Case Study: VC10

Vertebrae Well Systems for Risky Gaps

SITE
Former Elegance Dry Cleaner - Orlando, Florida

CONTAMINATION
Dissolved solvent constituents (mostly perchloroethylene and trichloroethylene) were estimated to impact approximately 185,000 square feet (deep zone, approximately 25 ft bls). The surficial shallow plume (41,000 square feet) begins on-site under the building and travels down under the adjacent roadway and property. The below figures show the shallow zone groundwater sampling impacts before and after Vertebrae™ Well Systems (VWS) installations.

OBJECTIVE
The design involved three shallow and four deep VWS utilizing 84 independent well segments to provide targeted in-situ chemical oxidation to the two layered plume. This case study illustrates how VWS can be efficiently utilized for High Resolution Containment Distribution (HRCD), regardless of the built environment and utilities. The deep zone is not shown by this case study for brevity.

BACKGROUND
The Elegance Cleaners operated from 1989 to 1994. During a recent property transaction in 2016, a site exploration and sampling event found apparent contamination. This was investigated and delineated in 2016 and 2017.

Figure 1

INSTALLATION DETAILS
The shallow VWS were installed under the building and parking lot and the deep VWS were installed under the building parking lot, highway and adjacent property. The VWS were installed at the rear of the site and in the right of way which eliminated business disruption while allowing complete coverage of the 700 foot long dissolved plume. Installation of the VWS were completed over two and half weeks including development activities. The 84 well segments were each 20 feet in length constructed with 1-inch nominal HDPE screens and geotextile with half inch riser tubing to the surface.

SAMPLING RESULTS
Prior to the installation of VWS the impact was characterized by Geo-probe® groundwater sampling and a limited number of vertical wells (Figure 1). Sampling of the VWS revealed significant source area, previously unidentified as also shown in Figure 1. The estimated mass was 8 times more than the initial contaminant site model (CSM) indicated. The data provided HRCD iso-contours pinpointed the mass directly under the building where treatment and data collection was unattainable by other tools.

TYPICAL FINDINGS – GAP TYPES

The VWS derived results from this site are similar to many other sites in our experience. Quite often, serious data gaps exist to a much greater extent than originally believed. In essence, "it comes with the territory, because before the advent of horizontal wells, the tools for proper site characterization were lacking. Consequently, we have made a difference in this industry-wide shortcoming by creating more accurate CSMs.

TABLE 1

Recent Sites With Vertebrae for Gaps			
Site	Initial Mass Estimate	Updated Mass Estimate	Mass Change
Light Industrial SW FL	820 (lbs)	7,022 (lbs)	8.56 X
Elegance Orlando FL (S)	10	82	8.20 X
Elegance Orlando FL (D)	64	44	-0.68 X
Fed Site (SE US)	3,120	16,290	5.22 X
C-Store Pensacola, FL	19	37	1.95 X
C-Store Milton, FL *	785	1,406	1.79 X

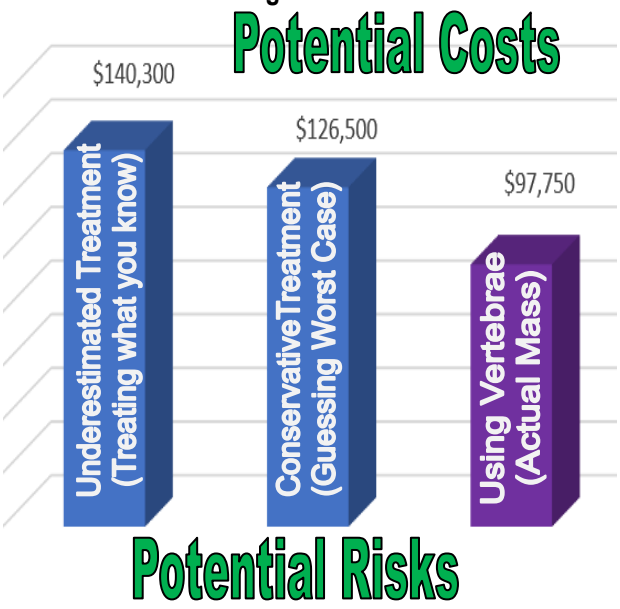
It is important to note that some of these sites did not have perceived gaps. With reference to Table 1, for the Pensacola, Milton, and the subject of this case study (Elegance), data was collected where monitoring wells were at 'normal spacing' yet mass was greater than estimated in between. Therefore, we need to address two data types:

- Obstacle Gaps (where data is inaccessible, known)
- Spacing Gaps (unknown mass between data points)

COST DISCUSSION

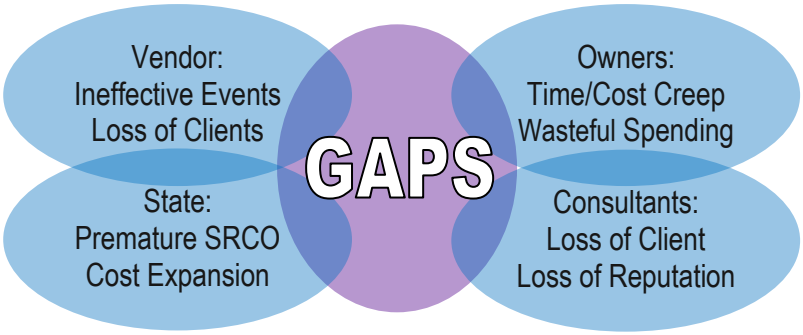
Failure to properly characterize the mass is a major issue in the environmental industry. We all fight the need to keep cost down during assessment and try our best to find all the mass, but to say it is elusive is an understatement. Further, it is always problematic that a host of obstacles exist to impede our ideal layouts. This is where **Vertebrae offer a significant advantage and always saves money!** This is illuminated in the examples cited in Figure 2. For instance, a site (also in Orlando) was used for analysis of cost comparison for a data gap of 80 x 100 ft under a building and treatment. Three cases were examined; 1) trying to over treat and guess the area that was moderately contaminated, 2) treating only what was known, 3) installing VWS to find out and treat precisely as possible. The cost comparison shows VWS saves cost over both alternatives.

Figure 2



RISK RECEPTORS (ALL OF US)

Also in Figure 2, we see that the value of data helps everyone! Each party has some risk when an area of the site is left unexplored and standard procedures fail. Given the nature of the unknowns, HRCD sampling provides a solution to limit the risk, whether it is perceived or not.



CONCLUSIONS

Vertebrae is an excellent tool for exploring unknown areas of the site. It is also an excellent tool to provide better coverage in open areas of the site. Utilizing VWS in both situations reduces cost and helps protect all of us from the risk of inadequate and inaccurate CSMs. **As more sites utilize Vertebrae for assessment CSMs will improve.**