RAMBOLL

ENVIRONMENT
& HEALTH

Ms. Wanda Washington
FOCUS
PO Box 28
Tallevast, FL 34270

Re: Review of AECOM's 2023 Remedial Action Status Report for the Groundwater Recovery and Treatment System, Tallevast Site, Florida

December 12, 2023

Dear Ms. Washington,

At your request I have reviewed the latest *Remedial Action Status Report for Groundwater Recovery and Treatment System* (AECOM; October 2023) for the Tallevast Site. This report describes the past and then-current ground water conditions beneath and around the Lockheed Martin Corporation (LMC) facility on Tallevast Road in Manatee County, Florida (the "Site"), and covers the operating/reporting periods of September 2022 through August 2023. The ground water in aquifers beneath the Site and surrounding areas has been undergoing remediation since 2013, by pumping/treatment to remove contaminants (principally 1,4-Dioxane [1,4-D] and certain chlorinated volatile organic compounds, or CVOCs) that were previously released from the LMC facility by a predecessor operator. Having completed my review of this report, I would offer the following observations and recommendations.

Ramboll
10150 Highland Manor Drive
Suite 440
Tampa, FL 33610
USA

T +1 813 628 4325
F +1 813 628 4983
https://ramboll.com

Overall, the ground water recovery and treatment system being operated by AECOM for LMC continues to generally perform within the operating parameters contained in the approved RAP and operating permits for the Site. By this statement I mean that ground water continues to be recovered and the treatment system is successfully removing contaminants from the water (approximately 17.7 lbs. of contaminants were removed in the 2023 reporting period) before it is disposed to the ground water reinjection systems, or to the county sewer. This is about 70 percent of what was removed in the prior reporting period. This persistent year-over-year decline is consistent with the asymptotic behavior of this type of remediation system, which my predecessor (Dr. Varney) noted as a concern prior to the RAP approval and which I have raised in past reviews. As more contaminants are removed, the annual removal rate slows down. This pattern is normal and expected and demonstrates that these types of remediation systems are not particularly efficient in removing contaminants in the latter stages of a remediation project when diffusion from finer grained sediments in the aquifer zone becomes a more limiting process. For this reason, Dr. Varney and others continually advocated for a secondary treatment technique to be performed along with the pump and treat system.

LMC's groundwater monitoring/testing in 2023 indicates that the contaminant plume in the USAS aquifer declined from 45 acres in 2022 to 40 acres in 2023. The progress in plume size reduction in the USAS likely reflects the more efficient flushing of COCs in the shallow water table zone from seasonal infiltration of clean rainwater percolating through the overlying soil, working in concert with the GRTS pumping. Essentially, the shallow water table receives an enhanced flushing benefit from the natural rain cycle in addition to any pumping being done in this zone.

The most widespread contaminant in the USAS is 1,4-D, which historically spread to the north of Tallevast Road and to the southeast. Low levels, above the GCTL, remain in both areas, although the area to the southeast has exhibited notable shrinkage in the past two years. This is probably due in part to the increased containment and flushing facilitated by seepage of clean water from the Amazon stormwater pond on adjoining property to the east. Some CVOC contamination also remains in the USAS, primarily to the east of the LMC property, south of Tallevast Road, and to a much lesser extent, immediately to the south.

In the deeper confined aquifer units, removal of COCs has continued and the overall size of contaminant plumes are trending downward, however this removal has proven to be more difficult and slower acting due to the smaller amounts of clean water available for flushing. Contamination in the LSAS remains the most widespread. The plume boundary in the LSAS declined from 90 acres in 2022 to 82 acres in 2023. Like the USAS, the overall plume boundary in the LSAS is primarily defined by 1,4-Dioxane, which historically spread to the north of Tallevast Road, to the east and southeast, and beneath the golf course to the southwest. Concentrations of 1,4-D remain relatively high (e.g., above 100 ug/L) in several areas of this aquifer well beyond the LMC property. Significant areas of the Arcadia Formation, lying immediately beneath the LSAS, are also contaminated, with the plume measuring about 46 acres in size, again defined primarily by the spread of 1,4-D. As the contaminant plumes in the shallower USAS are resolving, the 1,4-D contamination in these next two deeper aquifers is emerging as the most widespread and recalcitrant contamination remaining beneath the Site today.

The remaining plumes of contaminants in the deepest Salt & Pepper Sands are small and primarily confined to the LMC property. This plume boundary is more-or-less consistent as compared to 2022 data.

With regard to individual areas of the plumes, I would provide the following more-specific observations:

Southeast Area near PZ-USAS-19

Thes area southeast of the LMC facility (and off the southwest corner of the new Amazon facility property) is where 1,4-D has historically been detected in piezometers (e.g., PZ-USAS-19) at concentrations above the GCTL of 3.2 ug/L. This area was investigated in 2021 by DPT probes of groundwater in the USAS aquifer, which revealed low levels of 1,4-D primarily existed in the lower portion of the water table, just above the hard streak, and extended an additional several hundred feet beyond PZ-USAS-19 to the south-southeast. Additional sampling of the piezometers in this same area in February 2021 showed 1,4-D in piezometers PZ-USAS-15, -17, 18, and 19, respectively, at concentrations well above the applicable GCTL. Other targeted Site-related COCs

(primarily CVOCs) were reported at low concentrations (i.e., below the GCTLs) to ND in this same area. This southeastern USAS 1,4-D plume likely traces back to the area just east of the LMC facility, where 1,4-D has historically been much higher (i.e., over 1 mg/L at the start of the GRTS in well MW-27 circa 2013).

FDEP required and LMC constructed 12 new monitoring wells in the southeast area in June 2022 (nine in the USAS and three in the LSAS) in accordance with FDEP approved workplans. Water level measurements in August 2022 in these wells indicated the capture zone from horizontal galleries, which are pumping farther to the north in the USAS, extends to the vicinity of PZ-USAS-19 and encompassed the region where 1,4-D currently exceeds the GCTL in the USAS[1] (see 2022 RASR Figures 8 and 13A). In the deeper LSAS aquifer, water levels were measured to be 4-5 feet lower than in the overlying USAS in the three new monitoring wells, confirming at least the potential for 1,4-D to migrate through the hard streak separating these two aquifers. These new USAS wells were first tested for COCs in the August 2022 sampling event.

Overall, the new and historic data indicates the main body of the 1,4-D plume in this southeast area of the USAS is stable and contained by the historic pumping of the galleries to the north, and the more recent infiltration of water from the Amazon stormwater pond. It is noteworthy that the concentration in PZ-USAS-19 declined sharply in 2022 to a range of 1.4- 2.5 ug/L from a high of 11 ug/L the prior year (see Figure 13A of the 2022 RASR). This was a recent reversal of the historic trend for this well and may reflect the dilution and dispersal of 1,4-D along the southern-most edge of the plume by clean storm water infiltrating from the new Amazon storm water pond located just to the north of this piezometer.

This trend continued in the more recent 2023 RASR data. Concentrations of 1,4-D in PZ-USAS-19 are now reported as 2.6 ug/L (as compared to 2.5 ug/L in 2022), but other wells to the south of the Amazon pond are all now reporting ND. Similarly, concentrations of 1,4-D in PZ-USAS-18, immediately to the west of pond, are now reported as 1.9 ug/L, significantly lower than the 22 ug/L reported in February 2021[2]. Concentrations in PZ-USAS-17, located slightly farther to the northwest are now reported as 24 ug/L, which is also somewhat lower than the 38 ug/L that was reported in February 2021. This new information, along with the water level data from February 2022 (reported in the 2023 RASR, Table 14) demonstrates that the seepage of clean water from the Amazon pond is helping to contain and flush 1,4-D from this most southeastern area of the 1,4-D plume. The current GCTL exceedance lies between PZ-USAS-17 and PZ-USAS-18, which now defines the southeastern extent of the USAS plume boundary. Continued monitoring of these piezometers will be important in the future to track the progression of this 1,4-D plume in the southeast area, as the wells LMC constructed farther south no longer describe the active boundary of the contamination.

Water levels were not reported in the August 2023 water level survey in five piezometers/wells located in the southeast area. Apparently, based on my recent conversation with Paul Calligan, the casings for these wells were extended to a higher elevation in the late Spring of 2023 to facilitate the construction that was beginning on Project Woodworking in this area[3]; and the new

[1] Lower concentrations, below the GCTL, were found outside the capture zone farther to the south.
[2] There were no measurements of COCs in this well in 2022.
[3] This information was later confirmed in the 2023 RASR Addendum 1, issued on October 27, 2023.

casings had not yet been resurveyed by August to allow for accurate water level reporting. Water samples were collected from these wells for chemical analyses a week later in August 2023 however, the results of which were reported in the 2023 RASR.[4] It is important that the modification of these wells and their resurvey be completed soon to allow for accurate water level reporting in the next water level survey in early 2024.

Like in the USAS, the LSAS capture zone has been interpreted by AECOM to extend sufficiently far to the southeast to also encompass the GCTL exceedances, but like I noted in last year's RASR review comments, the boundary control on the LSAS 1,4-D plume in the area is poor. Consistent with my recommendation, LMC has agreed to construct a new LSAS well near MW-260 to hopefully close this monitoring gap, but apparently this construction has been delayed by the ongoing construction work at Project Woodworking in the area around wetland RW-3. This new LSAS well is a continuing, ongoing need that should be completed as soon as possible, because without this data the current extent of the 1,4-D LSAS plume in the southeast area is unknown and poorly defined.

East of the LMC Facility near MW-27 and MW-28

This area is about 300-500 feet east of the LMC facility and is the location of two infiltration galleries (EW-2103 and -2104) that collect groundwater and COCs in the USAS aquifer. Contaminants are being drawn to this USAS collection system from the surrounding area, extending west to the eastern portion of the LMC property and east to the Amazon property. Portions of this area remain a significant region of 1,4-D contamination in the USAS, particularly west of gallery EW-2103 and to the south to near PZ-USAS-17, however concentrations of 1,4-D have moderately declined in the eastern portion of the area over past year. Concentrations farther to the east/northeast of the galleries are now low to ND.

Similarly, USAS concentrations of CVOCs in monitoring wells west of gallery EW-2103 remain above GCTLs but have also continued to decline over the past year. Concentrations in monitoring wells east of the galleries, extending to the Amazon property, are mostly non-detect for CVOCs. This data collectively indicates that the cleanup of the USAS in the areas to the east/northeast of the galleries is approaching completion; but west of the galleries, significant concentrations above the GCTLs still persist.

I also note that LMC restored some recharge to the TW-6 wetland via infiltration gallery RC-7002 in January 2023 to a level approximately half of the pre-2019 norm. No explanation has been provided in the 2023 RASR or Wetlands Monitoring Report (WMR) as to how this new, seemingly lower rate of recharge was determined. Throughout most of the monitoring period covered in the 2023 WMR the wetland remained dry at the surface in spite of this renewed recharge.

Generally, concentrations of 1,4-D and CVOCs in the deeper units (beneath the USAS) in this area meet the GCTLs east of the galleries, but remain above GCTLs farther west, extending back to the eastern boundary of the LMC property. These COC are being controlled/removed by deeper pumping systems.

[4] The "depth to ground water" from the top-of-casing were also recorded in this sampling event but can-not be used to calculate the resulting ground water elevation until the extended well casings are resurveyed.

North of the LMC Facility across Tallevast Road

This area lies due north of the LMC facility on the north side of Tallevast Road. It is currently an area with concentrations of 1,4-D contamination in the USAS, LSAS and Arcadia aquifers above the GCTLs. In a few wells there are also some low detections of other CVOCs (e.g., 1,1 DCA and 1,1 DCE). Generally, the remaining contamination in the deeper (LSAS and Arcadia) units in this area is contained by the current GRTS pumping, but the effectiveness of the containment in the USAS unit remains an open question. I noted in my review of last year's RASR that there is little drawdown of the water table in the USAS north of Tallevast Road in the areas of EW-2011 and -2012. This is an area where 1,4D has been persistent over the years (albeit at low concentrations), but some small reductions in 1,4-D concentrations were recorded this year. Looking at the longer term record, however, the current pumping of the USAS north of Tallevast Road has been minimally effective in reducing the 1,4-D contamination in the USAS in areas between EW-2011 and EW-2012, particularly as compared to wells/areas just to the south on the LMC property. Why these extraction wells have such a minimal influence on water levels and COC flushing is unclear. I have noted in prior writings that an investigation of this area with DPT would be beneficial to confirm the gradation of the aquifer materials (useful information to confirm well screen and gravel pack designs) as well as to more accurately map the extent of 1,4-D found in wells like MW-109 and EW-2012. Unfortunately, those investigations have not been requested by FDEP, nor performed by LMC. At present the full northern extent of 1,4-D in this area of the USAS plume of 1,4-D remains unknown.

South and Southwest of the LMC Facility

Concentrations of COCs in most USAS wells in this area are generally low to ND, but I note there are too few wells in the residential area immediately south of the LMC facility to accurately define the conditions or plume boundaries in this area. Particularly concerning is the area along and just west of the rail ROW. AECOM has mapped the boundary of the USAS-TCE/PCE plume as lying well east of the ROW, but the only wells for this interpretation are farther to the east (MW-27 with 15 μg/L) and west (EW-2035 with a record of historical trace amounts). These wells are too widely spaced (about 700 feet apart) to confirm if USAS contamination above the GCTL remains beneath this residential area. Also, EW-2035 is a pumping well that produced about 1,600 gallons of water/day and as such any measurements of COCs in its water were subject to dilution as compared to a discrete (unpumped) monitoring well.

USAS well EW-2035 is located in the residential area south of the LMC property, and EW-2102 is located to the west on the golf course property. Both were recommended for shut down in the 2022 RASR based on measured low COC concentrations. LMC suspended pumping in both wells beginning in February 2023, and subsequently entered an EWPARM process with one year of quarterly monitoring. In the subsequent water quality tests in August, both wells reported ND for CVOCs and 1,4-D. However, monitoring well (MW-35), located in the eastern golf course property between these two pumping wells showed an increase in TCE/PCE to levels just below the GCTLs (i.e., from 1.5/1.4 μg/L in 2022, to 2.2/2.7 μg/L in 2023) after the pumping ended.[5] Low but

[5] This well is now being mapped as lying outside the USAS containment system (see 2023 RASR, Figure 8).

detectable levels of TCE/PCE were still being reported in EW-2035 when it was still pumping in 2022.

In a recent conversation, Paul Calligan (LMC's project manager) explained to me that the logic for suspending pumping of EW-2035 and EW-2102 at the same time was to allow the more efficient flushing of the area by the remaining extraction system, which today is primarily comprised of the extraction galleries (EW-2103 and EW-2104) to the east of the rail ROW. Historically when both wells were pumping, a hydraulic ridge formed between them, creating a region of more limited ground water flushing in the vicinity of MW-35. Now that the pumping has ended a new hydraulic ridge has formed in the same area (now being created by natural flow to the west and the gallery pumping farther to the east). The associated overall USAS capture zone boundary however has now shifted to the east of MW-35 (see 2023 RASR, Figures 8). This allows the TCE/PCE contamination that remains in the area of this well to flow westward and disperse under the golf course property, rather than being removed by the pumping system as was previously the case. This is not a desirable outcome. In retrospect, it may have been better to only shut down EW-2102 and allow EW-2035 to continue pumping a while longer to remove the CVOC contamination that remains under the residential area and eastern portion of the golf course today. This would have been a preferable strategy as compared to letting it now flow uncontrolled and disperse to the west.

Based on the continued presence of CVOCs in this area and questions about the reliability of extraction wells data to accurately represent conditions in the aquifer, I previously recommended a DPT investigation of the residential area south of LMC, the purpose of which was to verify if any CVOCs remain above GCTL levels. FDEP concurred with this recommendation and has twice asked LMC to perform this investigation. In a recent (October 24, 2023) letter, however, Lockheed continues to decline FDEP's request, citing its prior (2005) VP investigations of this area as adequate to understand the contamination. These prior tests, however, are now 18 years old and provide little useful information on the status of contamination in the community today, 10 years after the GRTS began operation.

Prior (2005) testing showed that CVOCs were found in the USAS across this residential portion of the Tallevast community. It was likely a southern extension of more diffused migration bordering the pronounced contamination migration pathway flowing to the east from the LMC facility, centered near MW-27 and MW-28 today. The observed concentrations in 2005 exceeded the TCE/PCE GCTLs (both 3 μg/L) in many samples, but only in relatively thinner layers of the aquifer, i.e., the higher concentration did not occur across the entire saturated thickness. Since these tests were performed, the limited monitoring points indicate that concentrations have decreased to a significant degree, due to the pumping and 18 years of overlying rain-water infiltration. Even so, the current test data shows that some contamination remains today. Although AECOM maps this area as now fully compliant with the CVOC-GCTLs (e.g., see 2023 RASR, Figure 13E), the actual levels of contaminants still present in discrete levels of the shallow aquifer remain uncertain, and the data in the recently released 2023 RASR continues to support the need for the DPT investigation I have previously recommended.

Contamination in the deeper aquifers in this broader area is generally centered on the southern portion of the golf course property. In particular the concentrations of 1,4-D and to a lesser extent other CVOCs in the underlying LSAS unit remain high, with the most contaminated well still reporting a 1,4-D concentration above 200 ug/L. Concentrations in the most contaminated wells have declined somewhat or remained stable over the past year, however, indicating the pumping is gradually having the desired effect of reducing overall mass. This region of LSAS contamination has been mapped by AECOM as extending east-southeast through well MW-101 (and potentially into the Southeast Area as I discussed above) suggesting it may be the principal source of the LSAS contamination found today in this Southeast Area. Given the historic slow progress in cleanup of the COCs, particularly 1,4-D in the LSAS unit in this area, it is likely that this contamination will persist and operation of the LSAS recovery wells in this region of the Site will continue for many years into the future unless LMC can implement some form of secondary in situ treatment.

Beneath the LMC Facility Property

Contaminants beneath the LMC property have spread vertically to as deep as the Salt & Pepper Sand unit. Within the shallowest of these (the USAS) the operation of the GRTS has been successful in lowering the concentrations of most CoCs to below the GCTLs, with only some residual contaminants left above these benchmarks in the eastmost portion of the LMC property and extending then eastward into the areas east of LMC as described above. In the deeper LSAS and Arcadia Formation sand units, higher concentrations of contaminants remain under the eastern portion of the LMC property and extend to the east and south onto neighboring properties.[6] 1,4-D is the most expansive of these contaminants in the deeper formations, extending to the south under the golf course, and as far to the east as along Tallevast Road north of the Amazon facility. The concentrations of COCs in these deeper units have materially declined since the onset of remediation efforts. All of the contaminants in these deeper units appear to be contained within the capture zones of the GRTS pumping system.

Wetlands

I have previously commented on the impact of the GRTS operations on the local wetlands in my review of the 2023 Annual Wetlands Monitoring Report (see Ramboll; September 15, 2023). In the interest of brevity, I would refer you to that document for my current thoughts on wetland conditions and impacts from operation of the GRTS. Nothing reported in the 2023 RASR has materially changed my thoughts on this topic.

Finally, I would encourage LMC and FDEP to engage the community in evaluating changes to the remedial action system so that community concerns and potential impacts can be fully discussed and evaluated as part of the decision-making process. I am happy to continue to constructively engage with you and LMC in this process if the community feels it is providing the independent technical assistance it needs in evaluating progress in fulfilling the goals of LMC's Consent Order with the FDEP.

[6] Of these, the Arcadia Formation remains the most contaminated of the deeper units.

If you have any questions regarding these thoughts and comments on the 2023 RASR, I would be happy to discuss them with you further.

Very truly yours,

Robert L Powell, PhD, PE
Principal