**Town of Hampton Concerns Regarding Future efforts at the Coakley Landfill**

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1 December 2017

The tens of millions of dollars that have been spent in the closure of the Coakley Landfill has been routinely mentioned by the Coakley Landfill Group (CLG) and regulators. While it is recognized that the CLG is taking responsibility in addressing the contamination issue, it is also readily apparent that cost decisions are constantly being made. These include value engineering decisions to: understand the nature of contamination, make progress on remediation, and be cost effective to the CLG members. In all of the documents reviewed to date, no cost has been mentioned to describe the value of human life or of human health. Health risk assessments were, and continue to be, performed obeying traditional methods, however letting the public know that there is less than a one in a million chance that contaminants from the landfill will result in future health issues yields little solace to community members who must bear this involuntary risk. At the same time, the health risk assessments are performed under limited knowledge of pollutant pathways, contaminant toxicity (especially with the class of emerging contaminants), pollutant sources, cumulative exposure, and original pollutant mass. The original health risk assessments in the Remedial Investigations (RI) and the Management of Migration (MOM) documents did not include emerging contaminants, and to this date the cumulative environmental health risk assessment is unconvincing in addressing cumulative risk due to uncontrolled contaminant plumes and multiple exposures.

EPA is now on record that they do not see the need for additional wells to the southeast of the landfill. This seems very interesting and counter intuitive since it was in the late 1980's that private homeowner wells to the southeast first complained to the State of NH about pollution in their wells. Obviously a contaminant plume from the landfill moved to the southeast before the landfill was ever closed, and that plume would have continued to move away from the landfill barring any active remediation away from the landfill such as a pumping strategy. The movement of contaminants radially away from the landfill, in both overburden and bedrock, is well documented in the past studies of the landfill, to wit:

> "*A second complaint was received in early 1983 by the New Hampshire Water Supply and Pollution Control Commission (WSPCC) regarding the water quality from a domestic drinking water well. Testing revealed the presence of five different COCs.* Coakley Landfill Management of Migration (O.U.2), NH, 30 Sep 1994, page 5.
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> *A subsequent confirmatory sampling beyond these initial wells detected VOC contamination to the south, southeast, and northeast of the Coakley landfill."* Coakley Landfill Management of Migration (O.U.2), NH, 30 Sep 1994, page 5.

*"The Coakley Landfill is located on the drainage divides of Berry's Brook, Bailey Brook, and the Little River watersheds."*

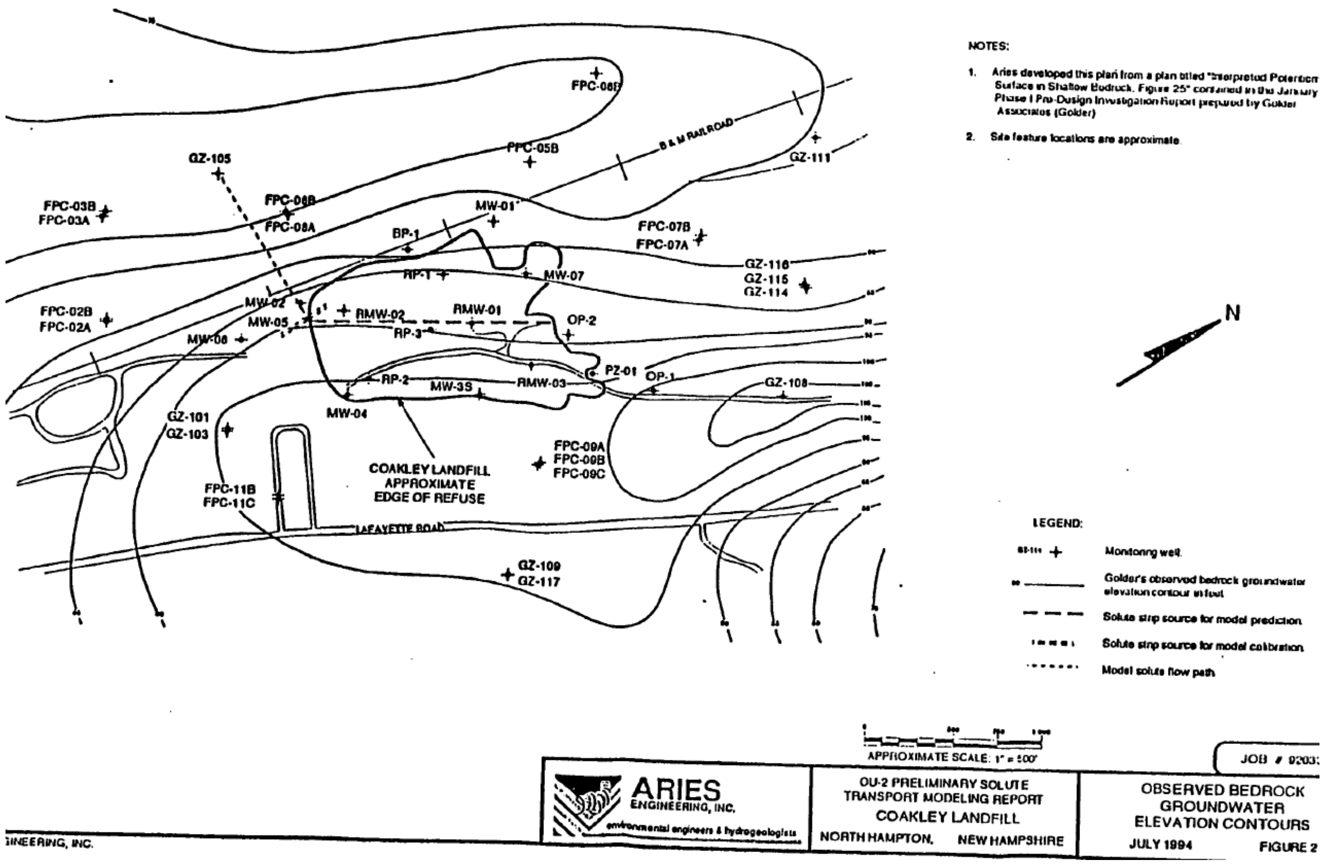
*"...groundwater movement within the overburden materials occurs in a generally radial manner from the landfill proper."*

*"Groundwater within the bedrock hydrogeologic unit is presumably recharged by downward vertical flow from the overburden hydrogeologic unit and through fractures where bedrock outcrops exist."*

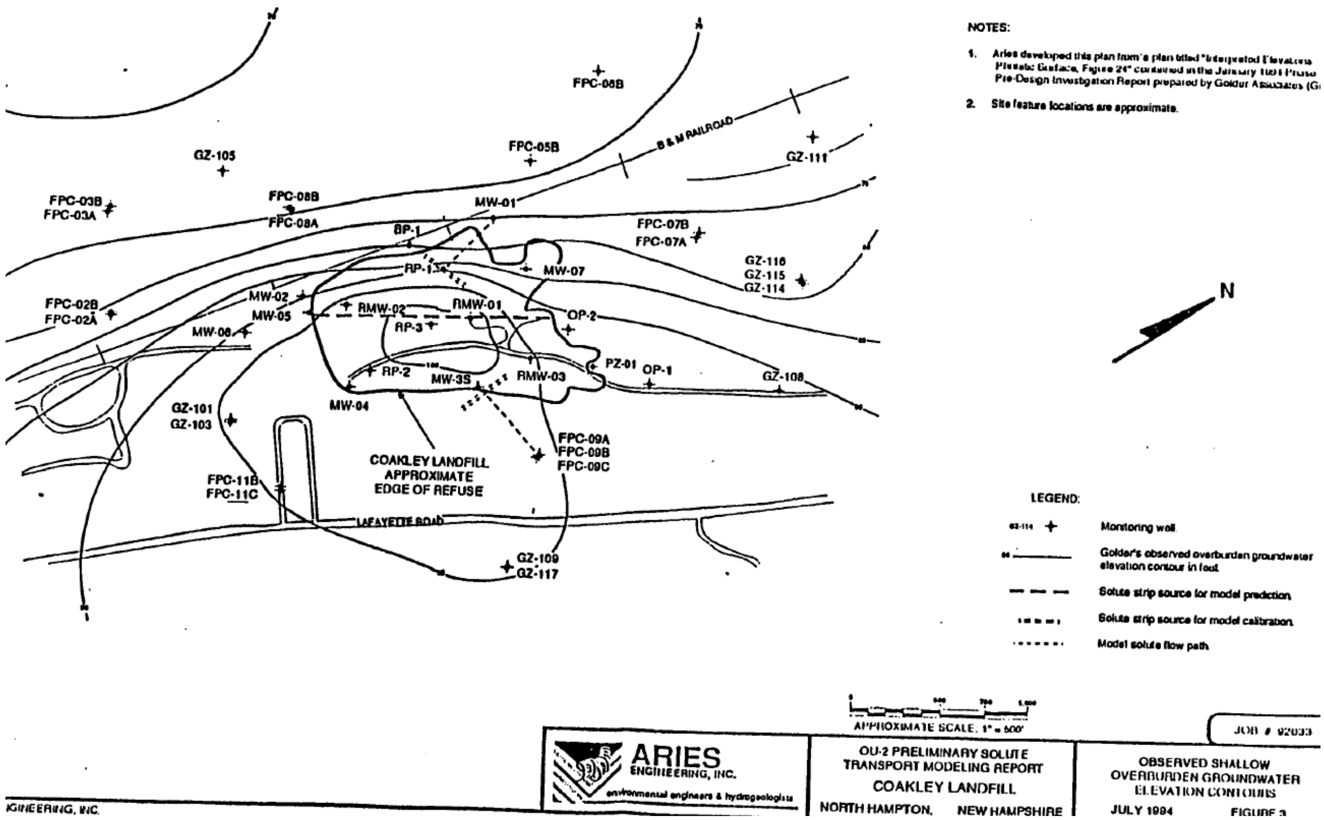
Remedial Investigation Coakley Landfill North Hampton, NH Volume 1 October 1988, pages 4-5.

*"Coincident with landfill operations, rock quarrying was conducted at the Site from approximately 1973 through 1977. Much of the refuse disposed of at Coakley Landfill was placed in open (some liquid-filled) trenches created by rock quarrying sand and gravel mining."* Coakley Landfill Management of Migration (O.U.2), NH, 30 Sep 1994, page 4.

*"Portions of the landfill lie directly on fractured bedrock..."* Coakley Landfill Management of Migration (O.U.2), NH, 30 Sep 1994, page 2.




Bedrock Piezometric Head Map. Coakley Landfill Management of Migration (O.U.2), NH, 30 Sep 1994




Overburden Piezometric Head Map. Coakley Landfill Management of Migration (O.U.2), NH, 30 Sep 1994

While the radial flow direction of the uncontrolled pollutant plumes from the Coakley landfill was recognized early on (also interpreted from the previous two figures), additionally, groundwater pumping was thought to be one physical reason for the plume trajectories:

> *"The primary directions of groundwater flow from the Coakley Landfill are southwest, west, and northwest toward the wetlands. And east to west groundwater divide directly west of the landfill causes groundwater to flow south toward North Road and presumably north toward Breakfast Hill Road. Residential and commercial pumping, occurring prior to the installation of public water supplies, altered the natural hydraulic system. EPA considers this pumping to be the primary reason for contaminant migration south, east, and northeast of the landfill."*

> *"Overburden groundwater flow appears to be radial from the Coakley Landfill and vertically downward into the bedrock aquifer. Surface drainage is also multidirectional since the landfill is near the headwaters of Berry's Brook to the north and the Little River to the south. Flow within the bedrock aquifer is a function of interconnected fractures and is affected locally by hydraulic gradients induced by bedrock water well usage within the area.*

*At least one major fracture system positioned in a south/southeast direction has been documented to interconnect with the Coakley Landfill. This is located in the south/southwest boundary where substantial recharge to the bedrock aquifer may be occurring.* Coakley Landfill Management of Migration (O.U.2), NH, 30 Sep 1994, page 1

*"…The bedrock recharges to the wetlands west of the landfill. Direct leachate discharge to the bedrock may take place beneath parts of the landfill, since the refuse is in direct contact with bedrock in areas where rock quarrying had previously occurred."* Coakley Landfill Management of Migration (O.U.2), NH, 30 Sep 1994, pages 3-4.

The local hydrology at and near to the Coakley Landfill moves radially away in both overburden and bedrock. However regionally, gravity directs all, and that means that ultimately the groundwater and surface water will flow east towards the ocean. Groundwaters that flowed west, south, or north will recognize this regional driving force and slowly change directions to flow east. It is not clear that either the RI or MOM documents explored the nature, significance, and impact of regional large groundwater withdrawals.

Bedrock groundwater flow modeling (Mack, 2008), that included the existing large groundwater withdrawals, demonstrated that in the vicinity of the Coakley Landfill, groundwater flows to the south and east (see next Figure).

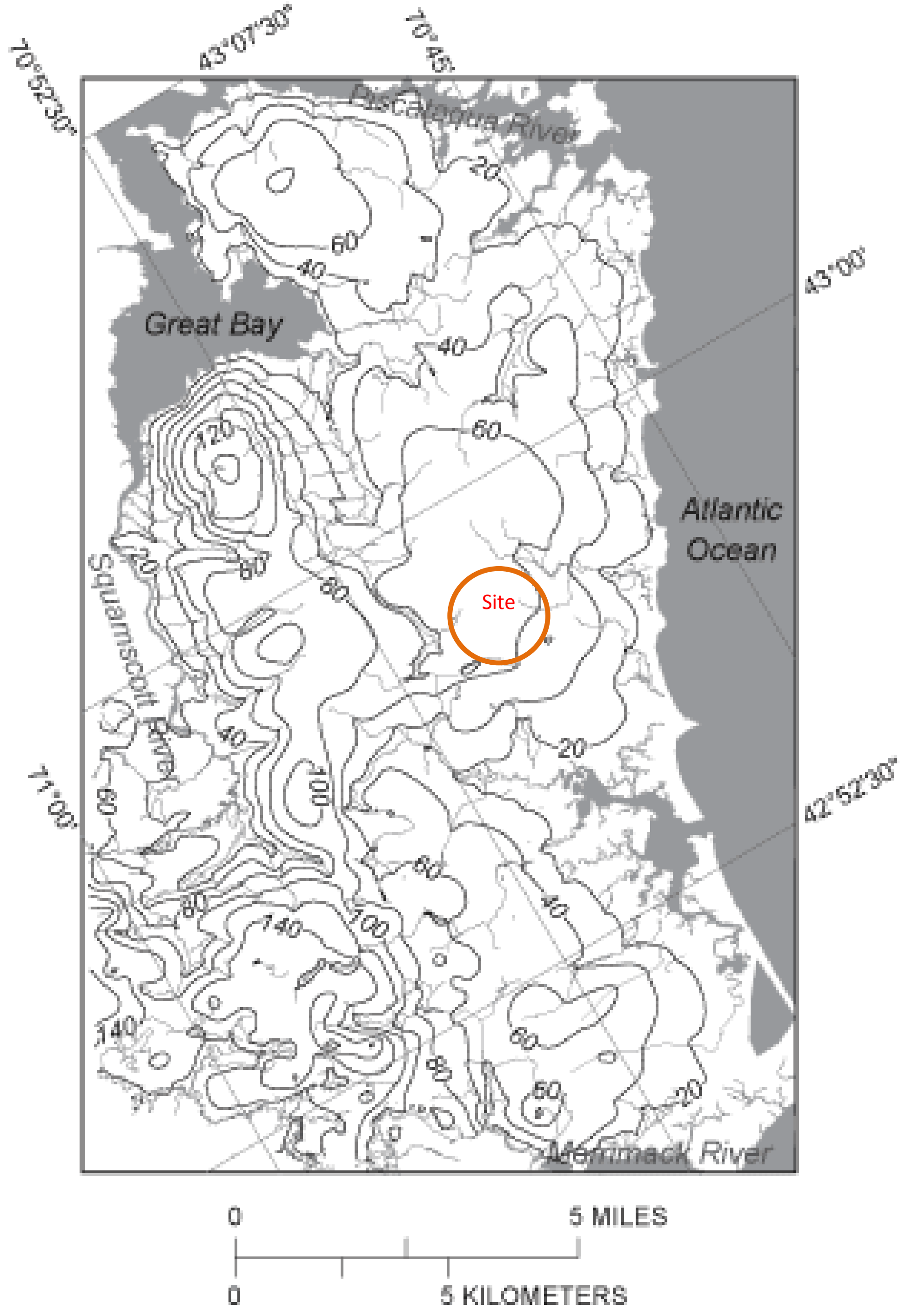



Figure 4. Simulation of preliminary bedrock-aquifer head contours in the seacoast area.

Mack, T. J., 2008, Assessment of Ground-Water Resources in the Seacoast Region of New Hampshire, USGS SRI 2008-5222.

The historic studies (RI and MOM) demonstrated that the Coakley landfill sat at the top of the hill and pollutants radiated away from it in both surface and bedrock.

Until recently, PFCs were not tested for in groundwater samples. The ROD had no performance standard for PFCs. It is very likely that PFCs from this site moved far from the property boundary over the last four decades. As the landfill plume is decades old, looking for PFCs close to the landfill itself misses the reality of where the contaminants may be today.

Given the millions of dollars that the CLG has spent, and the many thousands of dollars they collectively annually pay for basic commercial insurance, requesting monitoring that addresses contamination in public water supply wells is comparatively a very small expense and represents the best insurance against making decisions with imperfect information. Such wells will provide information that has escaped the studies to date. Put another way, individual CLG entities each carry insurance. They are willing to pay these premiums as a cost of doing business and to limit overall liability. To put the cost and rationale for the monitoring wells in context: the additional wells provide an insurance policy should they come up clean, and their cost is not even on the order of what CLG members collectively pay for general insurance now.

From the slides of the bedrock plume in the 15 November 2017 CLG/EPA presentation at the North Hampton, NH Town Hall (slides 24, 26, 28, and 30), there clearly appears to be a plume of pollutants moving in the bedrock to the west and then turning south. These slides are snapshots of the plume today. Curiously, no similar plume maps appear in the ROD or MOM documents. It is quite possible that contaminants moved great distances from the landfill prior to closure as well as afterwards in the absence of aggressive plume mitigation measures, especially in light of the EPA conclusion that pumping dramatically affected plume movement as well as the USGS modeling that demonstrates regional bedrock groundwater flow to the south and east. More troublesome is the possibility that the existing monitoring well network Provides “goalposts” through which a plume may migrate undetected.

This past summer, a public water supplier (Aquarion Water Company of New Hampshire, Inc.) had one of its major wells (Well 6) shut down due to PFC contamination. This supplier provides drinking water to Hampton, North Hampton, and Rye, NH. The well that has been lost produced just over 65 million gallons per year. This was an overburden well. Nearby there are four other Aquarion wells, some bedrock, that combine to pump an additional 219 million gallons per year. The Coakley Landfill studies have clearly demonstrated that there is an intimate connection between overburden and bedrock groundwater. The combined draw from these wells is manifested in the USGS modeling study results.

Recently, this water supplier has recognized that it has insufficient supply and storage to meet the immediate and growing water needs for these three communities it serves. The shutdown of Well 6, which supplies between 4% and 5% of the Aquarion system’s water has exacerbated and magnified this water shortage. Aquarion is now actively seeking to put on line a bedrock well in this same vicinity as its other wells and has been approved to conduct pumping tests at a rate in excess of 1.3 million gallons of water daily; DES has recognized that PFC contamination may be drawn into this well and is requiring monitoring for this and other contaminants.

The communities served by Aquarion water and by private wells are now caught in the precarious position of not owning the water company and residing immediately downgradient of the landfill plume. The communities are requesting additional monitoring wells to the south of the landfill and in line with the source areas (wellhead) of the shut down well and the other production wells. The initial regulatory response to this request is that the Coakley landfill is not the source of the PFCs that shut down the well. Yet all of the groundwater data that exists argues against this simplistic conclusion. In addition, the regulatory response has been that there are other PFC sources much closer to the shut down well. While this may be true, the PFC concentration in the well is a CUMULATIVE metric: it represents the totality of all sources. Neither the CLG nor the regulatory community have demonstrated that PFCs did not come from the Coakley landfill and that such a source is not what resulted in the shut down well concentration to exceed regulatory limits.

The request for additional monitoring wells is technically based in the data. The costs of the wells and their monitoring are not an onerous burden on the CLG in comparison to their present-day annual expense. Such monitoring needs are not indefinite, and will serve either to support or reject the present day conceptual hydrologic model for the landfill plume. If the community well contamination found in these new Coakley monitoring wells is due to the Coakley landfill, not only is this money well spent, but it helps the communities determine how best to address the problem. If the community well contamination found in these new Coakley monitoring wells are due to another source, the CLG has the ability to recoup these costs. Either other PFC source owners or possibly the private water company could take over these wells for their own monitoring purposes.

The requested monitoring wells should be well couplets that assess conditions in overburden and bedrock strata. They will not only supply water samples, but also water level information. These wells necessarily should be to the south and southeast of the landfill. In addition, the stream samples being made now and in the past would be enhanced with thermal surveys (to clearly delineate zones of groundwater discharges) and streambed piezometers (to sample the groundwater discharge prior to reaching the hyporheic zone).

In summary, telling communities that they are below an action level of risk for cancer is not satisfactory nor is it consoling especially when decisions are being made with inadequate data. There seems to be no solid ground not to err on the side of caution: the loss of a large supply of public water is not only a public health issue, but also an environmental justice issue.