G. FARM
CARMANS RIVER
SQUASSUX LANDING
SCALE: 1"=500'
FIGURE 3



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- SCDHS SURFACE WATER SAMPLING STATION
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- NEW SURFACE WATER SAMPLING LOCATION
- NEW GROUNDWATER PROBE LOCATION
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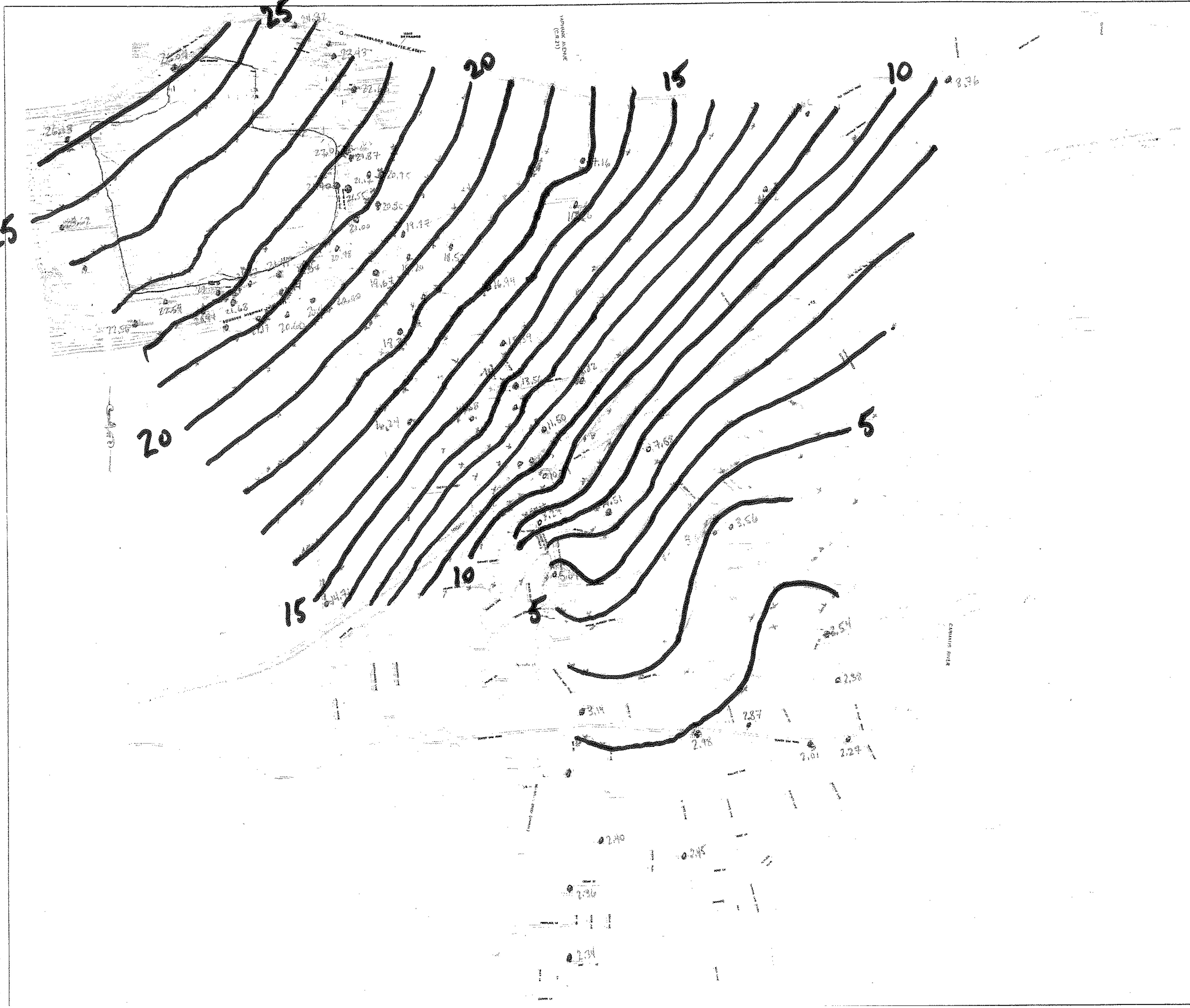
TOWN OF BROOKHAVEN LANDFILL MONITORING WELL AND SAMPLE LOCATION MAP

9/15



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MONITORING WELL LOCATION ACCORDING TO HISTORICAL REPORTS

GP-01 COMPLETED GROUNDWATER PROBE

TOWN SURFACE WATER SAMPLING LOCATION

SCDHS SURFACE WATER SAMPLING STATION

NEW MONITORING WELL CLUSTER LOCATION

NEW SURFACE WATER SAMPLING LOCATION

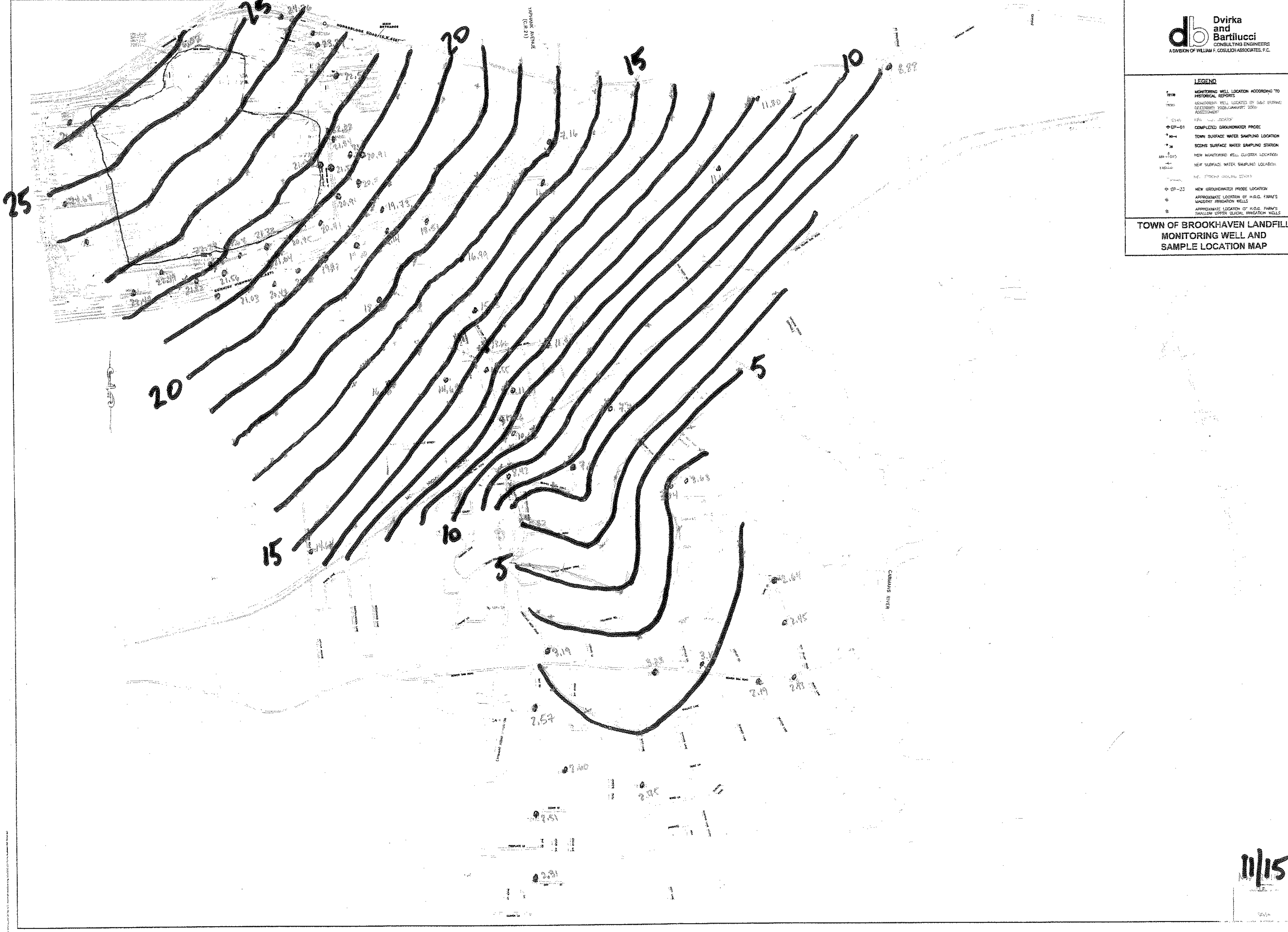
GP-33 NEW GROUNDWATER PROBE LOCATION

APPROXIMATE LOCATION OF H.O.G. FARM'S MAGOTHY IRRIGATION WELLS

APPROXIMATE LOCATION OF H.O.G. FARM'S SHALLOW UPPER GLACIAL IRRIGATION WELLS

TOWN OF BROOKHAVEN LANDFILL MONITORING WELL AND SAMPLE LOCATION MAP

10/15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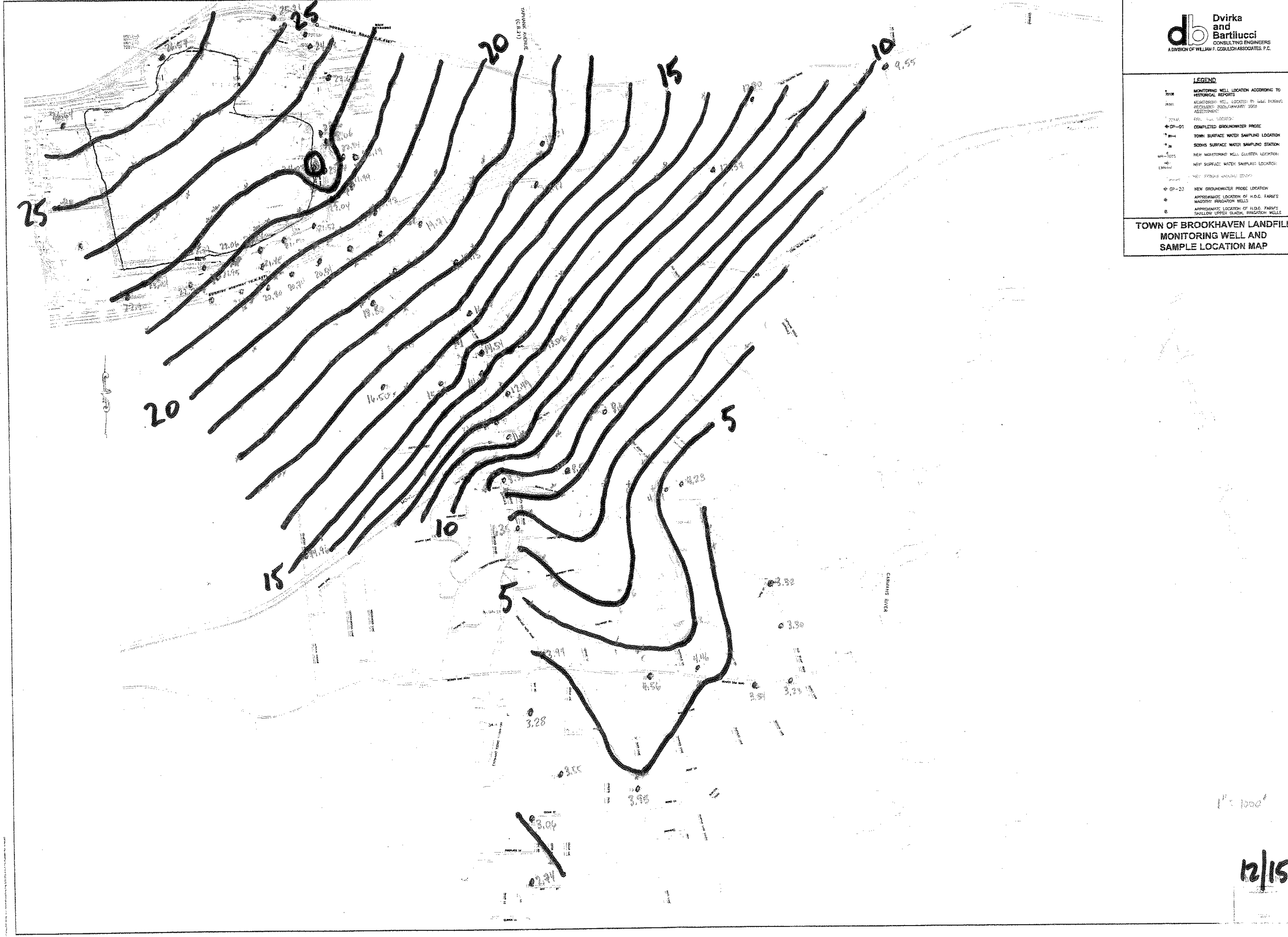
TOWN OF BROOKHAVEN LANDFILL MONITORING WELL AND SAMPLE LOCATION MAP
YAPHANK AVENUE (C.R. 21)
SUNRISE HIGHWAY
CARMANS RIVER
25
20
15
10
5
11/15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SAMPLE LOCATION MAP
25
25
20
20
15
15
10
10
5
5
CARMANS RIVER
9.55
4.28
3.32
3.50
4.46
4.56
3.84
3.23
3.28
3.55
3.95
3.06
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12/15