



Fuss & O'Neill Inc. Consulting Engineers

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November 3, 2003

Ms. Shirley Rasmussen
Town Planner
Town of Branford
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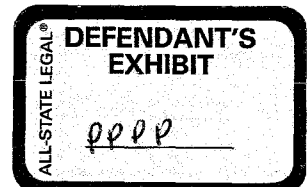
RE: Review of Documents
48-86 Tabor Drive Property
Branford, Connecticut

Dear Ms. Rasmussen:

As requested, Fuss & O'Neill has reviewed the following documents prepared by other engineers and environmental consultants with regard to the referenced parcel:

1. Letter from R. Beniwal, Ph.D. of Applied Earth Technologies, to Mr. Wendell Rice of Seaview Development Corp., dated August 28, 1986; Re: *Soil and Groundwater Pollution Investigation, Casgrove (sic) Parcel, Branford, Connecticut*
2. *Phase I Environmental Site Assessment, 46-86 Tabor Drive, Branford, Connecticut*, September, 1995, Cascio Bechir Engineers
3. *Phase II Environmental Site Assessment for 46-86 Tabor Drive, Branford, Connecticut*, October 1995, Cascio Bechir Engineers
4. *Phase I Environmental Site Assessment, IES Project #801-166, 46-86 Tabor Drive, Branford, Connecticut*, IES of Connecticut, June 15, 2001
5. *Phase II Limited Subsurface Investigation: The Fairways, 46-86 Tabor Drive, Branford, CT*, IES of Connecticut, April 23, 2003
6. Letter from David L. Bramley and Christopher Marchesi of Triton Environmental, to Timothy Hollister, Esq., of Shipman & Goodwin, LLP, dated September 3, 2003; Re: *Environmental Analysis, 48-86 Tabor Drive - Branford, CT*
7. Transcript of David Bramley Deposition (pp. 70 to 95)

Based on these reviews, our experience investigating similar properties, and our knowledge of conditions at the adjacent Town of Branford landfill, we disagree with Triton's conclusions that the "conditions at the Tabor Drive site are suitable for residential use". On the contrary, we believe that the documented presence of impacted soil and groundwater in the area could cause risk to human health should





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the property be developed. The evidence supporting our conclusion includes the following:

- Results of the limited site sampling indicate that both soil and groundwater have been impacted by historical activities. These impacts appear to have resulted both from the migration of leachate from the adjacent landfill property, as well as the deposition of contaminants on the Tabor Drive parcel. The full degree and extent of impacted environmental media is not known.
- Landfill gases pose a potential risk to human health and safety. The long-term characteristics of gas migration from the landfill to the Tabor Drive parcel have not been determined.
- On-site sources of contamination have not been investigated. Previous investigators reported the presence of a variety of potential contaminant sources, including wastes, construction debris, drums, tanks, stained soil, and construction equipment, throughout many areas of the property. The importance of characterizing these areas is especially clear when it is noted that five out of ten soil samples collected and analyzed by IES (2003) were found to contain petroleum hydrocarbons, despite the fact that IES did not specifically target potential on-site sources of contamination. These results suggest subsurface contamination by petroleum hydrocarbons may be widespread on the parcel.

In summary, we have three primary concerns:

1. Potential impacts from the adjacent landfill, including the migration of leachate and methane through the subsurface onto the 48-86 Tabor Drive Property, have not been adequately assessed.
2. Site impacts resulting from past site activities have not been adequately identified and evaluated.
3. Appropriate and relevant cleanup criteria have not been used to adequately evaluate potential risks to human health and the environment.

We discuss each of these concerns in detail below.

1. Potential Impacts From the Adjacent Landfill Have Not Been Adequately Assessed

The presence of the adjacent Town of Branford Landfill raises two primary environmental concerns with respect to adjacent properties. First, groundwater



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migrating beneath the landfill is contaminated by leachate. Second, as the landfill refuse decomposes, gases are generated that can migrate through the subsurface. These concerns include potential risks to human health, safety and the environment as described below.

Leachate Impacts

Over the years, rainwater that falls on a landfill soaks into the cover soil and enters the waste below. This percolating water dissolves a wide variety of organic and inorganic constituents in the waste, forming a liquid known as *leachate*. The leachate drains from the waste until it encounters the water table, where it mixes with the groundwater and spreads out to produce a *leachate plume*. A long-term groundwater monitoring program at the adjacent landfill property has shown that the Branford Landfill generates a leachate plume. Groundwater flow carries the plume contamination northward, beyond the northern property boundary of the landfill and onto the Tabor Drive parcel. Based on the investigations conducted to date, the groundwater in the western part of the Tabor Drive parcel appears to have been impacted by on-site migration of leachate from the landfill. In their Soil and Groundwater Pollution Investigation (1986), AET reported that landfill leachate had impacted groundwater on the parcel. The extent that this leachate plume extends to the north has not been defined.

Many of the contaminants detected in the Branford Landfill leachate plume are classified as volatile organic compounds (VOCs). For example, VOCs detected at MW-1, located at the southern property boundary of the Tabor Drive parcel, have included petroleum-related hydrocarbons, such as benzene, xylenes, and methyl-tertiary-butyl-ether (MTBE). Other VOCs detected at MW-1 include various chlorinated solvents used by industries, such as trichloroethene and tetrachloroethene, chlorobenzene and a variety of compounds that are generated by the breakdown of these solvents, such as vinyl chloride and dichloroethene. VOCs pose a special concern because these compounds can volatilize from the groundwater table and move upward through the soil. In vapor form, the VOCs could then enter structures such as basements, in much the same way as radon gas. With regard to the Tabor Drive parcel, the potential for VOC migration to overlying structures would be of particular concern because of the shallow water table; VOCs present in the groundwater would need to travel only a short vertical distance before encountering a building foundation.

In addition to VOCs, landfill leachate also typically contains heavy metals and high concentrations of compounds containing nitrogen, phosphorus and sulfur. Where such a leachate plume discharges to the ground surface, human contact with the



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contaminants would be possible. Furthermore, the contaminants in discharging groundwater can degrade the ecological value and aesthetics of springs, streams, ponds and wetlands. Commonly, such leachate-impacted surface waters are characterized by the proliferation of iron-reducing bacteria and eutrophication. Eutrophic surface waters often contain an overabundance of algae, and low dissolved oxygen.

Currently available groundwater data for the Tabor Drive parcel suggest that leachate contaminants are at low concentrations. However, it is important to note that the chemical constituents in landfill leachate, and the concentrations of these contaminants, can change significantly over time as a result of dynamic processes within the landfill. For example, the presence of waste containers in the refuse (such as the drums that are known to have been buried at the Branford Landfill), may corrode over time and begin to release their contents years after the containers were first put in place. Thus, in the areas of the Tabor Drive parcel affected by the leachate plume, groundwater quality may become significantly degraded over time as additional source containers begin to leak.

Additional studies are necessary to fully delineate the leachate plumes on the subject parcel. These studies should include accurate surveying of existing monitoring wells, and periodic gauging of groundwater elevations. The Triton letter indicated that the existing monitoring wells were surveyed by Codespoti & Associates using GPS. However, the accuracy of vertical control for this survey is not known. Typical hand-held GPS units are generally reliable for determining approximate X-Y coordinates (i.e., the position on the surface of the earth), but are usually not sufficiently accurate for determining elevation. Thus, before groundwater hydraulic gradients and flow direction can be determined, it is necessary to verify the accuracy of vertical control for the well survey.

Once the groundwater flow regime for the site is better defined, this information can be integrated with groundwater quality data to provide an accurate model of the landfill leachate plume. Such a model can then be used to better define long term trends in groundwater quality and evaluate the suitability of the subject parcel for development.

Decomposition Gas

In addition to the potential for leachate impacts, the proximity of the landfill also raises a question regarding possible migration of decomposition gases through the subsurface. These "landfill gases" can travel laterally through preferential flow paths, such as sandy strata, rubble-filled trenches, etc. Hydrogen sulfide in



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decomposition gas can cause unpleasant odors. Methane can accumulate in the subsurface or enter low-lying areas and structures such as basements or utility trenches. Because methane is highly combustible and potentially explosive, its potential presence is of primary concern in the vicinity of solid waste landfills. We recommend additional testing of shallow soil gas throughout the southwestern part of the Tabor Drive parcel to fully evaluate the potential for migration of methane and other decomposition gases.

As with the leachate plume, the generation and transport of decomposition gases in the subsurface can change over time as a result of changes in physical and chemical conditions. For instance, high concentrations of methane, up to 60% in July 2003, continue to be detected in GP-4 in the vicinity of the landfill garage. For example, the capping of the Branford Landfill (planned within the next two years) will reduce the ability of the landfill to vent these gases upward to the atmosphere. As a result, lateral transport of methane and other gases may increase, resulting in greater likelihood that these gases would migrate from the landfill, accumulate in off-site structures or utilities, and create potential explosive hazards.

2. Site impacts resulting from past site activities have not been adequately identified and evaluated

Based on our review of the referenced reports, we concluded that on-site areas of concern identified during earlier investigations have never been adequately investigated to determine whether releases of hazardous substances or petroleum may have occurred. For example, in their 1996 Soil and Groundwater Pollution Investigation, AET reported the presence of areas of the property "where soil and groundwater contamination may prevail", including "heavy equipment repair areas...new and old fills, and the dredged material." Phase I Environmental Site Assessment (ESA), Cascio Bechir (September 1995) reported the presence of "chemical/fuel storage tanks and drums...at various locations on the parcel", "defunct equipment" and "soil staining", and recommended that "these materials and contaminated soils should be removed from the site and disposed of in accordance with applicable regulations". Cascio Bechir also identified a large area of "construction debris" in the southern part of the parcel, and an "area of fill material" in the northeastern part of the parcel. Cascio Bechir recommended a Phase II Assessment to define impacts of the adjacent landfill and past site activities.

Subsequently, Cascio Bechir conducted a Phase II ESA (October 1995). Although they conducted some soil and groundwater sampling, this testing was very limited in scope. Most borings were drilled in the area immediately north of the Branford Landfill to assess impacts from the landfill leachate. Only three soil borings were



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drilled and sampled in the area of equipment storage and tanks (northwestern part of the parcel); based on Cascio Bechir's boring logs, none of the sampling was conducted in areas where surface soil staining was observed. Moreover, in their Phase II conclusions, Cascio Bechir recommended the following:

...storage tanks, drums, and defunct equipment should be located, contents tested, and units removed from the site for proper disposal in the near future. Soils around and underneath the units should be visually observed and sampled to determine whether releases have occurred to site soils. If releases have occurred, contaminated soil should be excavated and disposed of in an appropriate manner.

Based on these conclusions and recommendations, it is clear that Cascio Bechir believed that wastes remained on the site, that additional investigations were needed to adequately assess environmental conditions, and that soil remediation should be conducted at areas where stained soils were present. However, we have seen no documentation that these tasks were ever conducted. Therefore, we assume that most or all of the wastes, debris, drums and other contaminant sources identified previously remain on the site at this time.

Furthermore, we also note that Cascio Bechir did not conduct any sampling in the large area where "construction debris" was noted in the southern part of the site. Based on Cascio Bechir's mapping, this construction debris is scattered over many acres. We have investigated many such unpermitted inactive disposal sites and found that construction debris often contains a variety of contaminant sources such as old oil tanks, asbestos-containing materials, drums and other wastes. The presence of these wastes often results in soil contamination at concentrations exceeding State standards. In many instances, these contaminant sources present a significant impediment to property development and use. Environmental testing should be conducted at each area where stained soils were noted and at places where drums and tanks were stored or disposed to sufficiently characterize soil and groundwater quality in these areas.

In 2001, IES conducted a second Phase I ESA for the parcel. As with the Cascio Bechir site assessments, IES identified various past site activities as potential sources of contamination. In particular, the presence of various fill piles and quarrying machinery were noted and identified as potential contaminant sources. However, the subsequent Limited Phase II Subsurface Investigation (IES, 2003) did not focus on these areas, partly because of the inaccessibility of most areas of the site. Instead, according to the IES report, of the 14 soil borings installed and sampled, all were designed either to define the extent of potential contaminants originating from the



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landfill or as background sampling locations. No samples were collected to address potential on-site contaminant sources. Furthermore, the soil samples from each boring were generally collected at the water table to evaluate potential contaminants moving with the groundwater, and therefore, would not be suitable for assessing potential impacts resulting from surface releases. Despite these factors, five out of ten soil samples that IES submitted for analysis contained measurable concentrations of extractable total petroleum hydrocarbons (ETPH). Since each of these five detections represents a different potential release area on the property, each release area would need to be adequately investigated to determine whether it presented a potential risk to human health or the environment. In addition, there were unexplained concentrations of tetrachloroethylene, an industrial solvent and suspected carcinogen, in four soil samples (B-3, B-4, B-7 and B-8).

It should be noted that the same overgrown conditions that preclude access to the property for sampling also tend to mask environmental impacts. The thick growth of trees and shrubs would be expected to hide stained soils, drums, tanks and other debris formerly identified at the property. We have seen no documentation that any of these conditions were ever addressed by remedial efforts; thus, we assume that these wastes remain on the property.

A representative sampling program may require several dozen borings to adequately evaluate the potential for contaminants in the debris. Because the nature of the wastes deposited in the debris disposal area is not well known, potential constituents of concern would include, at a minimum, petroleum constituents, (i.e., ETPH), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals and polychlorinated biphenyls (PCBs). Moreover, to fully address the potential risks to human health and the environment, these analyses should include measurements of both the total mass concentrations, as well as the concentrations of leachable contaminants determined using the synthetic precipitation leaching procedure (SPLP). Finally, to assess the possibility that the wastes disposed of on the property must be managed as "hazardous waste" (as defined in Federal regulations), samples in which contaminants are detected will also need to be analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) method.

3. Appropriate and relevant cleanup criteria have not been used to adequately evaluate potential risks to human health and the environment

Triton has stated that the Connecticut Remediation Standard Regulations (RSRs) do not apply to the parcel because the site is not subject to the Connecticut Transfer Act and is not under other Department of Environmental Protection (CTDEP) order or regulatory program. While this is currently true, our experience has shown that the



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cleanup criteria of the RSRs are generally accepted for gauging potential effects to human health or the environment at sites where contaminants have been released. Therefore, the RSR criteria are commonly used as relevant and appropriate standards for soil and groundwater quality for environmental investigations in Connecticut, regardless of whether the subject site is officially subject to the RSRs.

With regard to the Tabor Drive parcel, we believe that compliance with the numerical criteria of the RSRs would be appropriate prior to any development, particularly if such development were to include residences. Moreover, the subject parcel appears to have been used for unpermitted waste disposal over a long period between the 1960s and 1980s. As such, this property could easily become the subject of a DEP order. For example, the documented presence of disposed construction debris, tanks, appliances, furniture and drums could prompt involvement of the Connecticut DEP's Solid Waste Bureau. Alternatively, the reported stained soils and detection of petroleum hydrocarbons in the site soils could result in enforcement by the Department's Permitting and Enforcement Division; such a scenario would be likely if property development (grubbing, re-grading) were to reveal the presence of any buried drums, tanks or other wastes. Given the past history of the site, we consider this scenario a very real possibility. In addition, if any of the wastes that were disposed of on the property are determined to be hazardous, as defined by Federal regulations, the property would then meet the definition of "establishment" and would be subject the Connecticut Property Transfer Act upon transfer. Finally, if any person were to file a complaint with the State regarding the property, DEP would be obligated to respond and could issue an order for investigation and cleanup. As a result of these factors, we believe it would be prudent to demonstrate compliance with the RSRs prior to development.

Perhaps because they recognized the general acceptance and use of the RSRs, both Cascio Bechir and IES had used these baseline numeric criteria as a relative gauge of impacts for soils and groundwater at the Tabor Drive parcel. However, it is important to note that comparing soil and groundwater data to these criteria without adequate site characterization is inappropriate. Instead, if a Phase II investigation indicated that a release had occurred, a Phase III investigation is warranted to delineate and characterize this release area and to assess its impacts to soil and groundwater. Only after such a characterization is complete can the concentrations of contaminants within the release area be compared to the numerical RSR baseline criteria.

We agree with Triton and IES that the groundwater protection criteria are not relevant standards for the property since the area is classified by the State as "GB", and therefore, is not designated for use as a drinking water resource. Assuming



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ultimate development of the property for residential housing, the relevant RSR standards for soils would include the residential direct exposure criteria (Res DEC) and the GB pollutant mobility criteria (PMC); the relevant standards for groundwater would include the surface water protection criteria (SWPC) and the residential volatilization criteria (Res VC). Because groundwater contaminant plumes can be unpredictable, future groundwater monitoring at the property over multiple events would be necessary to adequately assess long-term changes and seasonal variations in groundwater quality.

Conclusions and Recommendations

Based on our reviews of available information and our knowledge of the landfill property, we conclude that the existing data do not support Triton's conclusion that the Tabor Drive parcel is suitable for residential development.

Given the existing conditions and the many data gaps in the understanding of environmental conditions, additional investigations are necessary to determine the suitability of the subject property for development. The scope of the additional studies should include:

- Updated Phase I ESA to identify and accurately locate all potential recognized environmental conditions (RECs), such as waste piles, drums, tanks, areas of soil staining and former equipment storage areas.
- Supplemental Phase II soil and groundwater sampling to ascertain if releases have occurred at all potential RECs; in particular, this sampling should include testing of all areas where previous studies have identified wastes, drums, tanks and other debris, as well as any areas where stained soils were documented (Cascio Bechir, September 1995, October 1995; IES, 2003).
- Laboratory analyses of soil and groundwater samples for all potential constituents of concern at all potential release areas.
- Phase III sampling of all impacted environmental media (e.g., soil, soil-gas, groundwater, surface water and sediment) to fully delineate and characterize all release areas and contaminant plumes on the site, and comparison of contaminant concentrations to appropriate RSR criteria.
- Supplemental soil-gas sampling to evaluate the potential for methane and volatile organic compounds to affect future construction projects



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Following completion of the Phase III ESA, the complete representative data set can be evaluated with respect to applicable criteria and the suitability of the site for development can be evaluated. This evaluation should be conducted within the framework of the Conceptual Site Model (CSM) procedures detailed in the Connecticut DEP's draft Site Characterization Guidance document. The CSM provides a means by which to identify and explain the factors that control the presence and migration of a contaminant in the environment. Properly applying the CSM procedure to environmental studies ensures that the data that are collected are scientifically defensible. From the standpoint of a property owner or developer, the information developed through the CSM process will provide assurance that the investigation has adequately identified any conditions that could potentially pose a threat to human health or the environment.

Should you have any questions regarding this letter or require additional services, please call.

Sincerely,

Robert M. Danielson, LEP, CPG
Senior Hydrogeologist

David F. Hurley, LEP, PG
Vice President

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