From: Joel Geier
To: Benton Public Comment
Subject: Oppose/Deny LU-24-027: Groundwater issues
Date: Tuesday, April 29, 2025 4:11:55 PM
Attachments: LU-24-027 comments - groundwater.pdf

Dear Community Development Department staff:

I'm attaching my third set of comments for the Planning Commission. Please include these comments in the information packet for their deliberations.

Thank you,
Joel Geier
North Benton County resident

Joel Geier ● 38566 Hwy 99W ● Corvallis, Oregon 97330-9320

Benton County Planning Commissioners
c/o Planning Division
4500 SW Research Way
Corvallis, OR 97333

April 29, 2025

RE: LU-24-027 Conditional Use Permit Application Regarding Landfill Expansion

Dear Chair Fowler and Members of the Benton County Planning Commission:

Thank you again for the opportunity to comment on the Conditional Use Permit (CUP) application submitted by Valley Landfills Inc.

This is my third in a series of comments, and focuses on **groundwater and related geotechnical issues.**

For rural residents in north Benton County, **having your own well that you can rely on is a key part of the character of the area.** We and our neighbors rely on our wells for clean drinking water for our families, for livestock, and for irrigating our vegetable gardens and small-scale farms.

Losing access to a reliable well would seriously interfere with our use of these properties. In such cases, we and our neighbors would have to install water tanks and pay to have water trucked in, just for basic household functions. Our ability to use RR- or EFU-zoned property for activities such as raising livestock or maintaining a vegetable plot or farm, would be severely curtailed.

The burden of proof is on the applicant to supply evidence that the planned development will not interfere with these existing uses and natural features of the area.

In their application and supporting exhibits, **the Applicant has failed to demonstrate that the proposed development would not put household wells, irrigation wells and natural springs at risk.**

The **applicant has failed to consider potential impacts of blasting** during the construction phase. Excavation for the proposed new landfill will require drilling and blasting an enormous amount of the natural hillside on Tampico Ridge. **Noise and vibration set off by seismic waves from the blasting would seriously interfere with our use of our property**, for the entire construction period which could last for years.

Each of these issues is cause for denial.

Benton County staff have failed to provide their own analysis of these risks. Instead, without any justification beyond acknowledging their own lack of expertise, they state, "*Staff concurs with the applicant's analysis and engineering comments*," and go on to endorse, without reservation, the applicant's claim that the proposal *"is unlikely to 'seriously interfere' with adjacent uses with regard to any groundwater impacts."*

It would have been wiser for county staff, recognizing their own lack of expertise, either to solicit opinions from independent experts in the field of hydrogeology, or to make no statement at all on this issue.

My technical comments on these issues, as detailed in Annex 1, are intended to help you to understand the shortcomings of the applicant's arguments on these issues.

My comments are based on my relevant technical education which includes a B.Sc. in mining engineering (UC Berkeley 1985) and a Ph.D. in geology with an emphasis in hydrogeology (OSU 2005), as well as on my 37 years of professional experience in the subject of groundwater flow and contaminant transport in fractured bedrock. My work includes recent engagements as a subject-matter expert for national agencies concerned with geological disposal of radioactive waste in Finland, Sweden, South Korea, and France.

I should make clear that my consulting practice is entirely international, and I do not practice professionally in the state of Oregon. Although I have a high level of education in the subject, my comments here are stated not as a professional practicing in Oregon, but as the views of a private citizen who feels a duty to comment for the benefit of the community and the health our shared environment.

So far as possible, I have tried to frame my comments in lay terms so that you can apply your own judgment and common sense.

Thank you for considering these comments.

Yours sincerely,

Joel E. Geier, Ph.D.

Annex 1

Deficiencies in the Applicant's Analysis of Hydrogeological and Seismic Impacts of Landfill Construction and Operation

My comments in this annex focus on the following three major issues:

1. Risk that excavations for construction of the new landfill and leachate ponds could impact the dependability of nearby wells or springs.

1.1 No analysis of effects of dewatering slope above new leachate ponds.

1.2 No analysis of effects of excavation for new landfill.

1.3 No groundwater protection plan.

1.4 No baseline measurements south of proposed excavations.

1.5 Groundwater divides are not physical barriers to groundwater flow.

1.6 Misleading use of the concept of a groundwater divide.

1.7 Inadequate investigation of geology and hydrogeology of Tampico Ridge.

2. Risk of groundwater contamination during landfill operation or in the post-closure period.

2.1 Applicant misunderstands and misinterprets the meaning of "groundwater divides."

2.2 Applicant has not demonstrated an understanding of bedrock hydrogeology below Tampico Ridge.

2.3 Landfill liner systems eventually fail.

2.4 Reliance on a "state of the art" new liner system implies that long-term performance data for this system do not exist.

2.5 VLI cannot guarantee that their drainage system will function in perpetuity.

3. Blasting impacts during landfill construction

3.1 Applicant's geotechnical consultant has recommended drilling and blasting as the main method of excavation

3.2 Excavation will be as close as 250 yards from nearby residential properties

3.3. Applicant has not evaluated how noise and seismic wave propagation from blasting will impact nearby residents.

1. Risk that excavations for construction of the new landfill and leachate ponds could impact the dependability of nearby wells or springs.

The Applicant has failed to provide any analysis of of the risk that excavations for construction of the new landfill and related infrastructure (new leachate ponds) could impact the dependability of nearby wells or springs.

Both in the Burden of Proof document and the supporting documents, the Applicant and their consultants have only discussed potential impacts of groundwater use for construction and operation of the proposed new landfill. Because the landfill relies mainly on the Adair Village municipal water system for most purposes, supplemented by minor use of well water for restroom facilities in the scale house and landfill office, of course the new landfill is not expected to result in significant groundwater use.

However, considering groundwater use alone is not sufficient to evaluate the potential for groundwater impacts that will result from construction.

In simple terms, if you dig an enormous hole below the natural groundwater level, water will flow into that hole. That water has to come from somewhere. This means that groundwater levels will be lowered for some distance away from the hole.

Whether existing wells are affected by your newly dug hole depends on how far this "drawdown" of groundwater levels extends, and at what rate the effect decreases with distance.

These things are controlled by the properties of the soil and bedrock that govern how groundwater flows. The effects can be estimated by means of mathematical models, if the soil and bedrock properties are reasonably well known. Such estimates are most reliable if the mathematical models have been tested by calibration to observed water levels, including in areas where potential impacts on wells need to be assessed.

The Applicant and their consultants have not presented any such models, beyond simple contour plots of groundwater levels within the footprint of the current and proposed de-

velopment area. In particular, they have not presented any model that includes residential wells along Tampico Ridge south of the proposed new landfill.

1.1 No analysis of effects of dewatering slope above new leachate ponds

Wallace Group recommend that the slope above the proposed new leachate ponds should be dewatered to a depth of 50 feet. Applicant has neither considered nor evaluated how far the area of groundwater depression (draw-down) from these ponds will propagate on the forest conservation (FC) zoned parcel.

Besides potential impacts on wells on neighboring properties, this could cause drought stress to Douglas-firs growing on that parcel, increasing future fire risk.

Since the excavations for the proposed new leachate ponds would be mainly in soils rather than in bedrock, this should be a relatively simple situation for the Applicant to model the potential impacts on neighboring properties. However the Applicant has not provided any such analysis.

1.2 No analysis of effects of excavation for new landfill

The excavation to accommodate the new landfill will be an open pit as deep as 155 ft below the natural land surface on the north end of Tampico Ridge. Any water-bearing features (such as fractured zones of the basalt) that are intersected by this excavation will drain into the resulting pit. This water will need to be pumped out or otherwise drained from the excavation, as a practical matter to allow excavation.

Applicant has not presented any analysis of how the draining of water-bearing features will propagate through the base of Tampico Ridge. The site characterization work to date was not designed to produce the information that would be needed to inform such an analysis.

1.3 No groundwater protection plan

The applicant has not presented any plan for protecting groundwater resources, in the event that their excavations are discovered to intersect significant water-bearing features (such as fractured zones) that drain into their excavations.

The geotechnical consultant of record (Wallace Group) has presented a credible evaluation of soil properties on the site that affect constructability of the proposed new landfill. They also include a long section of recommendations for construction of an access road above the landfill, which was a feature of a previous expansion proposal that was rejected[1] but is not part of not the current proposed design. However, in general they have not investigated factors that would control potential impacts of the development on groundwater utilized on nearby residential properties.

The applicant's consultant for hydrogeological issues, Tuppan Consultants (Tuppan), though tasked with providing a memo on "Environmental and Operational Considerations," has not addressed any potential impacts of the substantial excavations that are planned as part of the proposed development.

Tuppan recognizes that securing a well with adequate flow for residential and/or agricultural use in this area can require a certain level of drilling effort, due to intrinsic limitations on predictability of occurrence of water-bearing zones. He accurately notes:

> *Water wells in this area produce primarily from fractured basalt bedrock. Predicting where and at what depth the basalt will be fractured enough to produce enough water for a supply well is problematic. This is because the lateral and vertical geometry of fractures in the bedrock basalt flows is naturally not uniform. In addition, the basalt is commonly altered to low permeability clays along fractures and in brecciated zones, thus reducing the ability of groundwater to flow within fractures. Domestic wells in this part of Benton County typically produce water from the basalt bedrock (frequently called "Blue- or Black Basalt" on the drillers' logs).*

However despite these challenges, all residential properties on Tampico Ridge have wells with adequate flow for the current residential use, and in some cases, also small-scale agricultural use. To my knowledge, none of the households on Tampico Ridge currently require water to be trucked in for household use.[2]

1 The previous design, submitted by the Applicant in 2021 and evaluated as LU-21-047, proposed to close Coffin Butte Road and replace it with a steep access road that would go up above the new disposal area, along the south edge of the development area. This plan was rejected by unanimous vote of the Benton County Planning Commission.

In other words, this is a challenge that local residents have thus far been able to surmount. The concern is that excavations for the landfill will jeopardize wells that currently provide adequate sources of water.

The applicant's consultants also fail to mention the presence of a year-round spring on the north part of Tampico Ridge, which has existed for generations. The presence of this dependable water source was likely responsible for use of this part of Tampico Ridge as a campsite by Indigenous people preparing to set out on trips through the Coast Range.[3]

An appropriate groundwater protection plan should start with a clear inventory of these existing groundwater uses and natural groundwater features, and identify methods for ensuring their protection. But the applicant has not done this.

1.4 No baseline measurements south of proposed excavations

Despite planning at least since 2020[4] to expand their landfilling operation onto Lot 1107, based on plans that included substantial excavations in the north end of Tampico Ridge, the applicant has not made use of the intervening years to develop a baseline understanding of groundwater in Tampico Ridge, anywhere to the south of the area that they propose to excavate. The applicant's parent company, Republic Services owns the adjoining land to the south, so this failure to obtain baseline data is not due to lack of access.

The applicant has not presented a compilation of data from existing household wells on Tampico Ridge, nor anywhere else around the vicinity of the landfill, except for the well for the Phillips family (whose property next door to VLI's office is "landlocked" by VLI/Republic Services holdings). Such a compilation could have been helpful to establish baseline conditions.

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2 Unlike, for example Logsdon Ridge near Lewisburg and other outliers of the Coast Range that are dominated by marine sandstone/shale sequences or tuffaceous members of the Siletz River Volcanics rather than basalt.

3 Personal communication, Rick Kipper, based on recollections of older relatives and presence of artifacts in the vicinity. Historian Bob Zybach showed Tampico Ridge as the eastern terminus of a ridge-line trail system, used by the Kalapuya and other Indigenous people, which connected all the way from here to Yaquina Bay and Siletz Bay on the coast.

4 Per December 2020 e-mails between VLI/Republic Services representative Julie Jackson and Benton County Counsel Vance Croney obtained through a public records request, which clarified that Republic Services was planning to expand operations onto this parcel, and per site development plans submitted to Oregon DEQ on July 9, 2021.

In the absence of such a compilation and lacking any baseline data of their own, the applicant's consultant is left to speculate regarding the actual hydrogeological conditions on Tampico Ridge. The groundwater elevation contours in Figure 2 of Exhibit 16, within the proposed development areas on Lot 1107 and 1200, are based on just two groundwater monitoring wells (BH-16 and BH-17) anywhere south of the current leachate-handling facility, plus apparently a natural seep or spring[5] at around 350 ft elevation, in the ravine that runs southward up the middle of Lot 1107.

The applicant's consultant (Exhibit 16) recommends adding a few wells at a later stage, mainly for groundwater quality monitoring purposes, but even these will be limited to the immediate periphery of the proposed development (emphasis added in bold):

> ***In a future phase,*** *Valley Landfills will augment the groundwater monitoring network in the south development area (for the interim, two temporary piezometers[6] were installed along the northern slope of Tampico Ridge as part of the geotechnical study). ... This will include (1) installing wells upgradient, between the landfill and properties to the south and southeast, (2) installing wells cross- and down-gradient along the perimeter of the landfill footprint to function as compliance wells, (3) decommissioning any wells that are within the planned footprint of the landfill, and (4) conducting hydraulic testing to estimate the hydraulic properties of the bedrock unit.*
>
> *...*
>
> ***installation of new groundwater monitoring wells is not proposed for this phase of site characterization*** *for several reasons. First, the locations being considered for upgradient wells are along the new access road that will be constructed south of the landfill footprint.* ***The wells can only be installed after the road is constructed because of the amount of excavation (over 100 feet vertical) from the current topography to the proposed road elevation.*** *Second, cross gradient to potentially downgradient locations will be in the way of earthwork activities if they are installed too soon—and could be destroyed. Therefore we advise to install these wells* ***after most of the landfill construction is complete****. And last, two wells that we are considering at a downgradient*

5 My conjecture based on noting that the 350 ft groundwater elevation contour coincides with the topographic elevation at this point.

6 Apparently these temporary piezometers were installed in BH-16 and BH-17 and thus are the source of data for the groundwater elevation contours mentioned above.

location (MW-8S and MW-8D) ***will hopefully be preserved*** *during landfill and infrastructure construction. During the interim, we will continue to monitor them consistent with the current monitoring program.*

From the above (noting the statements emphasized) it is clear that the applicant has no intention to develop additional baseline data for groundwater, and any new monitoring wells will be installed only after the main excavation work is completed.

Note also that the applicant's hydrogeological consultant is not even sure that the two wells MW-8S and MW-8D, located at the extreme NE corner of the proposed new landfill just off Coffin Butte Road on the adjacent FC-zoned Lot 1200 (which is not supposed to be part of the new landfill footprint), can be maintained.[7]

1.5 Groundwater divides are not physical barriers to groundwater flow

The Applicant's Burden of Proof document claims that a "groundwater divide" on Tampico Ridge will protect groundwater resources south of their proposed development. The applicant and their consultants either misunderstand or misrepresent the fundamental concept of a *groundwater divide* -- which is a phenomenon arising from groundwater flow patterns, rather than a physical feature that dictates those patterns.

Unlike a *surface-water divide*, which is directly controlled by topography, a groundwater divide need not coincide with topographic divides. Explanation of the differences between these concepts in lay terms can be found from various sources, including USGS websites.[8]

Although at very shallow depths the groundwater tends to follow topography, deeper groundwater flow can pass underneath local topographic divides. Groundwater in bedrock, in particular, may flow in different directions than flow in shallow surficial sedi-

7 There should be no rational reason for this concern by the applicant's consultant, if the applicant's plans are in fact limited to their stated goal of a "limited" expansion followed by closure of the landfill. However if their actual plan is to follow LU-24-027 with a request for the county to vacate Coffin Butte Road to allow them to implement the original plan set forth in LU-21-047, then those wells could be in the way. Perhaps, if given opportunity to ask questions of applicant's consultant, you could ask him why he was concerned about potential loss of these two monitoring wells.

8 See for example this U.S. Geological Survey website which uses the Great Lakes region of Wisconsin as an illustrative example: https://wi.water.usgs.gov/glpf/cn_nt_divides.html

ments, especially where groundwater flow through bedrock is constrained to fractures (as the applicant acknowledges is likely to be the case on Tampico Ridge).

It is also important to understand that groundwater divides are not static. As noted by the USGS website cited above[9]:

> *A second factor that controls the location of the ground-water divides is pumping from wells. Pumping can shift ground-water divides from their natural locations and even cause ground water that previously discharged to a local stream to move across surface-water divides within the basin to a regional pumping center outside the basin. Increases in pumping gradually cause the ground water divides to shift, but they have no effect on the surface-water divides.*

It follows that dewatering a slope (such as above the proposed new leachate ponds) or uncontrolled drainage to deep excavations (such as for the footprint of the proposed new landfill) could also shift groundwater divides.

A recent hydrogeological investigation by Ochoa et al. (2022)[10] of the Oak Creek watershed in Benton County, about 8 miles southwest of the proposed new landfill, shows examples of how the groundwater divides identified by actual hydrogeological investigations can differ from what might be speculated based on topographic divides. In particular is seen in Figure 6 of Ochoa et al. (2022), where the interpreted groundwater divides are distinct from the watershed boundaries following topographic divides.

As Ochoa et a. (2022) explore, this is the result of bedrock geology including the influence of the Corvallis Fault Zone. They note:

> *The low angle of the Corvallis Fault creates a wedge of Siletz Formation volcanic rocks overlying Spencer and Tyee formation sedimentary rocks which compartmentalizes vertical groundwater movement and promotes horizontal groundwater movement parallel to the fault line.*

9 ibid.

10 Ochoa, C.G.; Jarvis, W.T.; Hall, J. A hydrogeologic framework for understanding surface water and groundwater interactions in a watershed system in the Willamette Basin in western Oregon, USA. 2022, 12, 109. https://doi.org/10.3390/geosciences12030109

The Corvallis Fault also passes at a low angle below the landfill site. Although the surface trace of this fault is about 1.75 mile away from the proposed development area[11], the vertical separation between the fault and the proposed excavations may be as little as 2500 ft (less than half a mile). Hence the situation could be similar to that near Oak Creek. A comparable level of effort could be needed to demonstrate understanding of the local hydrogeology, including actual (rather than speculative) locations of groundwater divides.

1.6 Misleading use of the concept of a groundwater divide

As a guess regarding the hydrogeological situation on the rest of Tampico Ridge south of where they have any data, the applicant offers a schematic cartoon (Figure 1 of Exhibit 16). This cartoon, overlain on a topographic map, has green lines and blue arrows which, according to the legend, are supposed to be "topographic/groundwater divides" and "groundwater flow directions."

This cartoon in itself would be harmless, if taken solely as a depiction of the applicant's speculative hypothesis (or "conceptual model") regarding groundwater flow below Tampico Ridge. But as noted above, the applicant has amplified the speculative location of these "groundwater divides" into a major feature of their Burden of Proof, arguing that these will protect groundwater resources from impacts of their proposal.

The applicant has presented no data to support that that the green lines represent groundwater divides, nor that the blue arrows represent actual groundwater flow directions. The green lines do appear to coincide with topographic divides, but as established above, groundwater divides and topographic divides do not necessarily coincide.

Applicant's consultant seems to understand this where he first introduces Figure 1 on p. 5 of Exhibit 16. There he uses nuanced phrases such as "groundwater is ***generally assumed*** to flow ..." and "***presumed*** areal flow direction of groundwater" (emphasis added in bold).

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11 Wallace Group state that the closest mapped portion of the Corvallis Fault is 3 miles to the south near Adair Village, but Dr. Chris Goldfinger interpreted the surface trace, though concealed by recent surficial disturbances, to continue northeast as far as Independence Hwy just south of its intersection with Camp Adair Road. *See:* Goldfinger, C., 1990. Evolution of the Corvallis Fault and Implications for the Oregon Coast Range," M.S. thesis in geology, Oregon State University, Corvallis.

But by the next page, this nuance has been forgotten and the supposed "groundwater divide" is discussed as if it were a confirmed and absolute fact. A page later (p. 7) the consultant goes even further: "*It is this groundwater divide ... that prevents groundwater from one side of the hill to flow to the other.*"

This scientifically erroneous claim is then brought forward in the Burden of Proof:

> ***Impact on groundwater quality**. Tuppan and CEC describe a number of features and systems that protect groundwater resources, including the groundwater divide created by Tampico Ridge ....*

1.7 Inadequate investigation of geology and hydrogeology of Tampico Ridge

Applicant's presentation of information on the geology and hydrogeology of Tampico Ridge, anywhere south of the development area, is insufficient to demonstrate an understanding of how the proposed development will impact existing groundwater resources.

The evaluation of bedrock properties in particular severely circumscribed, limited to an account of at what depth bedrock not amenable to mechanical excavation was encountered. Beyond the depth at which competent bedrock (basalt) was encountered, despite that they employed core-drilling, they provide no structural geological information or interpretation, other than RQD (rock quality designation) which is a crude measure of fracture intensity.

They did not map any specific bedrock structures either in the test pits or boreholes. They made no attempt to interpolate structures between the 19 boreholes that extended into the bedrock. No pumping tests or any other types of hydraulic tests were performed to evaluate the hydraulic properties of the bedrock or the potential for lateral persistence of water-conducting zones. Only one borehole (BH-3) was located outside the footprint of

the planned development area.[12] This borehole was abandoned by filling it with bentonite, rather than using it for groundwater measurements and monitoring.[13]

Critically, there is no structural geological analysis (identification of bedrock geological structures such as local fault zones that could be significant as water-bearing features). The applicant, VLI, has also not presented any mapping of structural geological features on the exposed quarry faces at Coffin Butte, which could help to inform an analysis of risk to groundwater resources in that direction.[14]

In the Wallace Group report, the entire discussion of groundwater occurrence is limited to one paragraph in Section 4.3 (emphasis added in bold font):

> *Groundwater was encountered during the exploration at depths ranging between 4.6 and 67 feet bgs with the groundwater level generally deeper towards the northeast. We expect groundwater will be present within fractures of the weathered and competent bedrock, perched above the interface between soil and bedrock, and within alluvial soils at the lower elevation areas.* ***Fractures provide the primary transport mechanism of groundwater in the bedrock; therefore, the occurrence and amount of groundwater encountered during the excavation of the expansion cell and ponds will depend on the nature, distribution, and interconnection of the fractures.***

Despite recognizing the importance of fractures for groundwater flow in the bedrock, the drilling logs do not identify the specific locations of any such structures.

Applicant has not presented any inventory of local residential wells to identify which ones rely on water-bearing features that could potentially be drawing from fractured zones or

12 The only borehole located outside of the development area for the current proposal, BH-3, was located near the edge of the development area for the previous development plan that was rejected as LU-21-047, and thus appears to be a carry-over from that plan, rather than indication of an effort to understand the geology and hydrogeology of Tampico Ridge south of the currently proposed excavations.

13 Oregon Department of Water Resources well record BENT 56394.

14 During a landfill tour for the Benton County Talks Trash process in autumn of 2022, I asked VLI's site managers if there were any plans to map the quarry face, noting that it provided excellent exposures of fractures including possible local faults which could be valuable for risk assessment of the planned expansion into the quarry (Cell 6). They responded that Knife River wouldn't allow this due to safety issues.

networks of such zones that could be intersected by the excavation. Productive household wells on Tampico Ridge are typically screened in fractured zones in the basalt.[15]

Understanding the lateral persistence of these zones and their connections would be key to assessing the risks of excavation impacting nearby wells. However the Applicant and their consultants have neither developed nor presented any such understanding of the bedrock hydrogeology.

15 On a personal note, before we purchased our property on the east flank of Tampico Ridge in 2004, I made my own evaluation of well logs from neighboring properties on Tampico Ridge (easily obtained from the Oregon Water Resources Department database), and noted that wells capable of producing sustained water flow were generally screened in fractured zones in the basalt. We were able to find such a zone for our own well, which for the past 20 years has provided us with reliable water both for household use and for a large vegetable garden.

Issue 2: Risk of groundwater contamination during landfill operation or in the post-closure period.

Applicant argues that there is no risk of contamination from the new landfill. Their argument relies on (i) erroneous understanding of the concept of "groundwater divides," (ii) optimistic claims regarding the efficacy of an unproven liner system, and (iii) an assumption that the new landfill can be kept drained in perpetuity.

2.1 Applicant misunderstands and misinterprets the meaning of "groundwater divides

The preceding comments on Issue 1 (under subheadings 1.5 and 1.6) also apply here. The position of a groundwater divide for the bedrock aquifer system under Tampico Ridge has not been established. Since groundwater divides are not physical barriers, but depend on the flow system, the current position of any groundwater divides could shift, for example if there is an increase in groundwater pumping to the south.

2.2 Applicant has not demonstrated an understanding of bedrock hydrogeology below Tampico Ridge.

The preceding comments on Issue 1 (under subheadings 1.4 and 1.7) also apply here. The applicant has not presented neither data nor validated models for the area south of the proposed new landfill, nor adequate plans to obtain the type of data that would be needed.

2.3 Landfill liner systems eventually fail

A US Geological Survey fact sheet (Christenson and Cozzarelli, 2003)[16] summarizes the situation succinctly (emphasis added in bold):

> *Federal and state regulations were passed in the 1980s and 1990s to manage disposal of solid waste. Those regulations require that most landfills use liners and*

16 Scott C. Christenson and Isabelle M. Cozzarelli, 2003. "The Norman Landfill Environmental Research Site: What Happens to the Waste in Landfills?" USGS Fact Sheet FS-040-03, August 2003, U.S. Geological Survey, United States Department of the Interior.

leachate collection systems to minimize the seepage of leachate to ground water. Although liners and leachate collection systems minimize leakage, ***liners can fail and leachate collection systems may not collect all the leachate that escapes from a landfill.*** *Leachate collection systems require maintenance of pipes, and pipes can fail because they crack, collapse, or fill with sediment.* ***The US EPA has concluded that all landfills eventually will leak into the environment*** *(U.S. Environmental Protection Agency, 1988). Thus, the fate and transport of leachate in the environment, from both old and modern landfills, is a potentially serious environmental problem.*

The applicant's claim that risk of leakage can be avoided by use of a liner system, however advanced, amounts to asking us to ignore both common sense and the cumulative scientific evidence that landfills do eventually leak.

The applicant acknowledges (in their Exhibit 29 titled "Arsenic Memo") that their existing landfill, on the other side of Coffin Butte Road, had "a seepage event" (in other words, a leak) which VLI discovered in 1994 when groundwater sampled by a newly drilled monitoring well, MW-23, was found to have elevated levels of arsenic. Despite the applicant's claims that they resolved this issue, arsenic levels both in that well and in their compliance boundary wells continue to fluctuate. Record-high levels for the site and indeed, for the western mid-Willamette Valley, were reported in their 2023 Annual Environmental Monitoring Report.[17] I will discuss this memo at length in separate testimony, but here it bears noting that the applicant has not been able to demonstrate conclusively that their existing landfill is free from leaks.

2.4 Reliance on a "state of the art" new liner system implies that long-term performance data for this system do not exist

The argument here is very simple. If a new liner system has just recently been developed, there cannot be any data on real-world performance over time scales of decades. Man-made materials can degrade, creep, or become brittle over time.

17 The 2024 Annual Environmental Monitoring Report is still not publicly available, though a copy was supposed to be provided to Oregon DEQ earlier this year. I requested a copy from DEQ through a public records request on April 9, 2025, but as of this date I have not received it.

The history of modern technology, from the Titanic to Three Mile Island, is full of systems that were considered to be "state-of-the-art" and "fail-safe" at the time of their development.

Decades of monitoring will be needed to determine whether or not this new "state-of-the-art" liner system is as fail-safe as the applicant claims. This is not something on which we can rely in a decision on the current land-use application.

2.5 VLI cannot guarantee that their drainage system will function in perpetuity

The applicant's consultant has argued that, because the new landfill is planned to be kept in a drained condition, leachate accumulating inside the landfill couldn't rise to such a level that it would cause leachate to flow into water-bearing features in Tampico Ridge.

As noted in the US Geological Survey fact sheet referenced above (Christenson and Cozzarelli, 2003):

> *Leachate collection systems require maintenance of pipes, and pipes can fail because they crack, collapse, or fill with sediment.*

In addition, this landfill is located in a seismically active region. Besides the nearby Corvallis Fault (the activity of which is not fully understood), the Cascadia Subduction Zone is known to be capable of producing enormous earthquakes up to magnitude 9.0 or even 9.5, according to the most recent estimates.

In the event of an earthquake, even if the landfill doesn't experience slope failures that would be evident to observers assessing damage on the surface, differential movements between layers of the landfills could shear off pipes and render leachate collections systems non-functional.

A system that requires on continued maintenance also depends on the financial viability of the operator. If either VLI or its parent company go bankrupt, who will make sure that the leachate collection system keeps going?

A system that depends on indefinite maintenance of pumps and plumbing is not an intrinsically safe system. The applicant should provide an analysis of what will happen if and when the leachate collection system stops to function.

Issue 3: Blasting impacts during landfill construction.

3.1 Applicant's geotechnical consultant has recommended drilling and blasting as the main method of excavation

In reviewing the geotechnical consultant's report (Wallace Group, Exhibit 5), I noted that the geotechnical consultant has recommended drill-and-blast rather than mechanical excavation:

> *Competent basalt bedrock will likely require rock hammers or drilling and blasting to excavate. The western hillside may be excavatable mechanically; however, it will result in a ragged final slope which may be problematic over time. The eastern hillside is more competent and mechanical excavation methods will not be appropriate. We recommend that drilling and blasting is used during rock excavation. The rock excavation method should be performed in a manner that limits as much as practical blasting disturbance beyond the rock cut.*

Blasting in competent bedrock (such as basalt) is favorable to propagation of seismic waves produced by blasting, with limited attenuation.

Experience from the existing quarrying and landfill operation on Coffin Butte suggests that this is a non-negligible concern. Testimony submitted on April 16, 2025 by William J. Briskey, PE, mentions that on his family's rural residential property on the NW side of Coffin Butte, "*quarry blasting has caused structural shifts in our house, broke a window, and we now have major cracks in concrete slabs in out-buildings.*" This blasting was carried out to enable expansion of the existing Coffin Butte Landfill into a new area referred to as "Cell 6," about 200 yards from Mr. Briskey's outbuildings.

3.2 Excavation will be as close as 250 yards from nearby residential properties

The design for the proposed new Tampico Ridge landfill will require blasting within 250 yards of residences on the west side of Tampico Ridge, and within 500 yards of existing buildings on the east side of the ridge.

During blasting in the former Morse Bros. / Knife River quarry, especially during expedited excavation to make way for the ongoing landfill expansion into what the operators call "Cell 6," we and our neighbors at times experienced percussive waves that were sufficient to rattle windows. For family members who have lived in areas with frequent earthquakes (including myself), these incidents triggered an startling, alarm reaction similar to experiencing a minor, "cupboard-rattling" type of earthquake or a sonic boom.

This was when the blast face was a full mile from our house, and on a separate hillside. If this activity were to move closer to us, and on the same ridge where we live, we can anticipate that the effects will be much worse, and will be a recurring source of stress.

3.3. Applicant has not evaluated how noise and seismic wave propagation from blasting will impact nearby residents.

The Applicant has not presented any analysis of potential impacts of blasting, nor have they even recognized this as a potential impact. This is an important issue that will lead to serious interference with use of nearby residential properties. The fact that the applicant didn't even consider this impact indicates a lack of awareness or concern for how their operations impact nearby residents.

From: Joel Geier
To: Benton Public Comment
Subject: Oppose/Deny LU-24-027: Arsenic issues
Date: Tuesday, April 29, 2025 4:48:15 PM
Attachments: LU-24-027 comments - arsenic.pdf

Dear Community Development Department staff:

I'm attaching my fourth set of comments for the Planning Commission. Please include these comments in the information packet for their deliberations.

Thank you,
Joel Geier
North Benton County resident

Joel Geier ● 38566 Hwy 99W ● Corvallis, Oregon 97330-9320

Benton County Planning Commissioners c/o Planning Division
4500 SW Research Way, Corvallis, OR 97333

April 29, 2025

RE: LU-24-027 Conditional Use Permit Application Regarding Landfill Expansion: Arsenic

Dear Chair Fowler and Members of the Benton County Planning Commission:

Thank you again for the opportunity to comment on the Conditional Use Permit (CUP) application submitted by Valley Landfills Inc., which proposes to start what amounts to a new landfill on the north end of Tampico Ridge, south of Coffin Butte Road.

This is my fourth in a series of comments, and focuses on the **anomalously high and fluctuating levels of arsenic** that have been found in groundwater monitoring wells around the east side of the existing landfill, ever since 1994 when the applicant first began to test for arsenic in this area.

Five monitoring wells in this part of the landfill site have frequently exceeded 15 micrograms per liter, which is 50% in excess of the US EPA's maximum contaminant level (MCL) for drinking water.

These arsenic levels on the landfill site are higher than have been found in any other well, anywhere within the applicant's 90 square mile Analysis Area. Yet remarkably the applicant asks you, in Exhibit 29 of their application, to believe that these are "natural" arsenic levels for the area.

"Why are is the applicant raising this issue as part of this application?" you might well ask. Exhibit 29 pertains to the existing landfill north of Coffin Butte Road, rather than the proposed new landfill to the south.

But regardless of their reasons, this exhibit does serve as a useful example of how the applicant handles legitimate environmental concerns that have been raised by local residents.

Rather than installing new monitoring wells to gain a better understanding of the issue, the applicant instead has tried to "argue the problem away."

As I detail in an annex to this statement, the applicant's arguments are shaky at best. The fact that they have included this dubious memo as part of their application casts doubt on the entire application, and **gives you further grounds to deny**.

Yours sincerely,

Joel E. Geier, Ph.D.

Annex 1
Comments on Arsenic Memo and Addendum

The applicant has raised the arsenic issue in a memorandum included as Exhibit 29 of their Burden of Proof statement, supplemented by an addendum on January 15, 2025. My comments here highlight the following problems with these documents:

1. Arsenic levels observed at the Coffin Butte Landfill site are highly unusual
2. Aggregation of data from wide regions is misleading
3. Claims of "steady" readings are questionable
4. Choice of baseline is questionable

These are elaborated in sequence below.

1. Arsenic levels observed at the Coffin Butte Landfill site are highly unusual for the western mid-Willamette Valley

The applicant asserts:

> *"There is no data to suggest that the existing arsenic levels are anything other than what is naturally occurring in the soil, or that leachate is impacting the environment or public health."*

This statement has two parts. The second part cannot be evaluated because neither the applicant nor Oregon DEQ nor Benton County have tested for potential impacts of leachate on the environment, anywhere outside of the site boundary. This despite that two of the compliance boundary wells (MW-26 and MW-27) have registered arsenic concentrations above the US EPA's maximum contaminant level (MCL) regularly for the past 14 years (Figure 1).

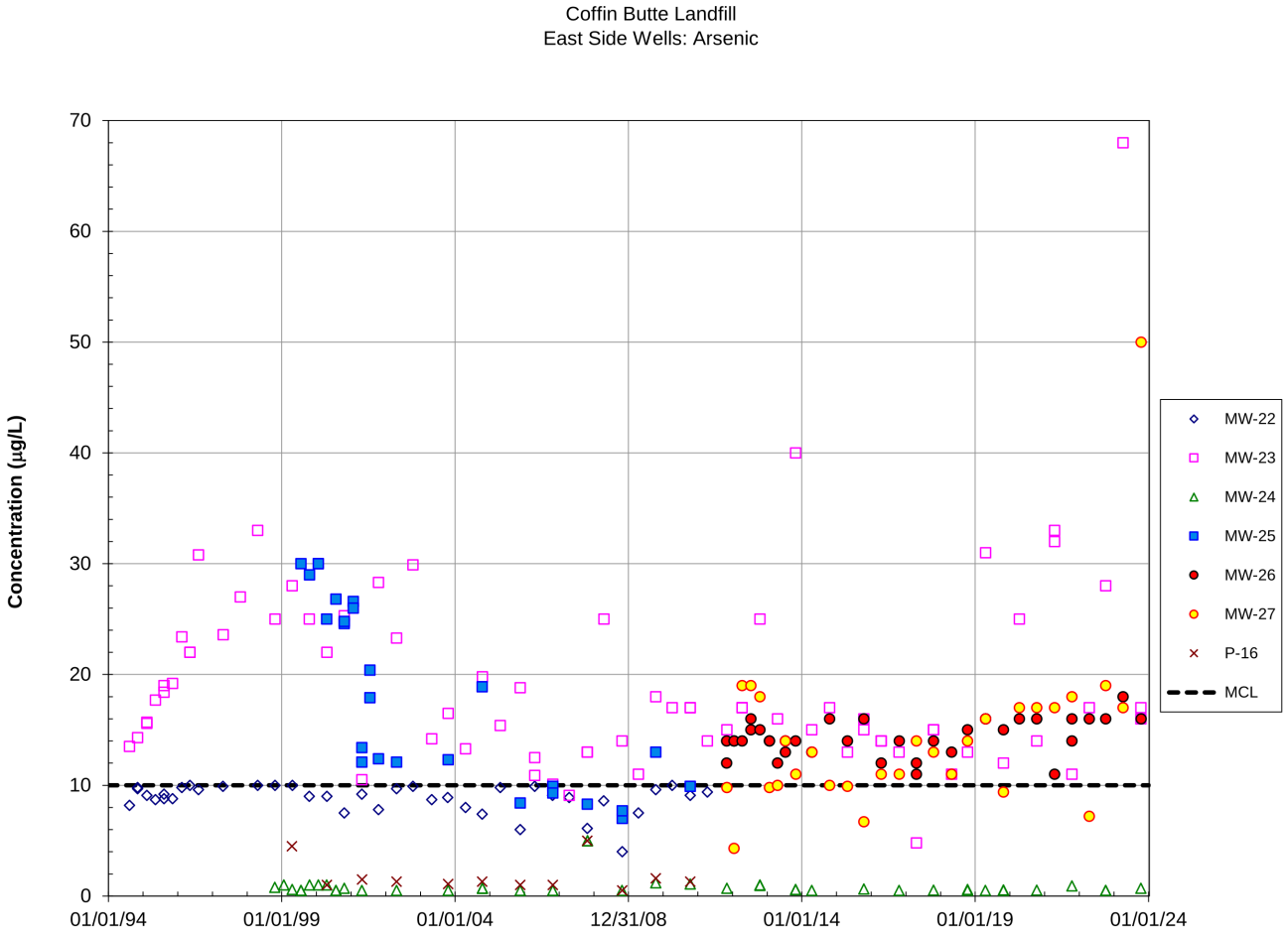

Figure 1. Arsenic concentrations in wells on the east side of Coffin Butte Landfill (from p. 245 of the 2023 Annual Environmental Monitoring Report submitted to Oregon DEQ).

Regarding the first part of the statement, the applicant has not developed any data regarding what arsenic levels are "naturally occurring" in the area of concern, since nearly all of their measurements in that area come from after a known leachate seepage incident (to be discussed in more detail below).

However a regional study data by US Geological Survey scientists, published in 1999,[1] shows clearly that the values observed at Coffin Butte are highly unusual for northwestern Benton County and adjoining areas of Polk County (see Figure 2).

1 Hinkle and Pollette, 1999, Arsenic in Ground Water of the Willamette Valley, US Geological Survey Water Resources Investigations Report 98-4205.

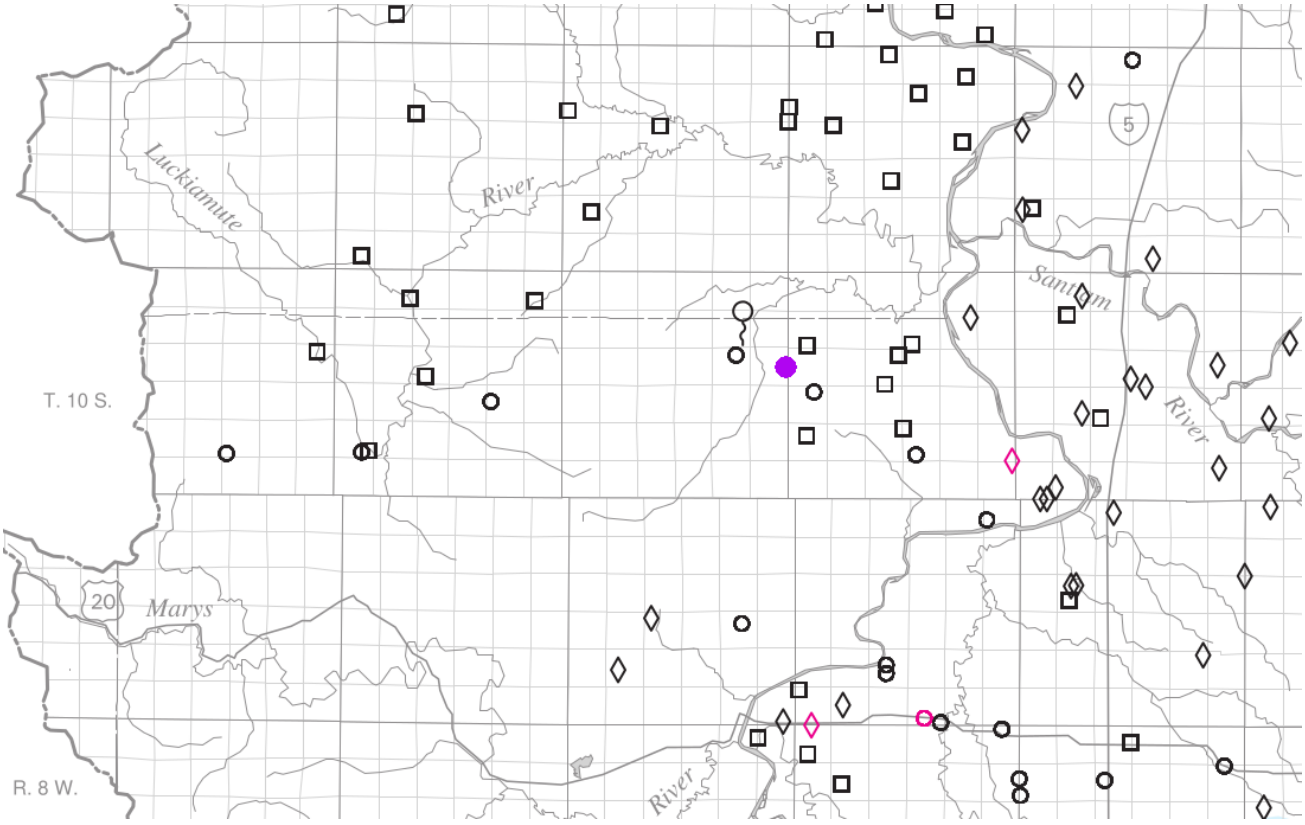

Figure 2. Detail of Plate 1 from Hinkle and Pollette (1999) showing arsenic concentrations in wells in the western mid-Willamette Valley region. The purple dot has been added for reference to show the location of Coffin Butte Landfill (not sampled by Hinkle and Pollette). Black symbols are wells and springs for which the measured arsenic concentration was 10 micrograms per liter or less. Red symbols show wells where arsenic concentrations were in the range 11 to 50 micrograms per liter. No wells in this area were found to have arsenic concentrations above 50 micrograms per liter. The square grid shows section lines (typically 1 mile on a side) for scale.

Values higher than the US EPA's maximum contaminant level (MCL) of 10 micrograms per liter are rare (just 3 wells out of more than 80 in the area of this detail, none of them within the applicant's Analysis Area). None of the wells evaluated by Hinkle and Pollette (1999) were found to have arsenic concentrations above 50 micrograms per liter. In contrast, arsenic concentrations in two wells at the Coffin Butte Landfill site have recently risen to 50 micrograms per liter and 68 micrograms per liter, respectively.[2]

Additional data aggregated by census tracts by the Oregon Health Authority (Table 1) indicate that just 1 of 146 wells in any census tract within 25 miles of Coffin Butte landfill

2 2023 Annual Environmental Monitoring Report for Coffin Butte Landfill

which registered an arsenic concentration higher than the MCL, and that well only had a concentration of 14 micrograms per liter. The average arsenic concentration over this sample is only 0.37 µg/L.

So clearly naturally elevated arsenic is extremely uncommon anywhere in the vicinity of Coffin Butte Landfill. Applicant has presented no data to support their suggestion that the observed arsenic levels are naturally occurring in the soil.

On the contrary, both in the Burden of Proof and in this memo, the applicant acknowledges that when these high levels were first noticed in MW-23 in 1994, the cause was found to be seepage of leachate from the south side of the landfill.

While the Burden of Proof suggests that this seepage event only happened in 1994, from statements in past AEMRs it appears that the applicant does not know exactly when the seepage began or how long it went on before it was detected fortuitously by sampling of MW-23. A more reasonable and parsimonious interpretation is that if seepage happened once and resulted in high arsenic levels, it could happen again and may even be ongoing.

Table 1. Arsenic levels in domestic wells as aggregated by the Oregon Health Authority for census tracts in Benton and Polk counties.

Census Tract	County	Geology (see key)	Approx. mean distance from Coffin Butte (miles)	Maximum distance from Coffin Butte (miles)	Number of samples N	Mean concentration (µg/L)	Maximum concentration (µg/L)	Number of tests over 10 ppb
41003010100	Benton	Tt, Qs	5	9	5	0.58	2.9	0
41003000500	Benton	Tcs, Qs	5	8	18	0.17	2	0
41053020302	Polk	Qs, Teo	6	12	3	0.73	2.2	0
41003000600	Benton	Qs	7	9	16	0	0	0
41003000400	Benton	Tcs, Qs	8	9	2	0	0	0
41003000900	Benton	Tcs	9	10	12	0	0	0
41003010900	Benton	Tcs, Qs	11	14	19	0.05	1	0
41003000202	Benton	Qs	12	13	13	0.15	1	0
41003000100	Benton	Qs	12	14	3	1.33	2	0
41003010200	Benton	Tt, Tcs, Qs	13	21	11	1.66	**14**	1
41053020303	Polk	Qs	13	14	1	0	0	0
41003010800	Benton	Tcs	13	14	3	0	0	0
41053020204	Polk	Teo	14	17	3	0	0	0
41053020202	Polk	Qs, Teo	16	13	1	0	0	0
41053020400	Polk	Tcs, Teo, Tmi	21	37	2	0	0	0
41053005300	Polk	Tmb, Teo, Qs	21	28	6	0	0	0
41053020500	Polk	Teo, Qs	22	23	1	0	0	0
41003010400	Benton	Qs, Tt, Tmi	23	32	27	0.78	7	0
Total	**Polk/Benton**		**<25**	**<35**	**146**	**0.37**	**14**	**1**

Key to abbreviations for geological formations, in order from oldest to youngest:
Tcs: Siletz River Volcanics (Paleocene to Eocene basaltic and related rocks of the Siletzia terrane).
Tt: Tyee Formation (Eocene marine sandstones/shale sequence, provenance possibly the Idaho Batholith)
Teo: Yamhill/Nestucca formations (Eocene to Oligocene marine volcanic-rich sedimentary and volcanic rocks)
Tmb: Columbia River Basalts (Middle Miocene basalts and minor tuffaceous sedimentary rocks)
Tmi: Mafic intrusions (Miocene mafic intrusions on Coast Range peaks including Marys Peak)
Qs: Quaternary sediments (late Pleistocene flood deposits and minor younger sediments on Willamette Valley floor)

2. Aggregation of data from wide regions is misleading

The 2/15/24 memorandum states:

> *In the Portland Basin, the background concentration is 8.8 milligrams per kilogram; in the Cascade Range it is 19 milligrams per kilogram; and in the South Willamette Valley (where Coffin Butte is located) it is 18 milligrams per kilogram.*

The units are surely incorrect, as 18 milligrams per kilogram of water (i.e., per liter) equates to 18,000 micrograms per liter, or nearly 2000 times the US EPA's maximum contaminant limit (MCL) for drinking water.

Even if the units were fixed, mention of concentrations in the Portland Basin and Cascade Range is meaningless for this application. The local geology in the area of the landfill (Siletz River Volcanics) differs from the geology that prevails in either of those regions.

Citing an average value over the Southern Willamette Valley is deceptive. It is well-known that the southernmost part of the Willamette Valley, from Eugene (Spencer Butte area) south to Creswell and Cottage Grove, is an area where high arsenic in water wells is a common problem. From Plate 1 in Hinkle and Pollette (1999), it can readily be seen that close to half of wells south of State Hwy 126 exceed the MCL, and many exceed 50 micrograms per liter. This situation has led to drinking water advisories for those areas. However from Fern Ridge Reservoir north, arsenic problems are rare.

3. Claims of "steady" readings are questionable

The Burden of Proof states that, after high levels of arsenic were detected in 1994 and were attributed to a seepage problem:

> *VLI took various and appropriate corrective measures to correct the issue. Readings taken from compliance wells installed in 2011 have been stable with averages consistent with the background concentrations of arsenic in the Willamette Valley.*

These steady readings indicate that there have been no leachate releases or impacts on groundwater.

From Figure 1 it can be seen that, after a few years of decline following measures to address the seepage problem, arsenic levels in MW-23 (see Figure 3 for well locations) have continued to fluctuate over a wide range, spiking several times to levels above 30 micrograms per liter.

The compliance boundary wells (MW-26 and MW-27) have exceeded the US EPA's MCL for arsenic in most measurements since they were installed. Most arsenic measurements in both of these compliance-boundary wells are also higher than in any wells not on the landfill site, within the Analysis Area chosen by the applicant.

From 2014 to 2019, only two or three of the 10 arsenic measurements were above 15 micrograms per liter in these two wells. Since then, all but three measurements have been above that threshold. In late 2023, the arsenic concentration in MW-27 spiked up to 50 micrograms per liter. That doesn't meet any common definition of "stable." Note that this measurement predated the 2/15/2024 memorandum included in the application.

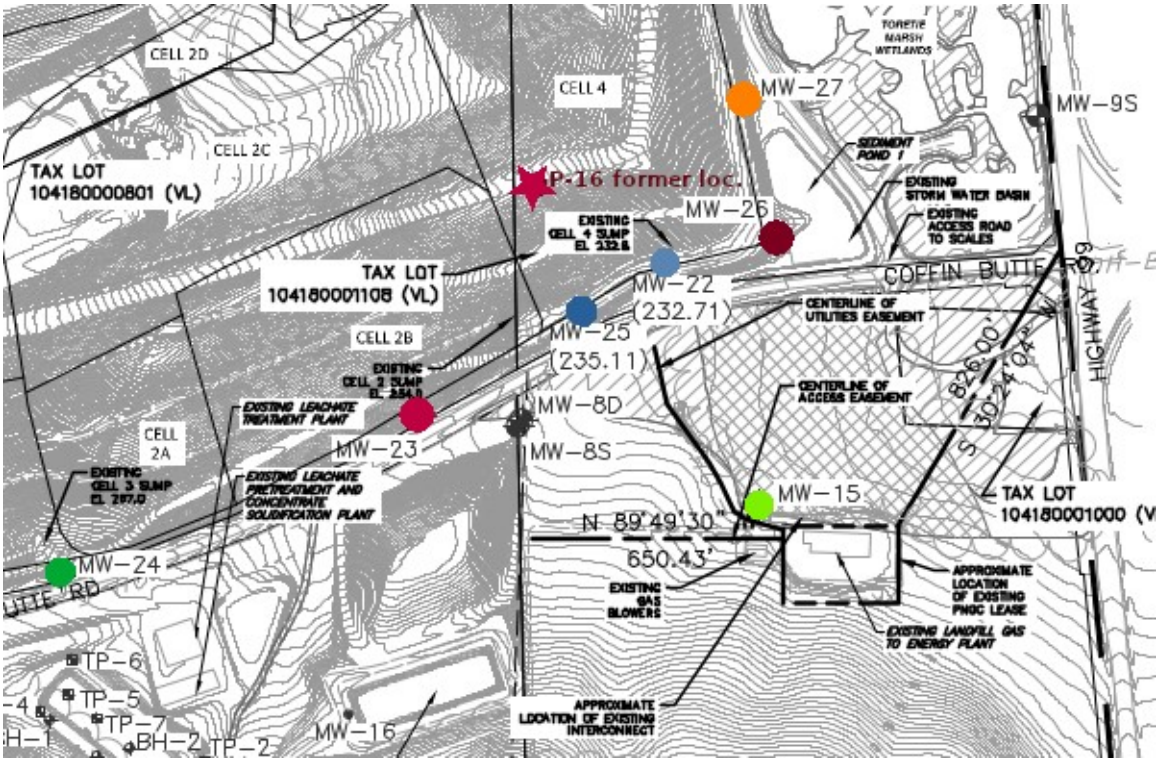

Figure 3. Location of monitoring wells in the area of concern.

4. Choice of baseline is questionable

The memo inaccurately suggests that the applicant started testing east-side wells for arsenic in 1991.

> *Arsenic testing at Coffin Butte initially began in April 1991, in well MW-S9* [corrected to MW-9S in the addendum] *on the landfill's northeast side.*

MW-9S was drilled on August 2, 1985, but there is no record of it having been tested for arsenic until February 8, 1995.[3]

The first reported arsenic measurements at Coffin Butte were in late 1988, mainly on the west side of the landfill.

The only pre-1994 measurement reported from the east side was apparently in MW-8S, in 1988.[4] That sample yielded a non-detection (ND) for an analysis threshold of 2 micrograms per liter in MW-8S. MW-8S is just across the road from the existing landfill, and about 90 yards downhill from MW-23, in the same direction as the interpreted hydraulic gradient.

The fact that arsenic was not detected in well MW-8S when it was sampled in 1988 may be a better indicator of baseline conditions, than wells that were sampled only after the acknowledged seepage problem that was discovered in 1994.

Applicant has instead claimed that MW-9S provides baseline data:

> *However, it is important to note that the initial sampling at this well – which established baseline arsenic levels in background concentrations - occurred prior to the completion of Cell 2 construction or any landfilling on the east side of Coffin Butte.*

3 Based on data provided in the AEMRs including a digital appendix of the 2023 AEMR, Appendix_F_-_2023_Historical_Database.xlsx. The latter shows that in 1991 MW-9S was sampled for alkalinity, chemical oxygen demand, chloride, hardness, nitrogen (various measures), total dissolved solids, suspended solids, sulfate, and total organic carbon, but not arsenic or other metals.

4 This measurement is missing from the database provided as digital appendix F, but shown as a plotted value in the 2023 AEMR, p. C-114 as well as in AEMRs from previous years.

As discussed above, there appears to be no record of sampling MW-9S prior to the early-1990s seepage incident.

According to the 2021 AEMR, this well drilled in 1985 is only 35 feet deep. The site map shows that this well is located right at the edge of State Hwy 99W, under what was part of the "half cloverleaf" interchange that was constructed for Camp Adair in the 1940s, using aggregate and fill rock from various sources. It is also right alongside the creek that was channelized to create what was called "the canal" during the Camp Adair period. This well is also immediately adjacent to a remedial wetland ("Toketie Marsh") that was constructed during the same time as the seepage occurred. Historical satellite images from Google Earth (Figure 4) show the condition of the area around MW-9S at that time.

The applicant has claimed:

> *Because this well is more than 1,800 feet away from MW-23, and because sampling occurred prior to the construction of Cell 2, it is implausible for the readings at this location to have been impacted by leachate.*

This ignores that there was a very simple way for leachate from the south side of the landfill to reach MW-9S.

This seepage would have drained into the ditch on the north side of Coffin Butte Road, flowed down through the ditch into the sediment pond, and into the newly created wetland as it was filling with water. Contaminated water in the wetland then would simply need to seep down through the disturbed sediments in which MW-9S was drilled.

Figure 4. View of east side of existing landfill development area from satellite images taken in May of 1944 (available on Google Earth). The recently constructed wetland on the east side of the scale-house road ("Toketie Marsh") is still in an unvegetated state though filling with water (indicated by shimmer). The sedimentation pond that flows into Toketie Marsh, receiving water from the ditch that runs past MW-23, also appears to be water-filled in this image. MW-9S is located at the edge of Toketie Marsh on the west side of Hwy 99W, next to the area where part of the former cloverleaf ramp has been bulldozed away.

Indeed, the available data from MW-9S (Figure 4) show that measurements shortly after the seepage problem was discovered in 1994 were higher (35 to 42 micrograms per liter) than the values seen since 2014 (in the range 27 to 29 micrograms per liter). This is consistent with the idea that this well could have initially been contaminated by leachate (which has arsenic concentrations above 100 micrograms per liter) arriving relatively directly via surface drainage, but since has declined to levels more consistent with a groundwater plume.

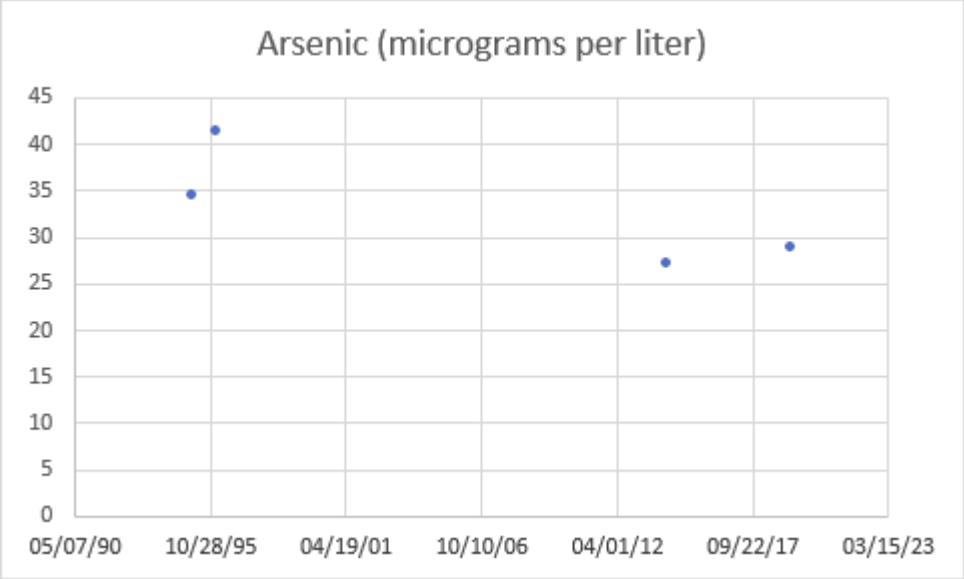

Figure 4. Arsenic concentrations measured in MW-9S from 1990 to 2023. Note that, although the applicant states that "this well has been subject to a quintennial sampling schedule (every five years) since 1991," the earliest reported are from 1995, and there appears to have been an 18-year gap in arsenic testing from February 1996 to April 2014. According to the applicant's arsenic addendum this well was again tested for arsenic in October 2024, with a reported concentration of 27 micrograms per liter.

In any case, concentrations observed in MW-23 and the compliance-boundary well MW-27 in 2023 exceeded the highest concentrations ever measured in MW-9S.

So even if we accept the applicant's questionable claim that MW-9S represents "baseline," recent measurements have exceeded the supposed baseline values.