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To: **Members of Bernards Township Planning Board**

Subject: **Quarry Rehabilitation Plan; Potentially Harmful Substances in Fill**

Introduction: This letter is written in support of oral testimony I plan to give on May 8, time permitting. I will make two arguments:

- You should not recommend approval of any rehabilitation plan before all issues related to the imported fill have been resolved.
- You should recall Joe Sorge for further testimony and questioning on the data and documents provided to the board before his testimony on December 20, 2011.

CDs with documents transmitted between Joe Sorge and DEP were given to members of the Planning Board on December 6, 2011. He testified on December 20. The documents were not available to the public at that time. They were posted on the township website afterwards. A review of those documents prompts questions that were not addressed on December 20. The most important relate to the test results for samples of water taken from well MW-1 in MOA Area A.

MOA Areas: In the quarry tract there are three areas covered by an MOA [memorandum of agreement] with DEP. They are of interest because they contain fill material that was imported into the quarry tract. The table below contains base data from Joe Sorge's reports thru the Phase II RIWP report of March 2011. [MCY means million cubic yards.]

MOA Base Data to March 2011

	Area A	**Area B**	**Area C**	**Total**
Area in acres	51	2.65	6.42	60
Volume of "new imported fill in MCY	3.1	0.17		3.3
Volume of "old" imported fill in MCY			0.556	0.6
Number of soil sampling locations	24	4	4	32
Number of soil samples	64	8	13	85
Number of wells	2	0	1	3
Number of well samples	10	0	4	14

The "new" fill was imported in the period from early 2006 to mid 2008. Area A fill was used to construct an embankment in the northwest corner where the west quarry wall meets the north wall. The embankment slopes down from this corner. Area B fill is in a pile near the north wall and about two thirds of the distance from the west to the east wall.

Area C fill was used to construct an embankment against the west quarry wall. I believe this "old" fill was imported in the early 90s, but I'm not sure. Area C contains the entrance road and joins Area A on its north side.

Problems in Well MW-1: There are two wells in Area A. MW-1 is in the high part of the embankment near the west wall. MW-2 is in the low part near the east edge. Samples were taken from both wells for analysis in January, April, July, and October of 2010 and in January of 2011.

There is sample data from one well in Area C. MW-3R is in the high part of the embankment just east of the entrance road. One sample was taken for analysis in April, July, and October of 2010 and in January of 2011.

Test results for MW-1 show problems. Water samples were tested for SVOCs [semi volatile organic compounds], metals, pesticides, and PCBs. SVOCs appear to pose the greatest risks. Tests were for 23 of these compounds. Seven failed DEP concentration limits for ground water, and I will focus on these here.

Dr. Jennifer L. Wollenberg submitted a report to the board dated 02-07-12. It contains an analysis of risks for several pathways associated with the imported fill. The SVOCs discussed here are major contributors to those risks.

Data and an analysis are in Attachment 1. This is a spreadsheet with a table and two charts. The SVOC names are in the first column. Next are the DEP limit concentrations for these compounds in groundwater.

The 3rd thru 7th columns contain test results for five water sampling dates. The numbers are shown in bold when the observed concentration exceeds the DEP limit. Note that the concentrations rise from the first sample in January 2010 to the last in January 2011. The last concentrations are many times DEP limits.

Example: The concentration for Benzo(a)anthracine rises from 0.46 ppb [parts per billion] to 4.10 ppb. The increase is by a factor of nine and the final concentration is 41 times the DEP limit of 0.10 ppb for water.

Average concentrations for the seven compounds are in the bottom row of the table. `These are plotted in Chart A. The rate of rise slowed slightly by the last date, but the trend was still strongly up. I have looked at empirical data all my adult life and am confident that this trend was real in 2010. In future it may continue up, level off, or turn down. We need more sample data from later dates.

Concentrations of the kind found in the MW-1 water would be unacceptable in the lake. We need to determine their origin. The most obvious explanation is that they are leachate from the material in the surrounding Area A. Let's test this hypothesis.

The 8th column in the table in Attachment 1 contains the average concentrations for the compounds in Area A soils. Chart B is a scattergram with water concentrations on the vertical scale and soil concentrations on the horizontal. Except for one oddball [bis(2-Ethylhexyl)phthalate], the correlation is excellent. This is strong evidence that the harmful compounds found in MW-1 come from the surrounding imported soil.

The rightmost column in the table contains the ratio of the water concentration over the soil concentration. Except for the oddball, the ratios run from 0.71% to 1.00%. This suggests that the soils in Area A are well-mixed and that the compounds have about the same solubility in water, hypotheses I find surprising. We need to think more about this.

Well MW-2 is also in Area A. Its test results contain no exceedances. [There are no concentrations that exceed DEP limits.] I suspect the influence of one or both of two conditions:

- The thickness of the water layer that soaks the soil surrounding the well is greater for MW-1 than for MW-2 [34 vs 14 feet]. This puts more soil in constant contact with water.
- The thickness of the soil layer above the bottom of the well is greater for MW-1 than for MW-2 [155 vs 20 feet]. This provides more soil for leaching.

Well MW-3R in Area C produced no SVOC exceedances. Because of its position high on the embankment it might emulate MW-1. But there is a huge difference: The tests for soils from the surrounding Area C are clean; there are no exceedances. Example: Benzo(a)anthracene fails in 28 of the 64 soil samples from Area A, but it is not once detected in the 13 soil samples from Area C.

In his testimony on December 20 Mr. Sorge said that synthetic leaching tests [SPLP] with some of these SVOCs did not show problems. I submit that the real-world evidence of leaching presented here trumps synthetic evidence.

In his March 2011 RIWP report Mr. Sorge proposed to continue quarterly testing and to add two wells in Area A. The additional data should do a lot to explain the harmful compounds found in MW-1. But they won't fix the problem.

Recommendation: Invite Mr. Sorge back now to discuss the data and analysis presented here, and the implications for the remediation investigation and the plan.

Soils and Cap: Below are two remediation standards defined in N.J.A.C. 7:26D.

RDCSRS: "Residential direct contact soil remediation standard" means a soil remediation standard for the ingestion-dermal and inhalation exposure pathways established or developed pursuant to this chapter that is designed to protect human health at residential use sites, schools (pre-K-12) and childcare centers. … "Residential use" means a land use scenario based on exposure to contaminated media for 24 hours a day, 350 days a year for 30 years by children and adults living on a site.

NRDCSRS: "Non-residential direct contact soil remediation standard" means a soil remediation standard for the ingestion-dermal and inhalation exposure pathways established or developed pursuant to this chapter that is designed to protect human health at non-residential use sites. … "Non-residential use" means an exposure assumption based on exposure of adult outdoor workers to contaminated media during an eight-hour work day, 225 days a year, for 25 years.

Mr. Sorge shows the concentration limits for both sets of standards with his soil data and identifies the exceedances for each set. Because there will be no residential development in the MOA areas, it is appropriate, I believe, to use the less restrictive NRDCSRS standards in designing the remediation plan.

It's not clear to me which set of standards Mr. Sorge is actually using. I wonder if the rock cap that he proposes for Areas A and B is necessary under the less strict standards. I would like to hear his comments on this.

Overall Plan for Rehabilitation: Some features of the plan are interdependent. Examples:

- The grading plan should integrate the grading for the MOA areas with that for the rest of the quarry tract.
- The lake management plan should provide for any harmful substances expected to leach from the MOA embankments over the long term. This includes testing and remediation.

[Paragraph and three bullets below added during oral testimony on August 21, 2012.]

MQI attorney, Michael Lavigne, suggested on June 5 that rehab work in the MOA was in accord with the rehab plan approved in the settlement of January 2006 and this put the MOA area off limits for the current rehab review. I believe this holding is false for three reasons.

- The drawings approved in January 2006 show slopes of 2:1. The actual slopes in MOA Area A are much less steep than this.
- The embankments in MOA Area A and B contain toxic substances, something not contemplated in the plan approved in January 2006.
- The quarry ordinance calls for a new rehab plan every three years to respond to changes that may occur during the three years. The MOA Areas A and B are significantly different now than they were in January 2006.

A major purpose of the rehab plan is to determine the cost for the township to return the quarry land to an acceptable condition, should the quarry owner be unwilling or unable to do so. This cost estimate is used to establish an amount of security. Because we do not know the nature and full extent of the problems associated with the imported fill, it is probably futile to speculate now on how these problems might be resolved and how much security should be provided.

There were some comments about "worst case" at the hearing on April 17 and someone suggested that the new fill be dug out and hauled away. This may in fact become necessary, but I doubt it will be necessary and hope it won't be. It would be very expensive and have

other downsides. The trucks annoy the public and the extent of the unsafe steep quarry faces would be increased. I suspect that you don't want to recommend security for this now.

Less Draconian, but still very expensive, would be to dig down to bedrock and build a permanent and watertight wall to contain the new fill. I suspect that you don't want to recommend security for this either with the incomplete information you have now.

Recommendation: Decide now to not recommend approval of any rehabilitation plan before all issues related to the imported fill have been resolved.

Thank you for considering this analysis and the recommendations.

Bill Allen

WATER AND SOIL COMPARISON 04-20-12 rev

All data for MOA Area A from Sorge RIWP of 03-21-11.

Well data from Table 2. Soil data are averages of 72 samples from Table 1.

Six SVOCs with Water Centration Llimits below 1 ppb

Compound	Limit ppb	Well Water Concentrations by Date					Avg Soil Concentration ppm	Water Concentration as Pct of Soil Concentration in Jan 2011
		01-07-10	04-08-10	07-08-10	10-08-10	01-20-11		
Benzo(a)anthracene	0.1	0.46	0.15	2.40	3.10	4.10	0.478	0.86%
Benzo(a)pyrene	0.1	0.29	0.10	2.40	2.70	4.20	0.392	1.07%
Benzo(b)fluoranthene	0.2	0.33	0.12	2.70	3.60	5.20	0.523	0.99%
Benzo(k)fluoranthene	0.5	0.12	0.04	1.00	2.00	1.20	0.159	0.75%
Dibenzo(a,h,)anthracene	0.3	0.04	ND	0.21	0.40	0.49	0.064	0.77%
Indeno(1,2,3-cd)pyrene	0.2	0.14	0.05	0.79	1.50	2.30	0.224	1.03%
Average		**0.23**	**0.08**	**1.58**	**2.22**	**2.92**	**0.307**	**0.95%**