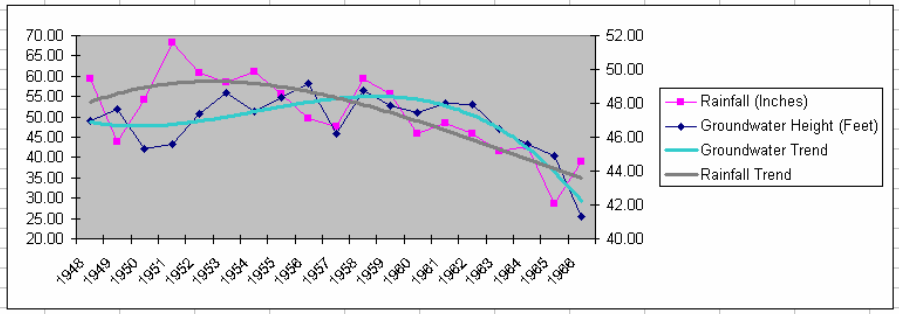
Statistics show that rainfall is the only factor impacting groundwater. There was a guy at the groundwater meeting in August who showed that development is not a factor and that the trendlines for rainfall and groundwater are identical? Why did the H2M study erroneously blame development? Is there anything that can be done to stop the rainfall?

Well, this deserves a serious answer. In reverse order, we can't control rainfall, the H2M Study was not wrong, and there is statistical proof that something other than rainfall is going on.
Where do we begin?

First let's take a look at the precipitation and well height data in the days prior to the Smithhaven Mall and the Long Island Expressway and all the homes and businesses. The information below shows the precipitation measured in Ronkonkoma versus the well height of Well s-1812 in Ronkonkoma.

Pre-Development

	Ronkonkoma Precipitation	Ronkonkoma Well Height
1948	59.49	46.95
1949	43.98	47.67
1950	54.23	45.29
1951	68.27	45.57
1952	60.92	47.35
1953	58.57	48.64
1954	61.05	47.52
1955	55.72	48.34
1956	49.65	49.16
1957	47.50	46.19
1958	59.40	48.75
1959	55.72	47.87
1960	45.96	47.47
1961	48.33	48.00
1962	45.92	47.96
1963	41.56	46.46
1964	42.74	45.61
1965	28.71	44.92
1966	39.07	41.30

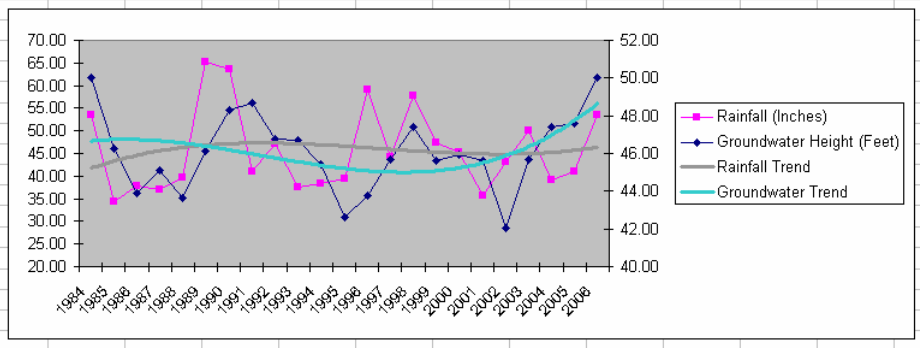


Notice that the precipitation rises first and then the ground water rises and that the precipitation declines first before the height of the groundwater declines. A trend lines shows that the water rises then declines and a similar hump occurs for the groundwater after a delay. If groundwater is primarily affected by rainfall, this is the type of graph we would likely see. Other factors, such as the speed of the rainfall can affect how much water is absorbed into the ground (a deluge creates more runoff than a long soaking rain) and unfortunately, we do not have that data available for analysis, so this is likely as good as it gets.

Let's fast forward a few years to a time after many roads and homes and businesses have arrived in the area. Again, this information shows the rainfall measured in Ronkonkoma versus the well height of Well s-1812 in Ronkonkoma.

Post-Development

	Ronkonkoma Precipitation	Ronkonkoma Well Height
1984	53.43	50.03
1985	34.41	46.25
1986	37.78	43.91
1987	37.12	45.13
1988	39.80	43.65
1989	65.32	46.15
1990	63.49	48.28
1991	41.01	48.67
1992	47.11	46.77
1993	37.64	46.73
1994	38.37	45.41
1995	39.40	42.61
1996	59.20	43.75
1997	44.14	45.71
1998	57.68	47.38
1999	47.40	45.60
2000	45.23	45.97
2001	35.77	45.61
2002	43.25	42.07
2003	49.94	45.66
2004	39.21	47.43
2005	41.05	47.60
2006	53.43	50.02



Something has changed. In some cases the precipitation decreases or increases, predicting a subsequent fall or rise in well height as expected. For example, in 1985 the precipitation declines and the soon after the well height does likewise. Similarly, the precipitation rises in 1989 and 1990 and the well height follows. Howevver, here we see

unexplained peaks and valleys in the water table without a corresponding change in rainfall. For example in 2004 and 2005, rainfall is below normal but the groundwater continues to rise throughout the period. The trend line are no longer well aligned. The ground water trendline starts heading up towards the end without a corresponding trend change in the precipitation amounts

As mentioned elsewhere, vision is not the proper way to analyze these figures. Let's use some math instead. Since rainfall takes a while to travel through the ground, let's build a statistical model using the past three years of rainfall to try to predict the current height of the water table.

Pre-Development

Here are the results for the pre-development years, we get a formula of:

Y[t] = -0.014255684748098 X1[t] +0.12994352020252 X2[t] +0.05937787668676 X3[t] +37.794414723007 + e[t]

Where Y is the Well Height, X1 is the precipitation two years ago, X2, is last year's precipitation, and X3 it the current year's precipitation. The R-squared figure for this and F-statistic figures are as follows:

R-squared: 0.569520152264246
F-statistic: 5.73295282646225

Well, the R-squared figure is not that good, but at least it is above .5 indicating some correlation between the data. How high an F-statistic we need is dependent on the size of the sample. It needs to be above the critical value for this size sample. The F-critical value in the table for an alpha = 0.05, with this sample size is 2.75. The F-critical value for an alpha = 0.01 is 4.10. The observed F-statistic is 5.73 which means the regression equation can be used with some assurance to predict expected the well height.

Post-Development

Here are the results for the post-development years, we get a formula of:

Y[t] = +0.051430215645789 X1[t] +0.09279725614364 X2[t] +0.0528168618604 X3[t] +36.971037720174 + e[t]

Where Y is the Well Height, X1 is the precipitation two years ago, X2, is last year's precipitation, and X3 it the current year's precipitation. The R-squared figure for this and F-statistic figures are as follows:

R-squared: 0.355581523013329
F-statistic: 3.12679110810765

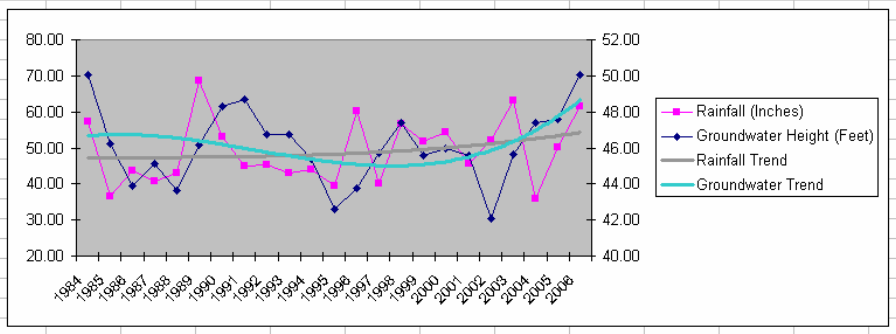
Well, the R-squared figure is much worse and shows that this model is unreliable. In other words, things other than recent precipitation are having a bigger impact on the groundwater level than precipitation itself. What about the F-statistic? What is the critical F-statistic for this sample size? The F-critical value in the table for an alpha = 0.05, with this sample size is 2.72. The F-critical value for an alpha = 0.01 is 4.02. The observed F-statistic is 3.13 which means the regression equation can be used with some assurance to predict expected the well height, but it is obviously not as good as the result from the pre-development days.

The August Groundwater Meeting

I need to comment on the information presented at the groundwater meeting at this time. There were a couple of things wrong with it. Well s-1812 has information going back to 1937, but the rainfall information near that location is not as extensive. Precipitation data from elsewhere was used to fill in the "blanks" where that data was not available. Also, there was no attempt at the meeting to compare the pre-development years to the post-development years, and as you can see from above, including the pre-development years would favor the "groundwater is solely due to rainfall" hypothesis since back then, it was solely due to rainfall. However, for the precipitation comparison, the graphs used at that meeting relied on precipitation data from the Brookhaven National Labs some 15 miles away from Lake Ronkonkoma. As indicated on another page, that rainfall is not meaningful if you are evaluating the Ronkonkoma area. For comparison, here is the graph of the post-development Brookhaven precipitation Versus Ronkonkoma groundwater charts:

Post-Development (using Brookhaven precipitation)

	Brookhaven Precipitation	Ronkonkoma Well Height
1984	57.16	50.03
1985	36.53	46.25
1986	43.73	43.91
1987	40.79	45.13
1988	43.05	43.65
1989	68.66	46.15
1990	53.01	48.28
1991	45.13	48.67
1992	45.16	46.77
1993	42.90	46.73
1994	44.16	45.41
1995	39.40	42.61
1996	60.22	43.75
1997	40.04	45.71
1998	56.61	47.38
1999	51.72	45.60
2000	54.37	45.97
2001	45.55	45.61
2002	52.07	42.07
2003	63.11	45.66
2004	35.86	47.43
2005	50.12	47.60
2006	61.59	50.02



This is visually worse than the post-development Ronkonkoma comparison and the rainfall trend here is continuously upward while the groundwater trend dips and rises. What about the statistics for this comparison? Here are the results for the post-development years (using Brookhaven precipitation rather than Ronkonkoma), we get a formula of:

Y[t] = +0.062560832960399 X1[t] +0.10618925313691 X2[t] +0.059518460085103 X3[t] +34.812326120662 + e[t]

Where Y is the Well Height, X1 is the precipitation two years ago, X2, is last year's precipitation, and X3 it the current year's precipitation. The R-squared figure for this and F-statistic figures are as follows:

R-squared: 0.270955233754925
F-statistic: 2.10606133171493

This R-squared figure is much worse than in the post-development Ronkonkoma comparison, almost saying that there is no correlation at all. What about the F-statistic? What is the critical F-statistic for this sample size? Since this sample size is the same as the post-development Ronkonkoma comparison the F-critical is 2.72 for an alpha of 0.05. The observed F-statistic is 2.11 which means there is a greater chance that any correlation is purely accidental than in any of the examples above. Thus, had the information at the meeting been fairly presented (even though meaningless, since the wrong precipitation data was used), the presenter should have concluded that precipitation was formerly a good predictor of groundwater levels, but now, the two are unrelated.

ADDENDUM IN RESPONSE TO INQUIRY FROM TPERT:

I do not make a habit of responding to questions about other sites, but since this is related to this topic and will help to correct some misconceptions, I am making an exception.

The recent glut of rainfall in the Brookhaven area has caused many Ronkonkoma area politicians to blame the rainfall in Brookhaven for the groundwater in Ronkonkoma. In addition, they cite the "31.5 inches" of additional recharge as the cause of the problem. Apparently, they did not read any of the information above. Regardless, I will let you decide for yourself. Below I have documented the NOAA (National Oceanic & Atmospheric Administrations) official rainfall records from the two locations for 2005 and 2006 versus the "normal" rainfall for those periods. These seem to be the same source of data that the other site is using. I am including the "Total Deviation" from normal for the two years for each site and something I am calling "Special Deviation" which is only special because it assumes that any precipitation before the month of October 2005 would have had no affect on groundwater. (In other words, it assumes that lack of rain prior to the deluge of 2005 had no affect in reducing groundwater levels). For very "Special" reasons, the politicians use this "Special Deviation" to support their position.

You decide for yourself why you think the politicians would rather use rainfall 15 miles away or local rainfall when talking about groundwater:

Brookhaven Precipitation Information (used by another site to explain the problems in Ronkonkoma) for 2005 and 2006:

Rainfall in Brookhaven (Brookhaven National Labs)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
2005	3.32	2.10	2.47	2.53	2.36	1.48	2.16	0.87	1.09	*22.14*	*5.00*	*4.60*	50.12
2006	*5.52*	*2.87*	*0.89*	*7.17*	*6.73*	*6.73*	*5.73*	*6.44*	*3.21*	*7.22*	*6.61*	*2.47*	61.59
NORMAL	4.19	3.76	4.77	4.27	3.88	3.51	3.27	4.43	3.65	4.07	4.44	4.53	48.78

Deviation from Normal in Brookhaven (Brookhaven Labs)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
2005	-0.87	-1.66	-2.30	-1.74	-1.52	-2.03	-1.11	-3.56	-2.56	*18.07*	*0.56*	*0.07*	1.34
2006	*1.33*	*-0.89*	*-3.88*	*2.90*	*2.85*	*3.22*	*2.46*	*2.01*	*-0.44*	*3.15*	*2.17*	*-2.06*	12.81

Total Deviation from Normal: **14.17** (This is the total deviation from normal across 2005 and 2006 including all months)

***"Special Deviation"* from Normal:** **31.52** (This ignores any affect of the 9 months of drought conditions from January to September of 2005)

Please note that the actual deviation across the two years in Brookhaven was 14.17 inches. The "Special Deviation" is what politicians use as an excuse for why they can't do anything about the problem.

Ronkonkoma Precipitation Information (which I claim is more relevant if you talk about Ronkonkoma) for 2005 and 2006:

Rainfall in Ronkonkoma (Islip MacArthur)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
2005	3.51	2.82	3.12	4.87	1.49	1.39	2.09	0.26	1.31	*14.07*	*3.17*	*2.95*	41.05
2006	*3.60*	*2.43*	*1.08*	*7.29*	*4.42*	*5.47*	*5.46*	*5.58*	*4.29*	*7.09*	*4.57*	*2.15*	53.43
NORMAL	4.27	3.33	4.76	4.13	3.9	3.71	2.93	4.48	3.39	3.63	3.86	4.13	46.52

Deviation from Normal in Ronkonkoma (Islip MacArthur)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
2005	-0.76	-0.51	-1.64	0.74	-2.41	-2.32	-0.84	-4.22	-2.08	*10.44*	*-0.69*	*-1.18*	-5.47
2006	*-0.67*	*-0.90*	*-3.68*	*3.16*	*0.52*	*1.76*	*2.53*	*1.10*	*0.90*	*3.46*	*0.71*	*-1.98*	6.91

Total Deviation from Normal: **1.44** (This is the total deviation from normal across 2005 and 2006 including all months)

***"Special Deviation"* from Normal:** **15.48** (This ignores any affect of the 9 months of drought conditions from January to September of 2005)

According to this, even the "Special Deviation" was half what was recorded in Brookhaven. Overall deviation from normal for the two years in question was 1.44 inches.

Highlights:

- In Ronkonkoma, there was only one month above normal for the entire year of 2005 and the first three months of 2006 were also below normal.
- In Brookhaven, the entire last quarter was above normal and this continued into January of the following year.
- Rainfall in Ronkonkoma is not always lower than Brookhaven, just different. See September of 2006 where Brookhaven had 3.21 inches of rain and was 0.44 inches below normal while Ronkonkoma had 4.29 inches of rain and was 0.90 inches above normal.

Notes:

All regression statistics noted above were computed with Quattro Pro from Corel Corporation and confirmed using the "Free Statistics and Forecasting Software" at wessa.net. Please see Wessa, P. (2007), Free Statistics Software, Office for Research Development and Education, version 1.1.21-r4, at URL http://www.wessa.netfor additional information. Full analysis data from that site for the above data is available below:

- Pre-Development Ronkonkoma Statistical Analysis
- Post-Development Ronkonkoma Statistical Analysis
- Pre-Development Brookhaven precipitation versus Ronkonkoma water table Statistical Analysis