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May 31, 2011

Mr. Anthony Branco, M.P.A.
Borough Manager
The Borough of Topton
205 South Callowhill Street
Topton, PA 19562

Subject: Heaving and Subsidence Investigation
Borough of Topton Community Swimming Pool
Topton, Berks County, PA
AG&E Project # TB-1020

Dear Mr. Branco:

In accordance with our April 14, 2011 letter proposal, and your subsequent approval of same, we are pleased to submit this letter report of our investigation, evaluation, and suggestions relative to the Community Swimming Pool Heaving and Subsidence conditions.

INTRODUCTION

During the winter of early 2011, Borough officials observed that the water level in the Borough's 50-year old Community Pool had dropped approximately 12- to 18-inches over an approximate 2-week period, after which the water level stopped falling. Approximately 2-weeks later, portions of the concrete deck around the pool heaved upward from 1- to 2-inches. After about another week, the heaving subsided.

In March, 2011, the Borough had a geophysical survey performed by Environscan, Inc., which resulted in Environscan's April 7, 2011 Final Report to the Borough of the Geophysical Survey results. The report indicated 3-mass deficient/low bedrock areas within and around the pool, and another mass excess/high bedrock area within the deep end of the pool; these areas are shown on the attached copy of Environscan's Report Figure 1. Cracks also were observed in the pool upon dewatering the pool for the geophysical survey.

About mid April, the Borough contacted our firm to visit the site and evaluate the conditions observed, which resulted in our April 14, 2011 letter proposal which is the basis of our investigation and this letter report.

SITE VISIT

On Friday, 4/15/11, Messr's., M. Ayub Iqbal and Dennis Gallino of Applied Geoscience & Engineering, Inc. (AG&E), visited the pool site with you. We first walked the outdoor pool site, then reviewed drawings (prepared by Wade Associates, Inc.) and construction photos from the 2006 Swimming Pool Renovations Project, and discussed same, in your office.

PROJECT UNDERSTANDING

Based upon our site visit and meeting with you, the following is our understanding of the project background:

- The pool was constructed approximately 50-years ago; no drawings or photos of the construction are available.
- In 2006, a Swimming Pool Renovations Project was bid and constructed. The project included renovations to the pool and the filter room, as further described in the 1/10/06 drawings prepared by Wade Associates.
- Construction photos from 3/22/06 thru 5/2/06 also were provided by the Borough on 4/21/11.
- Photos of pool cracking between 9/17/07 and 10/7/07, and again on 5/4/10, also were received from the Borough on 4/21/11.
- In January/February, 2011, the pool water level dropped approximately 12- to 18-inches in an approximate 2-week timeframe. At that time, the water in the shallow (south) end of the pool was up to the second stairway step from the bottom of the shallow (south) end of the pool; the water was approximately 21-inches deep at that location at that time. The water in the normally 10-foot deep (north) end of the pool was between 8- and 9-feet deep. The water level then stabilized at this level.
- Approximately 2-weeks later, the concrete deck around both (east and west) sides of the shallow (south) end of the pool, and along the east side of the deep (north) end of the pool, heaved up from 1- to 2-inches, while the bull-nosing surrounding the edge of the pool remained essentially intact.
- Approximately 1-week later (end of February or beginning of March, 2011), the heaving subsided.

- On March 2, 2011, Environscan, Inc., a Geophysical Survey firm from Lancaster, PA, prepared a proposal to the Borough, at their request, to prepare a Subsidence Characterization Geophysical Survey of the pool. Upon acceptance by the Borough, Environscan performed a microgravity and ground penetrating radar (GPR) survey of the pool and the surrounding pool decking. That survey resulted in an April 7, 2011 Final Report of the Geophysical Survey, which included mapping of the soil and rock beneath the pool area, a copy of which is included in Figure 1.

- In order to be able for Environscan to perform the Geophysical Survey, the Borough drained the pool in early- to mid-March, 2011. As the pool was being drained, a crack was discovered in the approximate center of the sloped pool bottom area; this area transitions the pool from the 6-foot deep portion of the deep end to the 10-foot deep (north) end of the pool. Water gushed out of the crack, to a height of approximately 8-inches above the crack elevation. The gushing eventually subsided.

- Just prior to our 4/15/11 site visit, accumulated rainwater was drained from the pool. Small seeps of water were observed from the crack, as well as a few other smaller areas closer to the 10-foot deep end of the pool. A horizontal seep also was observed along the east wall of the 10-foot deep end.

- The pool must be opened by NLT Memorial Day Weekend, which starts on Saturday, May 28, 2011.

- On May 25, 2011, it was understood from you that the water level in the pool had recently dropped as a result of the preparations for the 2011 swimming season.

ADDITIONAL NOTEWORTHY INFORMATION

- A currently-unused water well pumphouse is located near the southwest corner of the site, which fronts on W. Weis Street, a State road. In addition, a currently-used community drinking water well pumphouse exists to the southeast of the site across W. Weis Street from the pool property adjacent to the school property.

  a. Well # 5, which is adjacent to the pool and not currently in operation, was started in 1935. It is 297-feet deep and the pump depth is 200-feet. A new 30 HP pump was put in on 8/19/75. The well output is between 200 and 300 gpm.

b. Well # 2, which is located on Woodside Avenue, was installed in 1916. The depth of the well is 300-feet and the pump is 250-feet deep. A new 20 HP pump was put in on 10/31/07. The output is 200-250 gpm.

c. Well drilling logs and well water level readings were not available from the Borough.

- Toad Creek, an existing stream along the eastern boundary of the pool property, has been eroding the area along and beneath the pool fence along the eastern pool property boundary.

- This reportedly has resulted from a stormwater diversion along the south side of W. Weis Street along the school property across the street from the pool property. Further information relative to this stormwater diversion was not available from the Borough.

- The U. S. Army Corps of Engineers (ACOE) is proposing a Creek bank stabilization project along this stream, although further information was not available from the Borough.

- There are numerous springs and wetlands upslope of the pool property, to the south and southwest of the property. The Topton Mountain, which is located southeast of the pool property, appears to be approximately 700-feet higher than the pool property, as can be observed from the USGS Manatawny Quadrangle Topographic mapping, a copy of which is attached herewith. Also noted on this map is that the south end of the drainage area draining to the Toad Creek is approximately 400-feet higher than the pool property; this south end of the drainage area is approximately 6,500-feet due south of the pool. This drainage area appears to be in excess of 500-acres in area upstream of the pool property.

EVALUATION

There appear to be 3-major contributors to the cracking, heaving, and subsidence observed at the Topton Community pool. They are as follows:

1. The large drainage and groundwater catchment area (~ 500 +/- acres) immediately upslope of the pool property, as discussed above, and the potential for sinkhole development beneath the pool due to the hydrogeologic changes over the years.

2. Realignment of Toad Creek along the eastern boundary of the pool property, which may be the result of the previous stormwater diversion immediately across W. Weis Street from the pool property. This realignment may have an influence on the groundwater levels at the pool property, since the shifting of the creek channel toward the pool can increase the hydrostatic head of the groundwater in the pool area, which may create springs in the area.

3. Severe winter weather over recent years, resulting in deeper freezing and thawing effects on the soil/rock and their concrete interfaces (both bottom and sides of the pool).

It should be stated here that any effects caused by the 2006 pool renovations project are currently unknown, although the effects of the various construction activities may possibly have an effect on these conditions. It is interesting to note here that photos of the pool, taken by the Borough in September and October of 2007, about 1-1/2 years following the renovations, showed concrete cracking, spalling, concrete interface gaps, and water flowing through some of the cracks within the pool.

These circumstances may have affected the pool in the following ways:

1. Elevated groundwater levels, caused by contributors 1. and 2. above.

2. Freezing, thawing, and refreezing of the wet subgrade over the past 50-years since the pool was constructed, combined with the apparently-unreinforced concrete in the pool, may have created gaps between the concrete and the subgrade, and thus may have contributed to the loss of pool water through cracks in the concrete.

SUGGESTED RECOMMENDATIONS

1. Following the close of the 2011 pool season, it is recommended that subsurface borings be obtained beneath the pool, with a few borings through the pool walls at representative locations if possible. Potential boring locations are indicated on the attached copy of Environscan's Figure 1. These borings will be reviewed and evaluated accordingly in order to plan appropriate corrective measures recommendations.

    a. Approximately 5-deep sampled borings, from 10- to 20-feet into rock, are proposed from the bottom of the pool, within the pool perimeter, as indicated in Figure 1, in order to investigate the soil and rock conditions beneath the bottom of the pool.
    b. Approximately 4-shallow unsampled borings are proposed through the concrete deck surrounding the pool perimeter, as indicated in Figure 1, in order to investigate the soil conditions beneath the concrete deck.
    c. Additional shallow unsampled borings also are proposed within the pool perimeter through existing cracks in the bottom of the pool, in order to investigate the soil and rock conditions beneath the cracks, including the mass-deficient area shown by Environscan along the 5'6" Marker.
    d. Borings through the pool bottom should be obtained with a skid rig which would be lowered into the pool and placed in a manner so as not to damage the pool in any way.
    e. All borings will be continuously backfilled with non-shrink grout and/or a bentonite-soil mix up to the bottom surface of the pool.

2. The Toad Creek streambank should be stabilized with geotextile and riprap in order to prevent further erosion, and the creek needs to be realigned back to its original location. The Army Corps of Engineers proposed stream bank stabilization project should take care of this condition, provided adequate funding can be obtained.

Please let us know if you have any questions, comments, or require any additional information relative to this report. Please also let us know when you would like to initiate a boring program so that we can prepare appropriate bid documents for seeking bids from boring contractors.

Thank you again for this opportunity to serve The Borough of Topton.

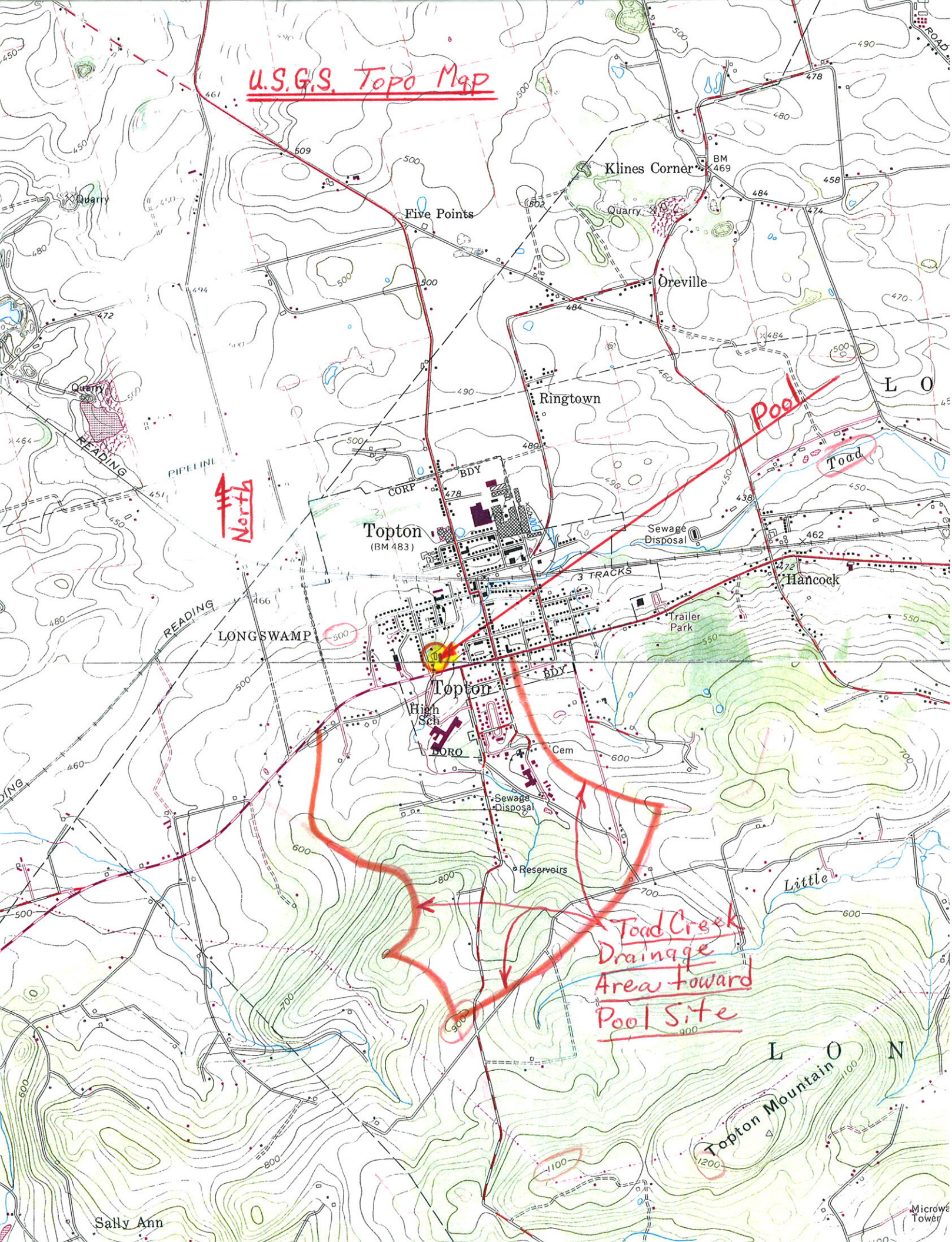
Sincerely yours,

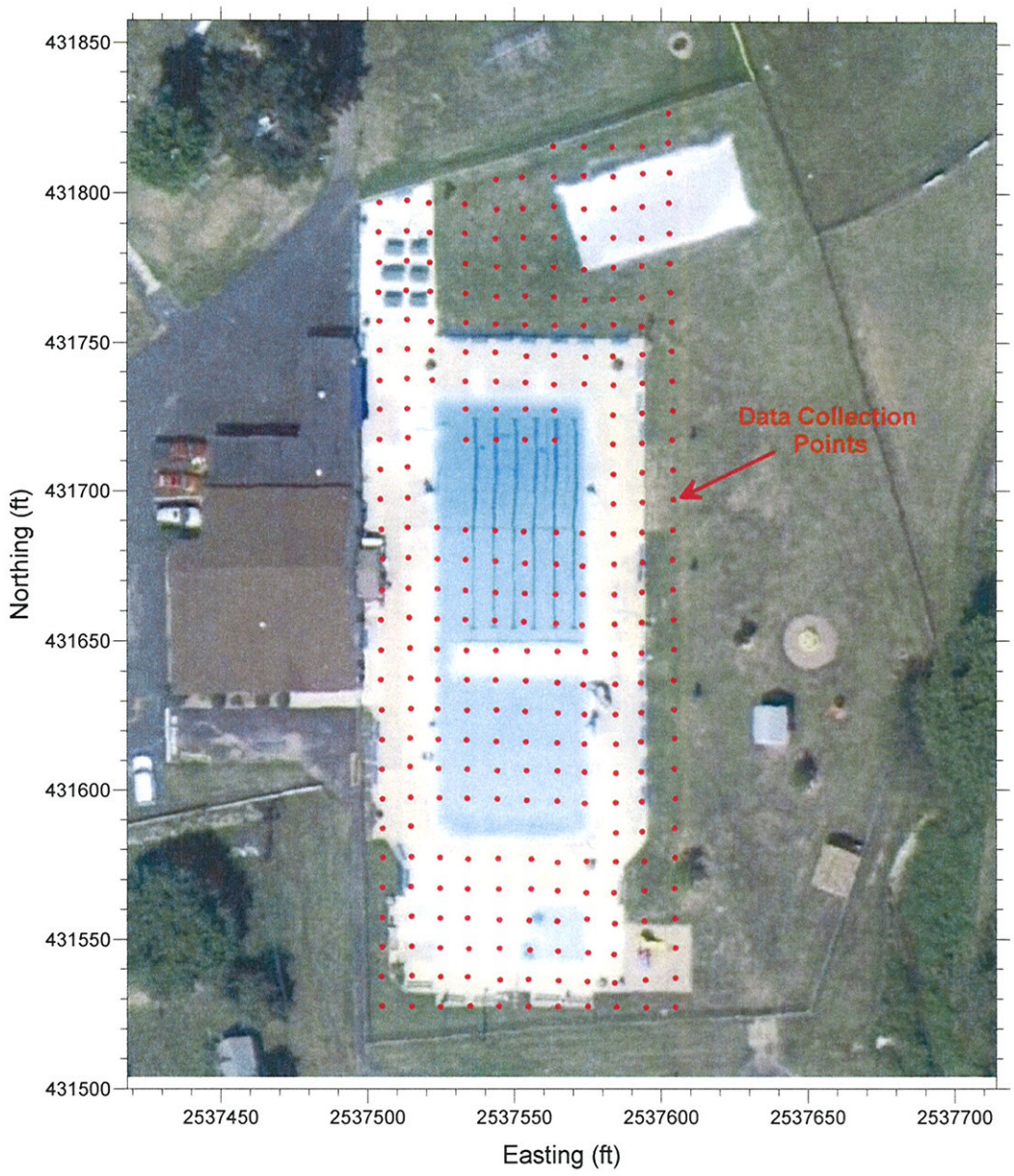
Dennis G. Gallino, P.E.
Project Manager

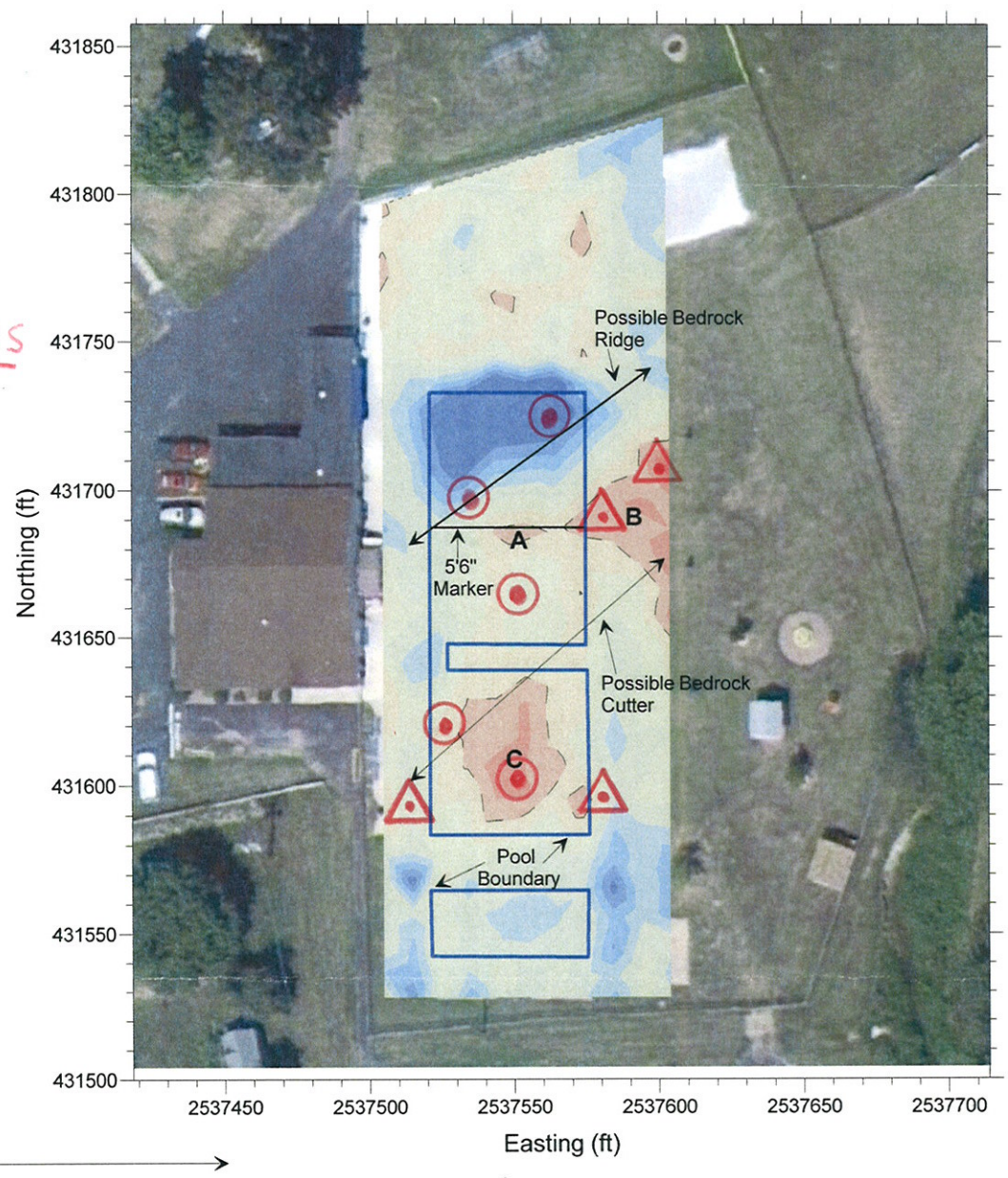
M. Ayub Iqbal, Ph.D., P.E.
Principal, Sr. Geotechnical Engineer

Cc: Mr. Ken Fulmer, Borough Engineer, Great Valley Consultants

F: Projects/ TB-1020

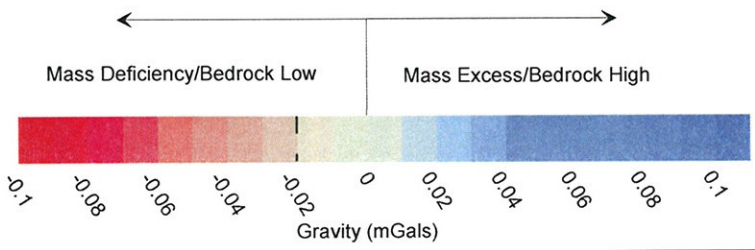

U.S.G.S. Topo Map
Klines Corner
BM 469
Quarry
Five Points
Oreville
Ringtown
Pool
Toad
Topton
(BM 483)
CORP BDY
North
READING
PIPELINE
Sewage Disposal
3 TRACKS
Hancock
Trailer Park
LONGSWAMP
BDY
High Sch
BORO
Cem
Reservoirs
Toad Creek Drainage Area toward Pool Site
Little
Topton Mountain
Sally Ann
Microwave Tower

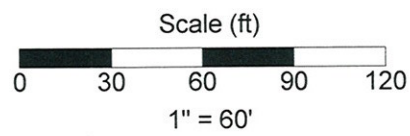




Legend of Proposed Borings

- ⊙ Sampled deep borings
- △ Unsampled shallow borings





Notes:

Coordinates in local site grid in feet.

Basemap from Google Earth.

Gravity data collected with a Scintrex AutoGrav CG-3M gravimeter on a 10' by 10' grid.

Prepared by: Enviroscan, Inc. 1051 Columbia Ave. Lancaster PA 17603 Tel: 717-396-8922 www.enviroscan.com	Title: **Geophysical Survey Data Coverage and Results**	Project Location: **Borough of Topton Pool Topton, PA**	Figure **1**
	Revision/Issue 03/29/2011	Project Number 031102	
		Original Scale 1:60 / Survey Ending Date NA	Drawn by: CAU / Approved by: FKB