LU-24-027 Supplemental Staff Report to Benton County Planning Commission

Benton County Exhibit 1 (BC1)
Compiled County Engineering and Public Works Comments

Contents:

- Maul Foster Alongi (MFA) and sub-consultants - June 23, 2025 engineering comments
- Maul Foster Alongi (MFA) and sub-consultants - April 17, 2025 engineering comments
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- Benton County Public Works – April 9, 2025 engineering and public works comments

Benton County Exhibit 1 (BC1)

- Maul Foster Alongi (MFA) and sub-consultants - June 23, 2025 engineering comments

MAUL FOSTER ALONGI
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June 23, 2025
Project No. M0732.02.001

Benton County Community Development Department
Petra Schuetz, Interim Director
4500 Research Way
Corvallis, OR 97333

Sent only electronically to: petra.schuetz@bentoncountyor.gov

Re: Third-Party Review: Coffin Butte Landfill Submittal

Dear Petra Schuetz:

Maul Foster & Alongi, Inc. (MFA) is contracted with Benton County (County) to perform third-party engineering and technical review of the land use application for the proposed Coffin Butte Landfill expansion. This letter provides a summary of our review of the correspondence and exhibits prepared by Valley Landfills, Inc. (Applicant), and submitted to the County in support of their application for a Conditional Use Permit (CUP) to expand the Coffin Butte Landfill. This review is intended to be an assessment of the engineering and other related elements of the submitted documents to establish their adequacy and feasibility for the County to make a land use determination.

MFA previously issued a letter dated April 17, 2025, summarizing our review of Applicant-submitted Exhibits 2, 5, 6, 11–14, 16–18, 20–22, 27–30, and 33. This current letter specifically addresses our review of Exhibits 36–38, 41, and 44–48, submitted by the Applicant on June 6, 2025. Please note that the review comments provided herein supersede the previous comments for Exhibit 11 (Noise Study) and Exhibits 12–14 and 33 (related to odor). The Recommended Conditions for Approval from the April 17, 2025 review letter are included at the end of this letter for completeness.

Review of Submitted Exhibits (June 6, 2025)

Exhibit 36: Revised Odor Dispersion Modeling Study

Exhibit Description: Exhibit 36 presents an odor dispersion modeling analysis of potential nuisance odor impacts from the existing and proposed operating scenarios for the landfill. Scenario #1 represents actual operations for 2023 (e.g., the existing scenario), and Scenario #2 represents the future operation during the estimated closure year in 2052. Scenario #2 is based on the assumption that the landfill will accept 930,373 tons of organic waste materials annually from 2023 to 2052, and that the design capacity for the landfill is limited to 41,110,068 tons.

The revised Odor Study addresses MFA's comments on the initial Odor Study that requested adjustment of the input parameters for the modeled fugitive landfill gas (LFG) emissions unit representations for Scenarios #1 and #2. Specifically, MFA requested SCS adjust the release height for the landfill surface area source representations to more closely align with the actual and future

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surface heights, and to set the initial vertical dimension for each area source representation to zero. Section 3.3.1 describes how SCS Engineers divided the landfill surface into a grid with 63 distinct 20,000 square meter areas. Each grid was represented in the dispersion model as a unique area source representation with a modeled release height based on the average elevation of each grid cell. This approach more accurately represents the landfill topography in the dispersion model and is in general alignment with MFA's recommendation. In addition, Table 3 presents the modeled release parameters for each area source representation included in the revised Odor Study. As shown in Table 3, no initial vertical dimension was included for any area source representation, which is in agreement with the MFA recommendation to conservatively set the initial vertical dimension to zero.

The revised Odor Study concludes that the proposed expansion of the landfill will not cause offsite nuisance odor impacts at nearby residential or commercial areas because the predicted dilution-to-odor threshold (D/T) for both scenarios is well below the commonly accepted nuisance threshold of 7 D/T.

Findings: MFA generally agrees with the dispersion modeling techniques and methodologies used by SCS Engineers to produce the results presented in the revised Odor Study. The revised Odor Study is based on actual measured data, including actual flowrates for the flare, current waste acceptance volumes for the landfill, onsite meteorological data, onsite terrain data, and actual operating hours for the tipper engines, as well as Oregon Department of Environmental Quality (ODEQ)-approved emission rates for the eight highest odor-causing pollutants potentially emitted by the landfill. This represents the best available data for conducting an odor dispersion modeling assessment.

Oregon does not have a recognized, regulatory threshold that determines when a nuisance condition exists. Because of this, the Applicant relied on a D/T threshold of 7 to make the conclusion that the proposed expansion will not create a nuisance condition. Table 1 prepared by the St. Croix Sensory Inc. presents various D/Ts with brief descriptions for what odors are likely to be expected at the associated D/T. As shown in Table 1, a D/T below 1 would likely have no noticeable odors in the community, while a D/T of 7 is the ambient odor level sometimes considered to be a nuisance.

Table 1. Odor Index Examples[1]

Odor Unit or D/T	Odor Description
1,000,000	Rendering plant uncontrolled exhaust
100,000	Venting anaerobic digester gases
10,000	Sludge centrifuge vent
1,000	Primary clarifier weir cover exhaust
500	Dewatering building exhaust
100	Multistage scrubber exhaust
50	Carbon filter exhaust
30	Ambient odor adjacent to biosolids land application
15	Ambient odor adjacent to aeration basin
10	Design value sometimes used in odor modeling
7	**Ambient odor level sometimes considered a nuisance**
5	Design value sometimes used in odor modeling
4	Ambient odor level common in a city
2	Ambient odor level usually considered "just noticeable"
1	**Ambient air in a community with "no odor" noticeable**

Reference

(1) McGinley, Charles & Michael McGinley. (2006). An Odor Index Scale for Policy and Decision Making Using Ambient and Source Odor Concentrations. Proceedings of the Water Environment Federation. 2006. 244-250. 10.2175/193864706783791696.

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The results of the revised Odor Study adequately demonstrates that Scenarios #1 and #2 are unlikely to exceed a nuisance D/T of 7. It is reasonable, for each scenario evaluated, that two odor pollutants (dimethyl sulfide and hydrogen sulfide) were predicted to be between the "no odor noticeable" D/T threshold of 1 and the "just noticeable" D/T threshold of 2, which aligns with the public's experience that there are some detectable odors from the landfill. However, based on the results of the revised Odor Study, it is unlikely that potential odors from the landfill will rise to the level at which a nuisance condition will be created, as indicated by the two highest predicted odor pollutants, dimethyl sulfide and hydrogen sulfide, resulting in a maximum D/T of 1.45 and 1.38 in Scenario #1, and 1.34 and 1.28 in Scenario #2, both of which are well below the nuisance D/T of 7.

As stated on the ODEQ website [https://www.oregon.gov/deq/aq/pages/nuisance-odor.aspx], "State law prohibits businesses from emitting odors which cause a nuisance. ODEQ is responsible for implementing those laws." Instead, nuisance conditions, including odors and odor control measures, are addressed in Oregon Administrative Rule (OAR) Chapter 340 Division 208. The ODEQ has issued guidance for implementing strategies for responding to public odor complaints and addressing the issue of mitigating them. Permitted facilities identified as having an odor issue by the ODEQ will be requested to submit an odor abatement proposal for evaluation and to enter into an enforceable Best Work Practices Agreement, which may include progressive or tiered levels of control. The landfill currently operates under an existing air permit (Title V Operating Permit No. 02-9502-TV-01) issued by the ODEQ. Therefore, there are regulatory steps enforceable by the ODEQ that would lead to a resolution in the event that nuisance odors were determined to be caused by the landfill. MFA is not aware of the ODEQ determining that odors from the landfill are currently causing a nuisance to the surrounding community. As a result, MFA does not believe an odor abatement agreement has been established between the ODEQ and the landfill (which would require odor mitigation measures). It is for the following reasons that MFA agrees with the Applicant that a nuisance condition will not be created upon completion of the proposed expansion:

- The ODEQ has not established that a nuisance condition exists at the landfill or taken steps to mitigate the issue.
- The revised Odor Study adequately demonstrates that emissions from the landfill will not exceed a D/T of 7.

Recommended Conditions for Approval:

36.1 Applicant's evidence submitted to support the conclusion that the proposed expansion will not seriously interfere with uses on adjacent properties or with the character of the area with regard to odor impacts is based on Applicant's submitted odor studies' assumption that the maximum organic waste acceptance will be no more than 41,110,068 tons by 2052. Accordingly, a condition of approval is appropriate to align with the Applicant's studies' assumed total organic waste acceptance volume, with provision that the annual organic waste acceptance volumes are within 10% of the modeled 930,373 tons per year through 2052.

36.2 During the first 48 months of landfill operations, the Applicant shall employ at its cost the services of a qualified third-party for an independent verification of the daily odor surveys conducted using certified inspectors with training in how to appropriately use a Nasal Ranger Field Olfactometer. Applicant is required to perform independent third-party verification at least once every 30 days and the third-party survey shall be documented and recorded. The standard D/T dial settings for a Nasal Ranger Field Olfactometer are set to 2, 4, 7, 15, 30, and 60. If independent verification results in a measured D/T of 4 or greater, Applicant shall immediately take steps to mitigate the odor level measured by independent verification. In addition, if Applicant consistently measures lower D/T values than the independent third-party,

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County should consider extending the independent third-party verification surveys beyond the 48-month timeframe.

Reviewers: Chad Darby, Brian Snuffer Zukas, PE

Exhibit 37: Beyond Toxics Testimony Response

Exhibit Description: Exhibit 37 contains the Applicant's response prepared by SCS Engineers to the May 6, 2025, testimony and documents submitted by Beyond Toxics.

Comments: MFA has reviewed the Applicant's exhibit and has not identified any technical concerns.

Reviewers: Brian Snuffer Zukas, PE

Exhibit 38: Memorandum – Additional Noise Mitigation

Exhibit Description: Exhibit 38 includes a memorandum dated June 6, 2025, prepared by The Greenbush Group, Inc. containing updated information related to the Applicants proposed noise mitigation measures.

Comments: MFA recommends removing the following statement on page 2: "Verification measurements may need to be made outside of normal operating hours to reduce noise contributions from other sources."

Findings: The above-referenced statement implies that sound measurements could be taken using a different method than was used to establish the baseline data for the 2023 assessment for the previous noise evaluation. It also may result in running the equipment outside of permitted operating hours, which would be counter to the purpose of focusing on noise mitigation. Otherwise, MFA is aligned with the proposed approach.

Reviewers: Bill Beadie

Exhibit 41: Environmental Methane Compliance Report of Findings

Exhibit Description: Exhibit 41 contains a report prepared by Guzi-West Inspection and Consulting, LLC dated January 2025, summarizing their review of the facility's management and permitting compliance of landfill gas and methane.

Comments: MFA has reviewed the Applicant's exhibit and has not identified any technical concerns.

Reviewers: Brian Snuffer Zukas, PE

Exhibit 44: Fire Risk Response

Exhibit Description: Exhibit 44 is a memorandum dated June 5, 2025, prepared by SCS Engineers responding to the public testimony and documents received related to fire risk at Coffin Butte Landfill.

Comments: MFA has reviewed the applicant's exhibit and has not identified any further technical concerns.

Findings: The applicant noted that they will be maintaining a running log of landfill fire incidents and will report each event to the ODEQ, as recommended in the planning commission hearings.

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Reviewers: Cem Gokcora, Ellery Howard

Exhibit 45: Landfill Cross Sections

Exhibit Description: Exhibit 45 contains topographic cross sections of the proposed landfill and Tampico Ridge prepared by Civil and Environmental Consultants, Inc. (CEC) and printed on May 22, 2025. This exhibit is intended to address the questions from the planning commission hearings regarding the height of the proposed landfill relative to Tampico Ridge.

Comments: This exhibit clarifies that the highest elevation of the final surface of the landfill will be at 450 feet elevation and below the elevation of Tampico Ridge.

Findings: The final surface of the proposed landfill expansion will not be visible from the south side of Tampico Ridge.

Reviewers: Cem Gokcora, Ellery Howard

Exhibit 46: Aerial Photo Showing Tarp Repair Areas

Exhibit Description: Exhibit 46 includes a May 9, 2025, aerial photo showing that previously reported tarp tears have been repaired.

Comments: MFA has no comments on this exhibit as it shows features and processes at the existing landfill and is not material to the proposed expansion of the landfill that is the basis of this CUP.

Reviewers: Cem Gokcora, Ellery Howard

Exhibit 47: Construction Sequence

Exhibit Description: Exhibit 47, dated June 2025, contains the general construction sequence for the proposed landfill expansion prepared by CEC in response to the questions posed during the planning commission hearings.

Comments: The sixth bullet of the construction sequence document states, “All the existing leachate piping that was routing leachate to the existing leachate ponds that is located in the expansion area footprint will be removed. New piping for the leachate will be installed that connects the leachate sumps in the existing landfill to the new leachate ponds.”

This bullet step precedes the necessary approval of ODEQ of the leachate ponds.

Findings: The referenced bullet should be moved to follow the bullet referencing the ODEQ approval of the leachate ponds.

Reviewers: Cem Gokcora, Ellery Howard

Exhibit 48: Dry Climate Landfills

Exhibit Description: Exhibit 48 is a memorandum prepared by CEC and dated June 2025, that explores landfill gas generation in dry versus wet climates. This document responds to testimony regarding the rate of production of landfill gas and leachate in drier climates, specifically in comparison to Coffin Butte Landfill.

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Comments: MFA has reviewed the applicant's exhibit and has not identified any further technical concerns.

Reviewers: Cem Gokcora

Recommended Conditions for Approval on Previously Reviewed Exhibits

This section includes the remaining Recommended Conditions for Approval from the previous MFA review letter dated April 17, 2025. The Recommended Conditions for Approval are repeated here to consolidate the recommendations from both technical reviews in one place.

Exhibit 2: Engineering Plans

Exhibit Description: Exhibit 2 contains the revised engineering plans prepared by Civil and Environmental Consultants, Inc. (CEC) dated January 2025.

Recommended Conditions for Approval:

2.1 The Applicant shall provide the County with copies of all documents submitted to the ODEQ for approval of this landfill expansion, including but not limited to, reports, design/construction drawings, specifications, and operations plan.

2.2 Prior to submitting a building application that will include human occupancy (i.e., Employee Building), the Applicant shall demonstrate that they satisfy the relevant portions of Benton County Code (BCC), including BCC 99.70 Sewage Disposal and obtain a site evaluation as outlined in BCC 99.710.

Reviewers: Cem Gokcora, Erik Bakkom

Exhibit 5: Phase II Geotechnical Exploration Report and Addendum to the South Expansion Area

Exhibit Description:

Exhibit 5 is the Phase II Geotechnical Exploration Report and addendum to the South Expansion Area prepared by Wallace Group dated July 15, 2024.

Recommended Conditions for Approval:

5.1 At the time of submittal of the grading or site plan submittal to the County, the Applicant shall provide further geotechnical analysis or clarification related to the slope stability analysis along the north end of Section B-B'. Due to the proximity of the cut slope crest to the public right-of-way of Coffin Butte Road and existing utilities, an explicit analysis of the subject slope, including the computation of factors of safety and, if necessary, the estimation of earthquake-induced horizontal deformation is recommended.

Reviewers: Columbia West Engineering, Inc.

Exhibit 17 Preliminary Drainage Report

Exhibit Description: Exhibit 17 is the Preliminary Drainage Report prepared by CEC dated January 2025, and updated March 2025

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Recommended Conditions for Approval

17.1 Prior to the ODEQ solid waste permitting submittal, the Applicant shall prepare the stormwater report and all related designs for the detention and conveyance features utilizing the most recent version of the Benton County Stormwater Support Documents.

Reviewers: Cem Gokcora

General Observations

MFA understands that the Applicant will be required to prepare various submittals to other agencies having jurisdiction (AHJ), including but not limited to ODEQ. MFA recommends that the County be copied on all submittals when they are prepared and submitted to other AHJ's. Therefore, MFA recommends that the following be added as a condition for approval:

> The Applicant shall provide the County with simultaneous and identical copies of all submittals made to other agencies having jurisdiction related to the proposed expansion of Coffin Butte Landfill.

Summary of Review

The information presented herein represents the summary of MFA and our subconsultants' technical review of a portion of the exhibits submitted by the Applicant in support of their land use request to expand Coffin Butte Landfill.

Please contact MFA if you have any questions or need any additional information regarding this review.

Sincerely,

Maul Foster & Alongi, Inc.

Erik Bakkom, PE
Principal Engineer

Cem Gokcora, PE
Senior Engineer

Attachment

Limitations

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Limitations

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

Benton County Exhibit 1 (BC1)

- Maul Foster Alongi (MFA) and sub-consultants - April 17, 2025 engineering comments

MAUL FOSTER ALONGI
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April 17, 2025
Project No. M0732.02.001

Petra Schuetz, Interim Director
Benton County Community Development Department
4500 Research Way
Corvallis, OR 97333

Sent only electronically to: petra_schuetz@bentoncountyor.gov

Re: Third-Party Review: Coffin Butte Landfill Submittal

Dear Petra Schuetz:

Maul Foster & Alongi, Inc. (MFA) is contracted with Benton County (County) to perform third-party engineering review of the land use application for the proposed Coffin Butte Landfill expansion. This letter provides a summary of our review of the correspondence and exhibits prepared by Valley Landfills, Inc. (Applicant), and submitted to the County in support of their application for a Conditional Use Permit (CUP) to expand the Coffin Butte Landfill. This review is intended to be an assessment of the engineering and other related elements of the submitted documents to establish their adequacy and feasibility for the County to make a land use determination. MFA's scope of review is limited to Exhibits 2, 5, 6, 11 through 14, 16 through 18, 20 through 22, 27 through 30, and 33.

Review of Submitted Exhibits

Exhibit 2: Engineering Plans

Exhibit Description: Exhibit 2 contains the revised engineering plans prepared by Civil and Environmental Consultants, Inc. (CEC) dated January 2025.

Comments: While the plan is preliminary in nature, meaning that it describes the intended site development without all the details that will be necessary for final construction, Exhibit 2 appears to adequately show the appropriate level of detail for the expansion of the landfill for a land use decision. MFA acknowledges the Applicant's proposed plan to defer the detailed engineering design, analysis, and calculations for the landfill expansion to the solid waste permitting application for Oregon Department of Environmental Quality (ODEQ) review.

Findings: If the CUP is approved by Benton County, the future plans submitted to ODEQ and the County will need to include additional design and detail for more in-depth review as mentioned in the Applicant's Response to Comments letter dated January 15, 2025.

Recommended Conditions for Approval:

2.1 The Applicant shall provide the County with copies of all documents submitted to the ODEQ for approval of this landfill expansion, including but not limited to, reports, design/construction drawings, specifications, and operations plan.

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2.2 Prior to submitting a building application that will include human occupancy (i.e., Employee Building), the Applicant shall demonstrate that they satisfy the relevant portions of Benton County Code (BCC), including BCC 99.70 Sewage Disposal and obtain a site evaluation as outlined in BCC 99.710.

Reviewers: Cem Gokcora, Erik Bakkom

Exhibits 5, 6, 16, and 30

Exhibit Description:

Exhibit 5 is the Phase II Geotechnical Exploration Report and addendum to the South Expansion Area prepared by Wallace Group dated July 15, 2024.

Exhibit 6 contains the well logs for PW-2 and the Berkland Well.

Exhibit 16 initially included a July 3, 2024, technical memorandum regarding the "Environmental and Operational Considerations" of the landfill prepared by Tuppan Consultants LLC. This exhibit was revised and resubmitted by the Applicant on March 14, 2025, with an updated technical memorandum by Tuppan Consultants LLC dated February 25, 2025.

Exhibit 30 is the Proposed Coffin Butte Landfill Seismic Design prepared by CEC dated July 9,2024.

Comments: A review of this group of documents was provided by Columbia West Engineering, Inc. (CWE), as a geotechnical subconsultant to MFA. CWE's comments are summarized below, while the entire CWE letter is provided as Attachment A.

Findings: In general, the scope of the field exploration, laboratory testing program, and analysis methods are appropriate for the geologic complexity and nature of the proposed development. The geotechnical report provides a thorough discussion of regional geology, local subsurface conditions, and relevant seismically-induced geologic hazards, as required by the Oregon Structural Specialty Code.

Strain-based compression index values used in the settlement analysis are generally supported by the results of one-dimensional consolidation tests included in the geotechnical report. Similarly, soil/rock properties and strength parameters used in the slope stability analyses are supported by laboratory test results and generally fall within the ranges found in typically found in published literature for similar soil types.

Our sole comment requiring potential further analysis or clarification from Wallace Group concerns the slope stability analysis along Section B-B'. While the analyses generally address the more critical portions (i.e., larger cuts) of the cross-section, the north end of Section B-B' may require explicit consideration due to the proximity of the cut slope crest to the public right-of-way. Aerial imagery indicates utilities at the surface in this area are approximately 25 feet south of the roadway edge, and it is unclear whether additional buried utilities are present. While we expect the slope to be stable under static conditions, the potential for slope movement under pseudo-static loading may impact the right-of-way. We recommend an explicit analysis of the subject slope, including the computation of factors of safety and, if necessary, the estimation of earthquake-induced horizontal deformation.

We also completed a review of the discussion of future geotechnical evaluations outlined in the "Geotechnical Issues and Seismic Stability" section of Exhibit 16. We conclude that the existing geotechnical data and analysis presented in the geotechnical report (Exhibit 5) do not indicate that there are any geotechnical or geologic constraints that would adversely impact landfill development.

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We note that additional geotechnical evaluation related to design of the landfill itself will be provided before landfill construction.

Recommended Conditions for Approval:

5.1 At the time of submittal of the grading or site plan submittal to the County, the Applicant shall provide further geotechnical analysis or clarification related to the slope stability analysis along the north end of Section B-B'. Due to the proximity of the cut slope crest to the public right-of-way and existing utilities, an explicit analysis of the subject slope, including the computation of factors of safety and, if necessary, the estimation of earthquake-induced horizontal deformation is recommended.

Reviewers: Columbia West Engineering, Inc.

Exhibit 11: Noise Study

Exhibit Description: Exhibit 11 is the Noise Study prepared by The Greenbusch Group (Greenbusch) dated September 25, 2023

Comments: The Noise Study summarizes existing sound levels measured near the proposed expansion area, sound levels produced by equipment currently being used at the landfill and predicted sound levels for both beginning and maximum future grade conditions. The report concludes that noise mitigation is not required to comply with regulatory limits. However, Greenbusch recommended that all backup alarms used on the site be replaced with ambient sensing broadband backup alarms if permitted by safety regulations.

MFA understands that the Applicant provided the following Operating Approval Conditions:

OA-1. Hours of Operation. Operating hours for disposal of waste in the landfill shall be as follows:

(A) Monday through Saturday, the site may open to vehicles using the commercial tipping area starting at 5 a.m. and to all other customers starting at 8 a.m. The site shall close to both commercial and other customers at 5 p.m. Internal operations, including but not limited to leachate hauling, infrastructure construction, disposal area activities and site maintenance is permitted to occur prior to and after these hours.

(B) On Sunday, the site will not open before 12 p.m. and will close no later than 5:00 p.pm. Internal operations, including but not limited to leachate hauling, infrastructure construction, disposal area activities and site maintenance is permitted to occur prior to and after these hours.

(C) During an emergency or when requested by a State, Federal, or County agency, Applicant may open the landfill outside of these hours.

OA-2. Vehicle Noise. All Applicant vehicles being used for operations on the new site shall be outfitted with white noise back up alarms.

OA-3. Noise Study Updates. Applicant shall provide an updated noise study prepared by Applicant's noise consultants once every three years. Applicant will implement mitigation measures to bring any non-compliant noise levels into compliance with ODEQ noise regulations.

Findings: Greenbusch used the median instead of the lowest measurement when establishing ambient noise levels. Greenbusch collected several hourly readings of existing sound levels, and they presented a low, high, and median value in Table 5.2 of the Noise Study. Greenbusch correctly states that Oregon Administrative Rules (OAR) 340-035-0035(1)(B) prohibits ambient sound levels

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from being exceeded by more than 10 decibels on the A-weighted scale (dBA). Specifically, the rule states:

> No person owning or controlling a new industrial or commercial noise source located on a previously unused industrial or commercial site shall cause or permit the operation of that noise source if the noise levels generated or indirectly caused by that noise source increase the ambient statistical noise levels, L10 or L50, by more than 10 dBA in any one hour…

MFA is not aware of anything in the ODEQ rules that states facilities are allowed to use the median noise value instead of the lowest noise value when establishing ambient noise levels. The inclusion of the phrase "in any one hour" implies that ODEQ rules require using the lowest measured value. If Greenbusch had selected the lowest measured noise levels, the predicted sound levels presented in Tables 7.1 would show that three of the four locations exceeded the allowable L50 noise level, while the fourth location approached the limit.

MFA finds that the noise study demonstrates that the applicable ODEQ noise standard will be exceeded at neighboring properties if Greenbusch used the lowest hourly noise value as MFA believes is required by DEQ rules. Even if the median value was considered as suggested by Greenbusch, the predicated sound level at location four is exactly equal to the ODEQ limit.

MFA believes that the noise study indicates that the proposed use may seriously interfere with uses on adjacent property or with the character of the area.

Recommended Conditions for Approval:

If the Applicant provides additional information demonstrating compliance with the ODEQ noise standards, MFA recommends that the County considers the following permit conditions in addition to the Operating Approval Conditions proposed by the Applicant:

11.1 The Applicant shall develop and implement a program to periodically (e.g., weekly) measure equipment sound levels and compare results to levels in Table 5.3. If results exceed the levels in Table 5.3 by more than 2 dBA, the Applicant shall remove the equipment from service and complete repairs to reduce sound pressure levels. The Applicant shall maintain records of measurements and provide a summary of results and subsequent repairs (if applicable) with the updated noise study provided every three years consistent with OA-3.

The Applicant should be allowed to use a mobile application, such as the National Institute for Occupational Safety and Health (NIOSH) Sound Level Meter, to make periodic sound level measurements if the Applicant can demonstrate results are not more than 2 dBA lower than measurements with a Type II sound level meter. Side-by-side measurements with a calibrated Type II sound level meter at least once every three years is an adequate method to demonstrate the sufficiency of measurements with a mobile application.

Reviewers: Bill Beadie

Exhibit 12: Findings on Odor

Exhibit Description: Exhibit 12 is the Findings on Odor memorandum prepared by Weaver Consultants Group dated April 26, 2024

Comments: MFA has no further comments on this exhibit. Refer to the odor-related comments and findings presented under Exhibit 33.

Reviewers: Chad Darby

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Exhibit 13: Memo Regarding Odor, Methane, and Hydrogen Sulfide Control

Exhibit Description: Exhibit 13 is letter regarding odor, methane, and hydrogen sulfide control prepared by Ian Macnab (of Coffin Butte Landfill) dated November 19, 2021.

Comments: MFA has no further comments on this exhibit. Refer to the odor-related comments and findings presented under Exhibit 33.

Reviewers: Chad Darby

Exhibit 14: Odor Dispersion Modeling Study for Landfill Expansion

Exhibit Description: Exhibit 14 contains the Odor Dispersion Modeling Study (2024 Odor Study) prepared by SCS Engineers and dated October 22, 2024. This exhibit was initially reviewed for completeness by MFA and noted several issues related to the assumptions and findings outlined in this study in a letter dated November 27, 2024. The Applicant submitted an additional odor dispersion study and report on March 14, 2025 (Exhibit 33). MFA did not provide the subsequent technical review of Exhibit 14 per the County's direction but instead completed a review of Exhibit 33.

Exhibit 16: Environmental and Operational Considerations

Exhibit Description: Exhibit 16 initially included a July 3, 2024, technical memorandum titled Environmental and Operational Considerations of the landfill prepared by Tuppan Consultants LLC. This exhibit was revised and resubmitted by the Applicant on March 14, 2025, with an updated technical memorandum by Tuppan Consultants LLC dated February 25, 2025.

Comments: MFA has no further comments on this exhibit. Refer to other prior sections of this letter for Columbia West's comments on a portion of this exhibit.

Reviewers: Derek Heitz, Cem Gokcora, Columbia West Engineering, Inc.

Exhibit 17 Preliminary Drainage Report

Exhibit Description: Exhibit 17 is the Preliminary Drainage Report prepared by CEC dated January 2025, and updated March 2025

Comments: MFA recommends the Applicant follow the Benton County Stormwater Support Documents, instead of the Corvallis Stormwater Standards, to finalize the stormwater calculations and design components for the ODEQ submittal. Based on MFA's review of the information provided, the proposed stormwater detention facilities appear to be conservatively sized, and despite the use of a different standard, the overall design of the stormwater facilities appears adequate from a land use perspective.

Recommended Conditions for Approval

17.1 Prior to the ODEQ solid waste permitting submittal, the Applicant shall prepare the stormwater report and all related designs for the detention and conveyance features utilizing the most recent version of the Benton County Stormwater Support Documents.

Reviewers: Cem Gokcora

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Exhibit 18: Aerial Renderings of Coffin Butte Landfill

Exhibit Description: Exhibit 18 contains the aerial renderings of Coffin Butte Landfill prepared by CEC dated July 2024.

Comments: MFA has no comments on this exhibit.

Reviewers: Cem Gokcora

Exhibit 20: Fire Risk Assessment of Coffin Butte Landfill

Exhibit Description: Exhibit 20 initially included the Fire Risk Assessment of Coffin Butte Landfill, Corvallis, Oregon prepared by SCS Engineers dated November 29, 2023. MFA reviewed its content for completeness in their letter dated November 27, 2024. However, on December 11, 2023, the Applicant submitted a more recent fire risk assessment dated September 24, 2024. This exhibit was later amended with an addendum memorandum prepared by SCS Engineers on January 14, 2025, addressing the completeness review comments.

Comments: MFA and our subconsultant, Dr. Tony Sperling of Landfill Fire Control Inc. (LFCI), have the following comments on this exhibit:

The Coffin Butte Landfill should continue to employ best industry practices for fire risk management, including but not limited to:

- Temperature and landfill gas (LFG) monitoring
  - Routine temperature monitoring via a thermal camera to confirm that temperature in affected areas remains below 50°C (122°F), after removal of hot materials.
  - Monitoring carbon monoxide (CO) in addition to the primary LFGs (methane, and carbon dioxide), as CO levels are good indicators of the presence of incomplete combustion.
- Maintain firefighting supplies on site, such as full water trucks and soil stockpiles
  - Sufficient soil should be kept near the working face to fully cover the active area with a minimum thickness of one foot.
- Proper acceptance and disposal of battery and electronic waste
- Periodic maintenance of the landfill gas (LFG) management system

LFCI agrees with the Applicant's statement that excessive extraction of LFG can lead to increased temperatures and the potential for subsurface fires. However, LFCI notes that a review of data from several major landfill fire incidents indicates that there are documented cases where subsurface fire has breached the surface. Given the associated risks of surface fires, it is strongly recommended that landfill operations prioritize the proper maintenance of LFG management systems and closely monitor for subsurface fire activity, particularly in cases of system failure or interruption.

Reviewers: Landfill Fire Control Inc.

Exhibit 21: Conditions of Approval

Exhibit Description: Exhibit 21 contains the Proposed Conditions of Approval prepared by the Applicant and dated January 15, 2025

Comments: The Applicant's proposed OA-7 states that the final grade of the new landfill cell shall not exceed 500 feet in elevation. MFA notes that the highest elevation for the final grade of the

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proposed landfill cell is shown as 450 feet on the revised engineering plan set. It is our recommendation that the operating approval conditions should reflect the 450 feet maximum elevation.

Recommended Conditions for Approval

21.1 The Applicant shall ensure the final grade of the new landfill cell does not exceed 450 feet in elevation.

Reviewers: Erik Bakkom, Cem Gokcora, Ellery Howard

Exhibit 22: Reclamation Plan for Expansion Area

Exhibit Description: Exhibit 22 contains the Reclamation Plan for Expansion Area prepared by CEC dated April 2022.

Comments: MFA has no comments on this exhibit.

Reviewers: Cem Gokcora

Exhibit 27: Leachate Management Summary

Exhibit Description: Exhibit 27 contains the Leachate Management Summary prepared by CEC dated March 2024 and updated January 15, 2025

Comments: MFA acknowledges that the detailed calculations regarding leachate quantities and collection system components will be developed and submitted to the ODEQ during the solid waste permitting process and recommends County to be copied with the ODEQ submittal, as noted in the prior section of this letter under Exhibit 2.

MFA noted that Coffin Butte Landfill has an agreement with the Corvallis wastewater treatment plant (CWWTP) to dispose of its leachate at their plant. The landfill currently disposes of 50% of their leachate at CWWTP. The permit for this operation expires December 31, 2025. The remaining 50% of the leachate is currently disposed of at the Salem wastewater treatment plant (SWWTP). Coffin Butte Landfill's discharge agreement with SWWTP expires December 31, 2027.

Reviewers: Cem Gokcora

Exhibit 28: Letter to County Regarding Methane Emissions

Exhibit Description: Exhibit 28 initially contained a letter to the County regarding methane emissions prepared by Ginger Rough dated February 23, 2024. MFA reviewed this for completeness in their letter dated November 27, 2024. This exhibit was later amended by the Applicant with an addendum prepared by Ginger Richardson dated January 15, 2025, addressing the completeness review comments.

Comments: MFA has no further comments on this exhibit. Refer to the odor-related comments and findings presented under Exhibit 33.

Reviewers: Chad Darby, Derek Heitz

Exhibit 29: Letter to County Related to Arsenic

Exhibit Description: Exhibit 29 initially contained a letter to the County regarding arsenic prepared by Ginger Rough dated February 15, 2024. MFA reviewed this for completeness in their letter dated

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November 27, 2024. This exhibit was later amended by the Applicant with an addendum prepared by Ginger Richardson dated January 15, 2025, addressing the completeness review comments.

Comments: MFA has no further comments on this exhibit.

Reviewer: Derek Heitz

Exhibit 33: Updated Odor Dispersion Modeling Study

Exhibit Description: Exhibit 33 contains the updated Odor Dispersion Modeling Study (2025 Odor Study) prepared by SCS Engineers dated March 2025. The report portion of this exhibit was submitted by the Applicant on March 14, 2025. The Applicant provided additional submittals on March 20, 2025, and April 10, 2025, to include the odor modeling files that were originally requested by MFA in their completeness review letter dated November 27, 2024.

Comments: As noted previously, the 2025 Odor Study follows a 2024 Odor Study (Exhibit 14). MFA previously found that the 2024 Odor Study did not incorporate emission rates, in units of grams per second, in the dispersion model representation of the landfill. For that reason, MFA does not feel the 2024 Odor Study can be relied upon. Overall, the 2025 Odor Study addressed the primary concerns MFA identified in the 2024 Odor Study.

The below comments follow a review of Exhibit 33 (2025 Odor Study) along with a cover letter from Miller Nash and the First Addendum to the Burden of Proof (BOP) dated March 14, 2025.

Comment 1: The BOP refers to the 2024 Odor Study on page 1 and in the conclusions on page 3, and it makes assertions from that study about the project odor impacts. MFA does not believe that the 2024 Odor Study should be cited as it does not rely on actual emissions from the landfill to draw conclusions. MFA submitted comments on the 2024 Odor Study pointing out several issues, which have largely been addressed in the 2025 Odor Study.

Comment 2: Per Item C in the BOP and section 5.2 of the 2025 Odor Study, Scenario #1 (2023 actual operations) was not expected to cause detectable nuisance odors since the [dilution-to-odor threshold] (D/T) ratio for each pollutant modeled was well below one. MFA recommends that the 2025 Odor Study include a section on model uncertainties and refer to these uncertainties when making concluding statements. For instance, the model is able to predict offsite odor pollutant concentrations for the majority of hours included in the modeled meteorological dataset. However, the model is unable to accurately predict impacts during low wind speeds, inversions, and very short-term meteorological conditions (less than 1 hour) that may result in less dispersion and, therefore, higher concentrations of odor-causing pollutants on neighboring properties. However, some of these same conditions are also likely to result in higher concentrations of odor-causing pollutants from other neighboring sources as well.

Comment 3: Per Item C in the BOP and section 5.2 of the 2025 Odor Study, Scenario #2 (2052 proposed operations) D/T ratios increased by 2 to 2.5 times as compared to Scenario #1 (2023 actual operation) for all pollutants except [total oxides of nitrogen] (NOX). The above statement alludes to the possibility that either the odor detected will be of higher intensity or the odor will be noticed by more people with greater frequency. If odors are primarily detected during calm periods, it is possible it will be more noticeable, but not necessarily more frequently noticed. MFA

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recommends that the Applicant includes a discussion about what the change in model results between Scenario #1 and Scenario #2 likely indicates.

Comment 4: MFA recommends that the Applicant clarify what emission units are included in the aggregate insignificant model identified in Section 3.3.

Comment 5: MFA recommends that the Applicant confirm if the November 2024 Modeling Report was reviewed and approved by the ODEQ. If not, the Applicant should provide supporting justification for the following modeled release parameters:

- The modeled release height (262.5-feet) and initial vertical dimension (122.1-feet) for the current landfill fugitive surface (Model ID: FUG). MFA is concerned that setting the entire waste-containing area for the current landfill fugitive emissions unit to the north of Coffin Butte Road at a single release height, plus the additive vertical dimension, is unrealistic and will result in a less conservative assessment.
- It is unclear from Table 3 whether the modeled release parameters for the current landfill fugitive surface (Model ID: FUG) are the same for Scenario #1 (2023) and Scenario #2 (2052). However, based on a review of the dispersion model output files for Scenario #1 and Scenario #2, MFA understands the modeled release parameters are unchanged between either scenario. The effective release heights appear to be nearly 100 feet above the highest point of the current landfill footprint based on a review of Google Earth terrain data (current as of July 2024) and would be inappropriate to represent existing conditions for 2023. Given the surface heights vary for waste-containing areas on the landfill, and it appears that emissions are being spread evenly over the entire landfill surface area, it would seem more appropriate to assume an average effective release height equal to half of the height of the landfill above the base elevation.
- The modeled release height (154-feet) and initial vertical dimension (71.6-feet) for the expanded landfill fugitive surface (Model ID: FUG_EXP).
- The modeled extents for the current landfill fugitive surface area (Model ID: FUG) and the expanded landfill fugitive surface area (Model ID: FUG_EXP). Modeled emission rates are divided by the modeled area, meaning the larger the modeled extents, the lower the corresponding modeled emission rate which results in a less conservative assessment.

MFA recommends separate release parameters for 2023 and 2052, as the landfill heights will be different. Separate tables for the release parameters should be provided and labeled in the 2025 Odor Study. MFA recommends that the modeled surface area be set at half the height of the landfill to account for areas that are both above and below this height unless other values are justified. MFA further recommends that the model include no initial vertical dimension. The landfill gas being released as fugitives from the landfill surface will be slow moving and may only be thermally buoyant a portion of the year. To be conservative, MFA does not recommend an initial vertical dimension for Scenario #1 or Scenario #2.

Comment 6: The Applicant should clarify the following statement from Section 3.6: Note, wind data in Figure 7 was measured during a different time period and at a different location than the on-site wind data used for the odor complaint analysis. Therefore, the wind data in Figure 7 was not used in the odor complaint analysis. The Applicant

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should also confirm that the onsite meteorological dataset collected from November 1, 2004 to October 30, 2005 was used for each odor model run.

Comment 7: An outdated version of the AERMET program executable (v18081) was used to process the meteorological dataset included in the AERMOD model runs. The selected AERMET executable is outdated and was originally issued in 2018. There have been several new executables issued by the EPA since 2018 that incorporate a wide variety of changes to preprocessing meteorological data. The potential impacts to offsite modeled concentrations may be significantly impacted by using the latest AERMET executable version. MFA recommends that each AEMROD model iteration use the most recent version of the AERMET program executable (v24142).

Comment 8: Each dispersion model was executed using the 1-hour averaging period. Odors are generally considered a nuisance if they recur over longer periods of time. Modeling for one-hour impacts may not accurately reflect the potential impacts from longer exposure. As a result, MFA recommends the AERMOD model iterations assume the 24-hour averaging period to more accurately represent exposure to emissions from the landfill and to local weather patterns.

Comment 9: As noted above, each dispersion model was executed using the 1-hour averaging period, but annual emission estimates were used as the basis for modeled emission rates. Annual emission rates in units of pounds per year were converted to grams per second (g/s) by dividing by 31,536,000 seconds (e.g., the number of seconds in a calendar year) and multiplying by 453.592 grams as shown in Appendix C and D of the 2025 Odor Study. Modeling annual-based emission rates with 1-hour averaging periods is inconsistent and may not accurately reflect short-term emission rates that tend to bias high for a wide variety of factors. MFA recommends that the Applicant add clarifying justification for modeled emission rates or conservatively incorporate a short-term variability factor (e.g., 20% or 30% contingency factor) to better represent potential short-term surges to emission rates.

Comment 10: Per Section 3.9, the total landfill fugitive surface area is 1,011,815 square meters, with 81% of this being in the current area, and 19% in the southern proposed expansion. Total fugitive emissions were split between FUG and FUG_EXP based on this area percentage. However, the modeled emission rates for the current and expanded landfill fugitive source representations (Model IDs: FUG and FUG_EXP, respectively) are equal as shown in the dispersion modeling output (*.ADO) files for each Scenario #2 model run, except for the NOX models. The Applicant should review, clarify, and update modeled emission rates.

Comment 11: The 1-hour nitrogen dioxide (NO2) National Ambient Air Quality Standard (NAAQS) is 188 micrograms per cubic meter (ug/m3). As shown in Tables 6 and 7, Scenario #1 and Scenario #2 result in maximum predicted offsite concentrations of 769 and 512 ug/m3, respectively, which are well above the NAAQS. Although this is not an odor-related issue, presenting a NAAQS exceedance may represent a larger issue for the Coffin Butte Landfill.

Comment 12: In Section 4.0 it is stated, “A D/T ratio of less than one indicates that the predicted impact would not cause a detectable nuisance odor impact. Detectable, nuisance, and impact all have arguably different thresholds and meaning. While a D/T ratio of less than 1 would not result in a detectable odor for the average person, there will be some people that are more sensitive and would still smell something. A nuisance is

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typically assumed to be a D/T value greater than or equal to 7 for state agencies that rely on this measurement method. Oregon does not utilize a technology-based method, choosing to rely instead on documenting frequency, duration, intensity and offensiveness of an odor. Because Oregon does not establish a numeric threshold based on D/T measurement, the predicted impact is subject to legal interpretation. It may be more appropriate to state that "the average person is not expected to detect a nuisance odor at the predicted concentration where the calculated D/T value is less than one."

Comment 13: The 2025 Odor Study does not present an uncertainty analysis, so it does not consider the potential impacts from more or less conservative assumptions. For instance, several of the pollutants with the highest measured concentration are all sulfur-based compounds. While it has been assumed that a D/T value less than 1 will not result in a detectable odor by the average person, several of these compounds could have an additive effect. MFA recommends the Applicant provide discussion to address potential additive effects relating to a nuisance condition. It should also be acknowledged that dispersion modeling has many limitations that may potentially result in predicted offsite concentrations not aligning with actual real-life concentrations. Known model limitations include low wind speeds, inversions, and short duration meteorological events, and their potential impacts should be discussed further.

Comment 14: On page 20, it is stated, This middle scenario would show results in between Scenario #1 and #2 with slight differences based on landfill mound height in the expansion area and would certainly show D/T values less than 1 for all pollutants. MFA notes that with lower release heights, dispersion characteristics will be different, which may potentially result in higher predicted offsite concentrations. MFA recommends a middle height scenario be included or that more technical discussion be included to justify that statement.

Comment 15: MFA believes that there are several statements in Section 5.2 that require further explanation.

It is stated that: Scenario #1 (2023 actual operations) was not expected to cause detectable nuisance odors since the D/T ratio for each pollutant modeled was well below one. Due to limitations of the dispersion model, it is possible to have periods of odor that are detectable by those who are sensitive to particular odors.

It is also stated that: Scenario #2 (2052 proposed operations) D/T ratios increased by 2 to 2.5 times as compared to Scenario #1 (2023 actual operation) for all pollutants except NOx. The Applicant should provide a statement about what this means in terms of increases to the frequency or intensity of odors.

Findings: While the findings of the Applicant's odor model predict that odors generally would not be considered an odor nuisance (where D/T values are below 1), MFA has observed several inconsistencies in the model setup that could significantly affect the predicted values. Specifically, these are without limitation:

- There is insufficient supporting justification for the modeled release height and initial vertical dimension for the current landfill fugitive surface. The effective release heights appear to be nearly 100 feet above the highest point of the current landfill footprint based on a review of

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Google Earth terrain data (current as of July 2024) and would be inappropriate to represent existing conditions for 2023.

- There is insufficient justification for the modeled release height and initial vertical dimension for the expanded landfill fugitive surface.
- An outdated version of the AERMET program executable (v18081) was used to process the meteorological dataset included in the AERMOD model runs and the potential impacts to offsite modeled concentrations may be significantly impacted by using the latest AERMET executable version.
- There is insufficient justification for the modeled emission rates where 81% of the total landfill surface area is in the current area, and 19% is in the southern proposed expansion, but the modeled emission rates for the current and expanded landfill fugitive source representations are equal.

Due to these noted inconsistencies, MFA believes that the odor study does not adequately demonstrate that the proposed use would not seriously interfere with uses on adjacent properties or with the character of the area.

Reviewer: Chad Darby, Brian Snuffer Zukas

General Observations

MFA understands that the Applicant will prepare a new Operations Plan for ODEQ's review and approval at the time of the solid waste permit application. This document will include critical information to determine operational compatibility with the proposed conditional use, such as hours of operation, haul routes, waste handling procedures, odor, dust, litter and noise control measures, safety and security protocols, and environmental protection measures (especially stormwater and groundwater).

In our completeness review letter dated November 27, 2024, MFA recommended that the Applicant submit a narrative description summarizing the proposed changes to the current Operations Plan instead of a draft Operations Plan, which has not yet been prepared. MFA still believes that this narrative description of planned changes to the Operation Plan or a draft Operations Plan would provide the County with information to determine if landfill operations will comply with applicable local codes and the proposed conditions of approval.

Summary of Review

The information presented above represents the summary of MFA and our subconsultants' technical review of a portion of the exhibits submitted by the Applicant in support of their land use request to expand Coffin Butte Landfill.

Please contact MFA if you have any questions or need any additional information regarding this review.

Sincerely,

Maul Foster & Alongi, Inc.

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Erik Bakkom, PE
Principal Engineer

Cem Gokcora, PE
Senior Engineer

Attachments

Limitations

A—Review Letter from Columbia West Engineering, Inc.

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Limitations

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

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Attachment A

Review Letter from Columbia West Engineering, Inc.

MAUL FOSTER ALONGI

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc
Vancouver, Washington • Phone: 360-823-2900
Portland, Oregon • Phone: 971-384-1666
www.columbia-west.com

April 11, 2025

Maul Foster & Alongi, Inc.
601 East Front Avenue, Suite 202
Coeur d' Alene, ID 83814

Attn: Ellery Howard, PE

Re: Geotechnical Pre-Design Review
Coffin Butte Landfill Application Review
28972 Coffin Butte Road
Corvallis, Oregon
CWE Project: MFA-7-01-1

INTRODUCTION

Columbia West Engineering, Inc. (Columbia West) is pleased to submit this letter summarizing our pre-design geotechnical engineering review for the Coffin Butte Landfill expansion in Corvallis, Oregon. The purpose of our review was to provide technical advice regarding the geotechnical data and analysis included in the geotechnical engineering report (GER) prepared for the project. Our objective was to identify data gaps, inconsistencies, and/or incomplete analyses that could hinder landfill design and analysis that will be completed prior to construction. We reviewed the following provided documents:

- Exhibit 5: Phase II Geotechnical Exploration Report and Addendum to the South Expansion Area, including the Narrative Report and Appendices A through F
- Exhibit 29: Updated Technical Memorandum: Environmental and Operational Considerations

A summary of our review and conclusions are provided below.

REVIEW

EXHIBIT 5

We completed a high-level review of the geotechnical engineering analyses presented in Exhibit 5: Phase II Geotechnical Exploration Report. Our review focused on the discussion and analysis inputs related to key design elements in the GER, including the field exploration program, laboratory testing, seismic hazard, seismically-induced geologic hazards, slope stability, and settlement.

In general, the scope of the field exploration, laboratory testing program, and analysis methods are appropriate for the geologic complexity and nature of the proposed development. The GER provides a thorough discussion of regional geology, local subsurface conditions, and relevant seismically-induced geologic hazards, as required by the Oregon Structural Specialty Code.

Strain-based compression index values used in the settlement analysis are generally supported by the results of one-dimensional consolidation tests included in the GER. Similarly, soil/rock properties and strength parameters used in the slope stability analyses are supported by laboratory test results, and generally fall within the ranges typically found in published literature for similar soil types.

We note that the GER recommends a Site Class D designation for the site, with a peak ground acceleration (PGA) of 0.61 based on ASCE 7-22. The slope stability analyses employ a horizontal seismic coefficient of 0.25g, approximately 41 percent of the recommended PGA. This is consistent with the range of 33 to 50 percent typically used in pseudostatic slope stability analyses.

Our sole comment requiring potential further analysis or clarification from Wallace Group concerns the slope stability analysis along Section B-B'. While the analyses generally address the more critical (i.e., larger cuts) portions of the cross-section, the north end of Section B-B' may require explicit consideration due to the proximity of the cut slope crest to the Coffin Butte Road and public right-of-way. Aerial imagery indicates utilities at the surface in this area, approximately 25 feet south of the roadway edge and it is unclear whether additional buried utilities are present. While we expect the slope to be stable under static conditions, the potential for slope movement under pseudostatic loading may impact the right-of-way. We recommend an explicit analysis of the subject slope, including the computation of factors of safety and, if necessary, the estimation of earthquake-induced horizontal deformation.

EXHIBIT 29

We also competed a review of the discussion of future geotechnical evaluations outlined in the "Geotechnical Issues and Seismic Stability" section of Exhibit 29. We concur that the existing geotechnical data and analyses presented in the GER (Exhibit 5) do not indicate that there are any geotechnical or geologic constraints that would adversely impact landfill development. We note that additional geotechnical evaluation related to design of the landfill itself will be provided before landfill construction.

CONCLUSIONS AND RECOMMENDATIONS

Based on our review of the provided documents, we conclude that scope of the subsurface exploration, laboratory testing program, and rigor of analysis described in Exhibit 5 is generally aligned with nature of the proposed development. However, we recommend completing additional slope stability analysis at the north side of cross-section B-B' to evaluate for slope instability to impact Coffin Butte Road or utilities within the adjacent right-of-way. We would be happy to discuss this recommendation further at your convenience.

♦ ♦ ♦

We appreciate the opportunity to be of service to you. Please call if you have questions concerning this letter or if we can provide additional services.

Sincerely,

Jonathan A. Nasr, PE
Project Engineer

Shawn M. Dimke, PE, GE
Principal Engineer

cc: Cem Gokcora, Maul Foster & Alongi, Inc.

JAN:SMD:slt
Document ID: MFA-7-01-1-041125-geol

Benton County Exhibit 1 (BC1)

- Kellar Engineering – June 18, 2025 transportation comments

KELLAR ENGINEERING

June 18, 2025

Coffin Butte Landfill Expansion Traffic Review Comments:

1. Kellar Engineering (KE) has reviewed the submitted Coffin Butte Landfill Expansion Traffic Impact Analysis (TIA) dated February 26, 2024 and the formal response to public comments memorandum dated May 23, 2025 by Transight Consulting, LLC.

2. KE has also reviewed the letter provided by Mark Yeager dated April 21, 2025 pertaining to his review of the TIA. The referenced letter cited deficiencies within the TIA and recommended denial of the proposed application. KE concurs that there are some areas where the TIA could provide more site specific analysis; however, it would not likely result in traffic volume increases that would be enough to change the projected intersection LOS operations in the TIA to be at a poor LOS. KE recommends that Transight Consulting, LLC provided a formal written response to this letter.

3. Below are two comments related to the TIA in opposition letters. KE's responses are below in **blue** font.

   - The applicant's TIA seems to have withstood staff and consultant scrutiny thus far. However, it is not clear that the TIA and its reviewers understood that the Knife River quarry operation on land leased from Republic had ceased. Republic has now prepared that portion of its property for landfill use, and commenced to fill it. That use will have traffic impacts which are substantially different from and more intense than those generated by Knife River.
     KE recommends that Transight Consulting, LLC provide a formal written comment response to address the above comment.

   - Applicant proposing to route so much landfill traffic on that road that even the Applicant's own traffic consultant acknowledges that functionality will be degraded.
     Per the May 23, 2025 Memorandum by Transight Consulting, LLC, the projected volume on Coffin Butte Road will be below the typical rural collector volume threshold. Please refer to Transight Consulting's response to Comment 4 in the Memorandum.

KELLAR ENGINEERING

If you have any questions, please do not hesitate to contact me at (970) 219-1602 or skellar@kellarengineering.com.

Respectfully,

Kellar Engineering LLC



Sean K. Kellar, PE, PTOE

Benton County Exhibit 1 (BC1)

- Benton County Public Works – April 9, 2025 engineering and public works comments

Engineering & Survey Division

Office: (541) 766-6821
Fax: (541) 766-6891

360 SW Avery Avenue.
Corvallis, OR 97333

co.benton.or.us

Benton County
PUBLIC WORKS DEPARTMENT

DATE: **April 9, 2025**

TO: Petra Schuetz – Acting Director
Benton County Community Development

FROM: Laurel Byer – Benton County Engineer
Gordon Kurtz – Associate Engineer
Benton County Public Works

RE: **LU-24-027 – Coffin Butte Landfill Expansion**
Property Owner: Valley Landfills, Inc.
Applicant: Republic Services
28972 Coffin Butte Road
Coffin Butte Road – County Road # 04451 – MP 0.00 – MP 0.38
Soap Creek Road – County Road # 05450
T10S – R5W – Sections 13 & 24
T10S – R5W – Sections 18 & 19

Public Works staff have reviewed the application noted above and have comments and conditions as follow.

FINDINGS OF FACT

The application proposes an expansion of the Coffin Butte Landfill, located on the west side of Oregon Highway 99W (Hwy 99W) northwest of the City of Adair Village. The landfill has been in operation for more than 70 years and currently serves Benton County and several additional nearby counties. To maintain operation of the quarry and continue mining rock resources, the Applicant proposes an expansion of the landfill to the south of Coffin Butte Road.

The landfill complex is comprised of numerous properties and tax lots used for several purposes. Those purposes include agriculture, forestry, waste disposal, quarry operations, sludge processing, and administrative offices. The properties and tax lots that comprise the landfill complex fall within multiple Benton County zoning designations including Landfill Site (LS), Forest Conservation (FC), Exclusive Farm Use (EFU), Rural Residential 10-Acre (RR-10), and Rural Residential 5-Acre (RR-5). The complex is bounded on the south by RR-10 properties, and to the south, west and north by EFU and FC properties, and to the east by the Finley Wildlife Refuge zoned Open Space (OS). The easterly boundaries of the complex border the Hwy 99W right of way which separates the landfill complex from the OS Zoned properties. Hwy 99W falls under the jurisdiction of the Oregon Department of Transportation (ODOT).

The proposed expansion directly affects two roads in the County system: Coffin Butte Road and Soap Creek Road. Coffin Butte and Soap Creek Roads carry the functional classification of major collector as defined by the current Benton County Transportation System Plan

At your service, every day.

(TSP). Neither of these roads meet current standards for a major collector.

Average daily traffic (ADT) on Coffin Butte Road east of the quarry entrance is approximately 243 vehicles per day (vpd), based on data collected in January of 2021. Roughly one-third of this volume is truck traffic. The ADT on Soap Creek to the west of the quarry entrance is approximately 136 vpd. The speed limit on Coffin Butte and Soap Creek is governed by Oregon's Basic Rule (ORS 811.100 – 811.108).

Drainage for the landfill complex flows roughly from west to east. The E.E. Wilson Wildlife Area, a network of ponds and wetlands east of the subject property are the direct receiving waters for drainage from the landfill. The E.E. Wilson Wildlife Area functions as one of the headwaters of Bowers Slough, a tributary of the Willamette River.

The project's disturbed area footprint exceeds one acre.

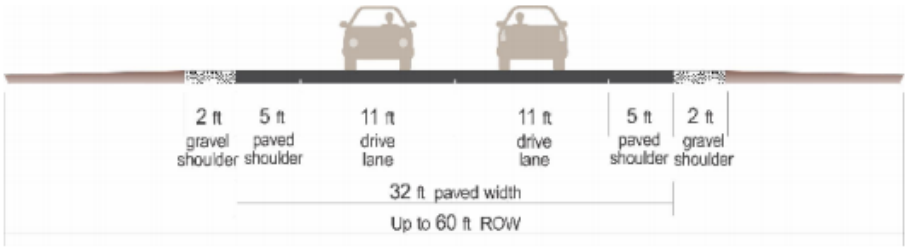
The Applicant's intent is to initiate the proposed developments and improvements within two (2) years of Conditional Use Permit approval.

ANALYSIS & CONCLUSIONS

The applicant has been in communication with Public Works staff since November of 2020.

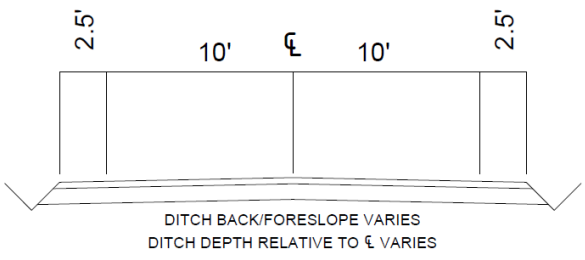
Coffin Butte Road, and the easterly segment of Soap Creek Road carry the functional classification of Major Collector. Neither facility meets current standards for this classification as specified in the TSP. The typical proposed section for a Major Collector is illustrated below.

Figure 16. Major Collector Standard Cross-Section



Improvement of Coffin Butte Road to this standard will provide additional lane width and wide shoulders for vehicle stops and to accommodate bicycle, pedestrian, and emergency access where this function is currently very limited. The approximate typical existing section of Coffin Butte Road and Soap Creek Road is illustrated below. Existing shoulder widths vary from 2.5 feet to less than one foot.

EXISTING SECTION



Construction of the proposed improvements may require permitting through regulatory agencies including, but not limited to, the Oregon Department of State Lands (DSL), the Oregon Department of Environmental Quality (DEQ), the Oregon Department of Fish & Wildlife (ODFW), the Oregon State Historic Preservation Office (SHPO), the Oregon Department of Geology and Mineral Industries (DOGAMI), U.S. Fish & Wildlife (USFW), the U.S. Army Corps of Engineers (COE), and the National Oceanic and Atmospheric Administration-National Marine Fisheries Service (NOAA-NMFS).

Benton County staff have cooperated with Kellar Engineering in this review process, and we concur with their findings and conditions regarding the Traffic Impact Analysis.

Final engineering design for any public infrastructure improvements will be required after Conditional Use approval. Review and approval of those calculations, drawings, right of way adjustments, and specifications will be completed prior to start of construction.

RECOMMENDED CONDITIONS OF APPROVAL

Public Works recommends the applicant meet the following conditions of approval:

1) The applicant shall survey, design, and construct improvements to Coffin Butte Road between Hwy 99W and milepost 0.377 to, at minimum, a Major Collector standard.
2) To accommodate westbound left turns into the new facility the applicant shall construct a center turn lane with a turn pocket storage capacity of four (4) standard semi-trailer trucks (~180 feet) with islands and 30:1 tapers to match existing.
3) Historically, Benton County has employed a section of 5” of HMAC over 17” of CAB for facilities that receive heavy truck traffic. Given the large volume of heavy truck traffic additional analysis will be required to determine if this section is sufficient for the proposed facility.
4) The applicant shall design and construct Coffin Butte Road drainage ditches, stormwater conveyances, connections to off-right of way conveyances, and detention facilities to accommodate runoff using ODOT standards, details and methodologies.
5) Construction and post-construction storm drainage discharge shall conform to the standards and tenets established by Oregon Drainage Law and shall conform to all Oregon Department of Environmental Quality and Benton County Stormwater Support Documents, erosion and sediment control details, and best management practices.
6) The applicant, the County and ODOT must work cooperatively to analyze and address requirements for modification of the Coffin Butte Road/Hwy 99W intersection, if deemed necessary.
7) The applicant shall provide calculations, design, and specifications for all proposed public infrastructure to Benton County Public Works staff for review and approval.
8) The applicant shall apply and obtain approval for a Permit to Perform Work in the County Right of Way. The permit will be issued when construction drawings are approved, and all supporting documentation has been provided to the County.
9) The applicant shall provide the County with a unit price cost estimate for the work to be performed within the Benton County rights of way. This estimate shall include trenching, backfilling, paving, striping, signing, grading/restoration, seeding, mulching, fence replacement, and any required landscaping. Permit fees will be 4.0% of the estimate provided.

10) The applicant shall obtain a DEQ 1200-C permit, and a Benton County ESC permit prior to start of land disturbing activities. (The applicant may wish to consider including the work within the Benton County right of way in the 1200-C application.)
11) The applicant shall obtain approval for all required local, state and federal permits prior to start of road improvements.
12) Prior to final approval of this conditional use permit, the applicant shall fulfill **ONE** of the following **TWO** options to meet the conditions for improvements noted above:
    a. The applicant shall construct the improvements noted above as required. **OR**
    b. The applicant shall enter into an Agreement for Improvements (AFI) with the County. The AFI will require security for the full amount of the work to be performed plus a 20% contingency. The security may take the form of a bond, a conditional irrevocable line of credit, or a cash deposit. The security serves to assure faithful performance of the required improvements, as outlined above, within 18 months of execution of the AFI.
13) The applicant shall provide the County with a detailed construction and sequencing plan for accomplishment of the conditions of approval. The conditions listed here involve a series of construction requirements and quasi-judicial actions that must be achieved in a manner to protect the interests of the applicant, the travelling public and the County's transportation system.

ADVISORIES

1) Existing survey monuments must be preserved and protected. Any survey monuments disturbed during construction of this project must be replaced at the expense of the applicant or the contractor.
2) All public improvements shall be subject to a 3-year warranty period. At the start of the 3-year warranty period the applicant shall provide Public Works with a warranty bond in the amount of 15% of the value of the work performed within the Benton County right of way.

Please contact me if you have questions.

LU-24-027 Supplemental Staff Report to Benton County Planning Commission

Benton County Exhibit 2 (BC2)
Compiled Agency Comments

Contents:

- Oregon Department of Geology and Mineral Industries (DOGAMI) email response
- Oregon Department of Fish and Wildlife (ODFW) supplementary email response and original response letter
- Benton County Environmental and Natural Resources Advisory Committee (ENRAC) recommendation letter to Planning Commission
- Adair Rural Fire Protection District response letter
- Oregon Department of Transportation (ODOT) Region 2 email response

Benton County Exhibit 2 (BC2)

- Oregon Department of Geology and Mineral Industries (DOGAMI) email response

From: SCHUETZ Petra
To: Larissa Gladding
Cc: Jesse Winterowd
Subject: FW: Land Use Application Agency Referral for Coffin Butte Landfill Expansion | Conditional Use Permit | LU-24-27
Date: Wednesday, April 9, 2025 1:40:01 PM
Attachments: image007.png
image008.png
image009.png
image011.png

From: CARLEY Melissa * DGMI <Melissa.CARLEY@dogami.oregon.gov>
Sent: Wednesday, April 9, 2025 10:29 AM
To: SCHUETZ Petra <petra.schuetz@bentoncountyor.gov>
Subject: RE: Land Use Application Agency Referral for Coffin Butte Landfill Expansion | Conditional Use Permit | LU-24-27

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

DOGAMI has no comments on the proposed Land Use Application.

Melissa Carley | Aggregate Permitting Reclamationist
Oregon Department of Geology and Mineral Industries - MLRR
Cell: (541) 520-8333 | e-mail: melissa.carley@dogami.oregon.gov

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From: SCHUETZ Petra <petra.schuetz@bentoncountyor.gov>
Sent: Thursday, March 20, 2025 5:32 PM
To: WEAVER Brianna * DGMI <Brianna.WEAVER@dogami.oregon.gov>
Subject: FW: Land Use Application Agency Referral for Coffin Butte Landfill Expansion | Conditional Use Permit | LU-24-27

You don't often get email from petra.schuetz@bentoncountyor.gov. Learn why this is important

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From: SCHUETZ Petra
Sent: Thursday, March 20, 2025 5:03 PM
To: Benton Public Comment <PublicComment@bentoncountyor.gov>
Cc: joseph.p.stack@odfw.oregon.gov; patrick.wingard@dlcd.oregon.gov; hilary.foote@dlcd.oregon.gov; jarod_jebousek@fws.gov; KRUGER Scott <scott.kruger@bentoncountyor.gov>; BYER Laurel <Laurel.Byer@bentoncountyor.gov>; odotr2planmgr@odot.oregon.gov; CAMARATA Mary * DEQ <Mary.CAMARATA@deq.oregon.gov>; Becky.WILLIAMS@deq.oregon.gov; Rian Amiton <rian.amiton@corvallisoregon.gov>; Pat Hare <pat.hare@adairvillage.org>; MCGUIRE Sean <Sean.McGuire@bentoncountyor.gov>
Subject: Land Use Application Agency Referral for Coffin Butte Landfill Expansion | Conditional Use

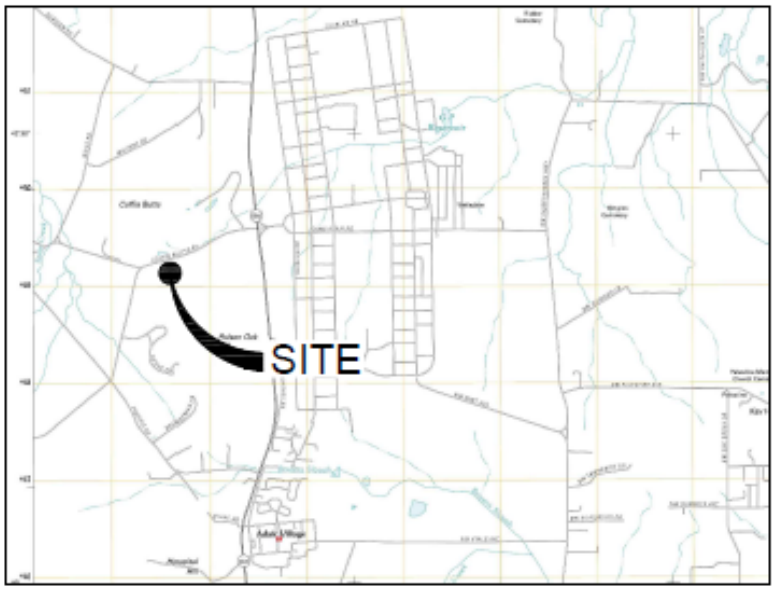
Permit | LU-24-27

Agency Referral

Agency Referral partner comments are an essential part of a successful land use application process. Benton County appreciates your time and attention to this review. Comments are due no later than **Friday, April 11, 2025**.

Request: Expansion of Coffin Butte Landfill
Application identifier: LU-24-27
Type of land use application: Conditional Use Permit
Applicant: Jeff Condit on behalf of Valley Landfills, Inc a.k.a. Republic Services
Application Details: Please use this link to the **application materials**. The application and all documents and evidence used by the applicant are available are also available for inspection at the Benton County Planning Division located at 4500 SW Research Way, Corvallis OR 97333.
Please upload your formal comments to **publiccomment@bentonor.gov**. If your organization chooses *not* to comment, please reply to this email with that intent.
Contact: Petra Schuetz | Planning Director | petraschuetz@bentoncounty.or.gov

Site location:
29175 COFFIN BUTTE ROAD
CORVALLIS, BENTON COUNTY, OREGON 97330



U.S.G.S. MAP

U.S.G.S 7.5 MIN. TOPOGRAPHY MAP,
LEWISBURG QUADRANGLE, OR, DATED 2011

SCALE IN FEET

0 5000 10000

REPUBLIC SERVICES



SITE MAP

SCALE IN FEET

0 600 1200

Petra Schuetz
Interim Community Development Director

Email: petra.schuetz@bentoncountyor.gov
bentoncountyor.gov

Benton County Exhibit 2 (BC2)

- Oregon Department of Fish and Wildlife (ODFW) supplementary email response and original response letter

From: STACK Joseph P * ODFW <joseph.p.stack@odfw.oregon.gov>
Sent: Friday, April 18, 2025 2:42 PM
To: Jesse Winterowd <jesse@winterbrookplanning.com>
Cc: REED Gregory C * ODFW <Gregory.C.REED@odfw.oregon.gov>
Subject: RE: Benton County Application No. LU-24-27 (email 2 of 2)

Hi Jesse,

Thanks for sharing the survey information and results. I only have one minor concern and that is related to the eastern rookery. Turnstone observed active nesting in the eastern rookery in 2022 during the first three consecutive visits, while those nests were not successful, the rookery itself would still be considered active for that year. Within the Forest Practices Act, a rookery is deemed abandoned only after three consecutive years of surveys with no nesting. It is good that the applicant plans to provide protection to this site and some sort of buffering, but an additional survey effort to show the rookery is not being used may be needed. Turnstone can consult with ODF to see if they concur.

Feel free to reach out if you have any questions.

Cheers,
Joe

Joe Stack
Regional Habitat Biologist
Oregon Dept of Fish and Wildlife
South Willamette Watershed District
Office: 541-757-5301/ Cell: 541-650-2840

From: Jesse Winterowd <jesse@winterbrookplanning.com>
Sent: Monday, April 14, 2025 3:29 PM
To: STACK Joseph P * ODFW <joseph.p.stack@odfw.oregon.gov>
Cc: SCHUETZ Petra <petra.schuetz@bentoncountyor.gov>; Melissa Ryan <mryan@batemanseidel.com>
Subject: Benton County Application No. LU-24-27 (email 2 of 2)

You don't often get email from jesse@winterbrookplanning.com. Learn why this is important

Good afternoon Joe,

Second email with addendum to applicant's Habitat Assessment.

Jesse Winterowd, AICP, PMP | Managing Principal
610 SW Alder St. | Suite 810 | Portland, OR, 97205
503.827.4422 ext. 109 | winterbrookplanning.com

Oregon
Tina Kotek, Governor

Department of Fish and Wildlife
South Willamette Watershed District Office
7118 NE Vandenberg Ave
Corvallis, 97330
(541) 757-4186
(541) 757-4252

April 11, 2025

Petra Schuetz
Planning Director
Benton County Community Development Dept.
4500 SW Research Way
Corvallis, OR 97333

RE: Benton County Application No. LU-24-27

Dear Petra Schuetz,

Thank you for providing the Oregon Department of Fish and Wildlife (department) with the opportunity to review LU-24-27. The applicant seeks a conditional use permit to expand the current footprint of the Coffin Butte Landfill. It is the policy of the state to protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations (ORS 496.012). The department reviewed the application and provides the following comments and recommendations for the County's consideration.

The department understands the need to expand the existing landfill and the public good this can provide to the community; however, sensitive wildlife habitat should be considered when making this decision. The department is aware of two historic Great Blue Heron rookeries on the property. There was a rookery documented on tax lot 1107 in 2018 (hereafter the western rookery) during a site visit performed by the department, the Oregon Department of Forestry (ODF), and a consultant hired by the applicant. A new rookery to the east (hereafter the eastern rookery) was documented in the spring of 2021 by ODF on tax lot 1200, although there was probably use in years prior. Approximate locations of both sites were sent to the Planning Department on September 1, 2021. The County identifies Great Blue Heron rookeries as a Goal 5 resource and outlines habitat protections by BCC 87.200 through 87.230[2]. While these particular rookeries may not be currently mapped by the County, they have been identified by both the department and ODF. Therefore, the department believes they should be afforded the same protections and BCC 87 should be considered. Great Blue Heron rookeries are nesting colonies of herons that can consist of a small number of nests up to multiple hundreds of nests. They are susceptible to human disturbance and if a rookery is abandoned it can negatively impact multiple pair of herons. Rookeries provide habitat for a number of critical life history behaviors including courtship displays, pair bonding, breeding, nesting, feeding, and fledgling. Rookeries are most always located near important foraging habitat and suitable places to nest can be limited.

[1] Benton County, Chapter 60
[2] Benton County, Chapter 87

Great Blue Heron rookeries are categorized as Habitat Category 2 per the department's Fish and Wildlife Habitat Mitigation Policy (OAR 635-415-0000 through 0025)[3] because they are both essential habitat for the species and limited on the landscape. The mitigation goal for Habitat Category 2, if impacts are unavoidable, is no net loss of either habitat quantity or quality and to provide a net benefit of habitat quantity or quality (OAR 635-415-0025(2)(a)). If either rookery is determined to be active, we recommend the applicant coordinate with the department to determine an appropriate mitigation plan. Additionally, the department recommends working with the Oregon Department of Forestry to ensure compliance with the Forest Practices Act.

Per OAR 629-665- 0120(1)(a), an active rookery is one that has been used by one or more pairs of Great Blue Herons in the past three years. The department recommends using this as a guide to determine whether these rookeries are active or if they have been abandoned. For active sites, the department recommends that a buffer of 300 feet around the primary nest zone be provided which will serve to maintain alternate nest trees, allow for growth of the colony, protect against windthrow, and prevent harassment. To further limit disturbance, it is recommended that during the critical nesting period from February 15 through July 31, major construction within a quarter mile of the rookery does not take place.

Future management of this site could be improved by monitoring active rookeries throughout the nesting season to determine site-specific nesting chronology, nest productivity, the degree of habituation to disturbance, and nearby foraging habitat.

Thank you for the opportunity to comment on this application. If you have any questions or need additional information, please contact me at (541) 757-5301 or joseph.p.stack@odfw.oregon.gov.

Sincerely,



Joe Stack
Regional Habitat Biologist
South Willamette Watershed
Oregon Department of Fish and Wildlife

[3] https://www.dfw.state.or.us/lands/mitigation_policy.asp

Benton County Exhibit 2 (BC2)

- Benton County Environmental and Natural Resources Advisory Committee (ENRAC) recommendation letter to Planning Commission

Board of Commissioners
Office: (541) 766-6800
Fax: (541) 766-6893
4500 SW Research Way
Corvallis, OR 97333
bentoncountyor.gov

April 16, 2025

To: Benton County Planning Commission
From: Benton County Environment and Natural Resources Advisory Committee

The members of the Benton County Environment and Natural Resources Advisory Committee (ENRAC) voted on April 9, 2025, to recommend to the Benton County Planning Commission to **deny** the Conditional Use Permit requested by Republic Services to expand Coffin Butte Landfill (CBL).

The following major topics, which are discussed in greater detail in the accompanying Report, were key considerations that informed ENRAC's recommendation. Each reflects a significant impact that was identified and assessed in whatever event of the Planning Commission's final landfill expansion decision.

- Air Pollution
  - Volatile organic compounds and odor contaminants still cause unknown issues; air quality permitting has not been consistent and CBL is currently on a DEQ Title V expired permit.
- Methane Emissions
  - Methane emissions have resulted in several EPA inspection infractions. Ongoing state and legislative efforts towards monitoring and an EPA subpoena recommend denial of the CUP to allow full analysis of what is happening with methane emissions.
- Water Pollution
  - Arsenic, other heavy metals, and organic pollutants (especially Polyfluorinated Alkyl Substances (PFAs)) have been problematic and remain unsettled; further comprehensive groundwater and toxicological analysis should be conducted.
- Leachate
  - Leachate has further complex toxicants that may be leaking, but primarily a more clear plan of how leachate is remediated and delocalized must be considered.
- Impact to Local Residents and Community
  - Residents near landfills experience higher rates of health issues, such as birth defects and cancers. New construction introduces new opportunities for contaminant spread and destruction of local wetland ecology. Environmental justice asks that those impacted have a significant voice.

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- Economics
  - Denial for CUP will likely increase rates for local rate-payers.
  - Removal of the intake cap means CBL can increase waste intake coming from other municipalities, thus shortening the longevity of the CBL.
  - Low-income communities are targeted for landfill locations, or become so due to their location, driving housing & land value down by around 13%.
- Regional Impacts and Coordination
  - Impacts to road wear and increased traffic, need for increased consolidation of waste and to minimize the use of trucks requires infrastructure investment.
  - With its lifespan already overestimated by 30-50 years, considerations of CBL end-of-life & closing should be clearly stated.

For more detailed reporting, referenced documentation, and individual member statements and comments, please see the further Report below.

Thank you,

Jason Schindler, ENRAC Chair

ENRAC Deliberations on CUP Expansion Application
FINAL REPORT – April 16, 2025

The following Report was created by ENRAC based on a worksheet that each member completed. Topics were identified at the March 12 meeting, and each row within the "Topic/Issue" is from an individual ENRAC member. No effort was made to aggregate language or find consensus per topic.

Overview

The following are resources, considerations, potential impacts to consider, and a general framework for ENRAC Members to evaluate Republic Services' application for a Conditional Use Permit (CUP) to expand the Coffin Butte landfill. ENRAC will develop a recommendation to be submitted to the Benton County Planning Commission to reject, accept, or accept the application with conditions. There is no legal or formal required length, content, or structure for the recommendation. The recommendation must be voted on and approved by ENRAC by April 22.

CUP Application Materials

The following are links to the CUP application & related materials:

- Landfill expansion application (submitted July 19, 2024)
- Revised application (submitted Oct. 30, 2024)
- Additional information (submitted Jan. 15, 2025)
- First Addendum to Burden of Proof (submitted March 14, 2025)
- To learn more about the decision process visit bentoncountyor.gov/coffin-butte-landfill

What to Consider Per Code

Per Code 53.215, the following are the considerations, but not limited to, when evaluating the CUP:

The decision to approve a conditional use permit shall be based on findings that:

(1) The proposed use does not seriously interfere with uses on adjacent property, with the character of the area, or with the purpose of the zone;

(2) The proposed use does not impose an undue burden on any public improvements, facilities, utilities, or services available to the area; and

(3) The proposed use complies with any additional criteria which may be required for the specific use by Benton County Development Code. [Ord 90-0069]

The following are additional Codes as reference:

- Chapter 23 – Solid Waste Management
- Chapter 77 – Landfill Site (LS)

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The following should be kept in mind when evaluating the application:

- Your analysis must focus only on the expansion area, NOT the landfill itself or its history
- The definition of “area” can be interpreted by you and/or by issue; such as, impacts to neighboring communities, impacts that go beyond the landfill, impacts on other jurisdictions, etc.
- You can consider & evaluate short-, mid- &/or long-term Impacts
- Benton County cannot control where the waste that is received at the landfill originates
- If the application is approved, the current cap of 1.1 million tons accepted per year will cease
- If the application is approved, Metro (Portland area’s disposal district) will not be able to send materials to Coffin Butte per existing policy

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ENRAC Deliberations Framework for CUP Application

The following is a framework to organize topics to be analyzed and feedback to be captured. The objective is for ENRAC Members to agree on a recommendation to the Planning Commission via either consensus or by majority vote. The 'Topics & Issues' were captured from the March 12 ENRAC meeting. For 'Potential Impacts', include your thoughts, research links, and/or any items for ENRAC to consider. For 'Thoughts on Recommendation', include your positions or perspectives on whether the Topic/Issue leans you to recommend approval, denial, or approval with conditions for the application. Staff will compile all comments as sent for discussion at the next ENRAC meeting. Lastly, please identify any additional topics you want included and/or thoughts on reorganizing the current framework.

Abbreviations noted, if not extensive:

- BC — Benton County (though usually as Benton County Governance)
- BCC — Benton County Commission (& Commissioners)
- BC PC — Benton County Planning Commission
- CUP — Conditional Use Permit (application in consideration; assumed to be most recent unless noted)
- CBL & CB — Coffin Butte Landfill, also Coffin Butte, but implies and implicates ownership by Valley Landfills, Inc. and Republic Services Operations
- EPA — Federal Environmental Protection Agency
- DEQ — Oregon Department of Environmental Quality, assumed to be Oregon chapter unless otherwise noted
- GHG — Greenhouse Gas Emissions, typically CO2 and methane, though others exist
- ENRAC — Environmental and Natural Resources Advisory Committee
- DSAC — Disposal Site Advisory Committee
- SWAC — Solid Waste Advisory Committee
- VOC — Volatile Organic Compound

All recommendations and documentation below assumes the inclusion of the above CUP Application documents already outlined in this letter.
All documents cited in this letter are shared here: https://drive.google.com/drive/folders/1K2eYDx56-TTG-xx_LOCHjr0iOagkuwSV?usp=sharing

ENVIRONMENTAL IMPACTS		
Topic/Issue	**Potential Impacts**	**Thoughts on Recommendation**
Air Pollution		Methane is released from landfills, so if expanded there is potential for increased methane GHG emissions. On the other hand, if the landfill were to not expand, there will be increased air pollution elsewhere as the region may have to truck our waste further to dispose of it.
		Approve with conditions, such as increased monitoring and stronger sorting of organics.
	Increased particulate matter and odor emissions during construction and expanded landfill operations. Possible worsening of local air quality for nearby communities	approval with conditions: Require air quality monitoring stations and dust suppression strategies during construction and operation
	local smell; methane leaks	
	❖ Odor Issues – see below Odor section ❖ VOC Emissions	
	• Oregon warns Coffin Butte Landfill over methane emissions • DEQ - Landfill Methane Emissions Reduction • Oregon regulators pause Coffin Butte Landfill air quality permit process • Coffin Butte Landfill • EPA Coffin Butte Inspection Report Summary – Beyond Toxics • EPA Inspection Report	Methane leaks seem to be a continuous issue for the landfill. After DEQ and EPA inspections, CB did not meet the guidelines for a methane flare, for methane leaks, and for methane reduction. As of Jan 2025, the DEQ had to pause its air quality public comment period and permitting review process for the landfill. CB's air quality permit has not been updated since 2009. This update has not happened yet because Republic Services claims to not be able to find their paperwork. The DEQ is currently letting them run the landfill with an expired permit until they can find this paperwork. This seems suspicious to me, especially because the EPA announced how CB was violating limits for as how much methane is leaking from the landfill. **Application should be denied, as their air quality permit is not up to date and CB is violating federal methane regulations.**

ENVIRONMENTAL IMPACTS		
Topic/Issue	**Potential Impacts**	**Thoughts on Recommendation**
Greenhouse Gas Emissions	Methane emissions are a huge concern.	Recommend requiring the most stringent applicable standards for monitoring and ameliorating, with independent monitoring of that monitoring. See Row 2 above.
	Additional methane and CO_2 emissions from increased waste volume	approval with conditions: Ensure strong GHG mitigation plans (e.g., expanded gas capture system, renewable energy utilization) and regular reporting
	methane no smell, but cited for leaks in June 2024 with ruptured plastic covers full report 8/24	
	• Methane Emissions Considering the extensive documentation below, with some focus on the "CBL and EPA - timeline.pdf," and its supporting documents. See documents available: • CBL and EPA - timeline.pdf • ENRAC - EPA Jun 2022 CBL Inspection Report - Heinz.pdf • ENRAC - EPA Jun 2024 CBL Inspection Report - Conley.pdf • ENRAC - EPA Subpoena CBL January 2025.pdf • ENRAC - Planning Commission Findings and Decision 2021.pdf • EPA landfill area demographics 1 mile radius exp.png • EPA landfill area demographics 3 mile radius exp.png • EPA landfill area demographics 5 mile radius exp.png • The Hidden Costs of Landfills.pdf • 5.3 Delegation of BCC 77 Duties from SWAC to ENRAC - 240702 - Order D2024-048.pdf • 133902.pdf • A huge landfill in Oregon is spewing methane. Its… _ Canary Media.pdf • Benton County News July 112024.pdf • Benton Cty Land Use Appl Process Map.pdf	• Methane Emissions Considering the extensive documentation provided, with some focus on the "CBL and EPA - timeline.pdf," and supporting documents, a general pattern of institutional negligence is observed that needs important inculcation. CBL was monitored by the EPA on at least two separate occasions, 2022 and 2024, both times finding significant methane emission events at various sites at the CBL site inspected. It is noted in the CUP that the events from 2022 inspection events were deemed addressed. The 2024 inspection, to my reading, did not include official DEQ or EPA action items merely from their reporting, so no action was required from CBL. However, within the further documentation provided, between a faulty and slow regulation and observation process between OR DEQ and EPA (my reading on jurisdictions are complicated and not always fully understood), a narrative suggesting that methane is not adequately and immediately addressed on site still remains. By my reading, had the spot inspection in 2024 been more successful and redress of previous infractions were more consistent, the need for Sen. Merkley, state officials, and local efforts by SGB to suggest further institutional and regulatory oversight may have been unnecessary. Instead, it can be observed that an incomplete and inadequate regulatory framework has led to at least a learned and

	• CB Aerial Map.pdf • CB Basic Facts.pdf • CB CUP Process Flow Chart.pdf • CB Ex. Summary.pdf • CB Expansion Overview.pdf • Coffin Butte Online Resources.docx • Email August 2024 Wyden Merkley Hoyle Urge EPA to Investigate Landfill Concerns in Benton County.pdf • Email June 2024 - URGENT Methane Leaks at Coffin Butte What You Need to Know.pdf • ENRAC Collab OneNote.pdf • EPA Inspection of Coffin Butte Landfill Accumulation of Flammable Methane.pdf • FAQs Benton Cty. June26.pdf • FAQs Coffin Butte.pdf • FINAL SGB Letter to Sen. Merkley - Coffin Butte Landfill.pdf • Gmail - Coffin Butte Resubmits 2023 Annual Landfill Report.pdf • July 10 ENRAC Meeting Video Recording.pdf • OPB Interview How much methane seeps out of Oregon landfills.pdf • SWACRecommendation.pdf • Testimony in support of SB 726 133902.pdf • Landfill Methane - Moms Clean Air Force.pdf • Benton County Talks Trash Final Report: bctt_final_report_4-11-2023.pdf • ENRAC Section 114 Info Request subpoena memo.pdf • Carbon Mapper explainer 3.pdf • Corvallis to stop accepting leachate from Republic Services.pdf	institutional lack of a culture of caring for the landfill and assuring methane security has been consistently met. Other details in the supporting documents (business info subpoena, resignations at CBL environmental lead) lend shade, if not fully realized or corroborated, that the system is not stable. The very recent activity of the EPA and DEQ suggest they are still in the process of understanding what to do about recent inspections and how to approach CBL in their infractions. As such, this is clearly an in-progress issue. Other details in the supporting documents and encapsulated in the "ENRAC Section 114 Info Request subpoena memo.pdf" timeline suggest that an ongoing legal and regulatory activity may be in progress (business info subpoena, resignations at CBL environmental lead) and lend shade, if not fully realized or corroborated, that the more information, insight, and response from EPA is forthcoming. The very recent activity of the EPA and DEQ suggest they are still in the process of understanding what to do about recent inspections and how to approach CBL in their infractions. As such, this is clearly an in-progress issue—and then timing is still key to understand whether the CUP should be approved as written and at present. Further, that the State of Oregon is currently considering SB 729 (with further supporting documentation included), suggests that a further need for improved and increased monitoring and regulation is required before the current institution of methane security can be achieved. It is also noted that methane is the largest factor in consideration here for GHG emissions, and while power co-generation and plume burning is present, the emissions from leakage is the biggest problematic part of that. It is also noted that methane leaks should also be associated with odor, VOC, and other volatile pollution emission as methane itself acts as increased carrier gas for those pollutants. Monitoring and testing of those leaks should be better understood. Further testimony and reporting in the Benton County Talks Trash documentation should be fully considered, of course. The history of

		SWAC, DSAC, ENRAC, BC PC, and BCC are all complicated in the assessment of methane emissions alone. **Therefore**, it is recommended that until further and fully demonstrable progress can be made to have site inspections be more successful and consistent, that methane can be assured to be secure upon random inspection, in-progress EPA considerations fully resolved, and the case for SB 729 and improved methane regulation and monitoring is resolved, **the present CUP application should be denied.** These progressions may constitute need for further consideration and redress in a further CUP, but because of the lack of real enforcement within a "recommendation with conditions," at this time, a full denial is the safest route.
Leachate	Leachate is quite dangerous and after learning from Beyond Toxics that landfills liners do not last forever, it is scary to know that toxins are leaking into the soil and groundwater.	Approve with conditions, such as increased groundwater and river monitoring.
	Increased waste volume could produce more leachate, potentially posing risk to groundwater and surface water if not managed properly	approval with conditions: Strengthen leachate collection and treatment infrastructure; require third-party audits of system capacity
	will never be free of PFAS, endocrine disruptors in humans (and likely other creatures)	
	• Potential toxicity of leachate from the municipal landfill in view of the possibility of their migration to the environment through infiltration into groundwater • Requirements for Municipal Solid Waste Landfills (MSWLFs)	According to Benton County's Environmental Assessment for 2022-2023, CB released about 30 billion gallons of leachate. CBL is alongside Soap Creek, a tributary of the Luckiamute River that flows directly into the Willamette. This means that toxins are flowing into our water. The Environmental Assessment claims that all this leachate is within drinking water standards but that does not necessarily mean that this isn't harmful to the ecosystem. The landfill is also built on previous wetlands, meaning there is a direct connection to the ground water. The plan for the expansion also shows the creation of new wetlands right beside the landfill. The EPA has requirements against siting and expanding landfills on or near wetlands. **Expansion of the landfill should be denied so we are not supporting further environmental degradation and pollution from leachate toxins.**

ENVIRONMENTAL IMPACTS		
Topic/Issue	**Potential Impacts**	**Thoughts on Recommendation**
Soil	Risk of contamination from accidental leachate release	approval with conditions: Require soil testing and protective barriers; implement best practices for soil erosion control
	possible toxins on site, soil contents will leach into local wetlands and eventually our waterways, which all connect to oceans	
Toxicology	Potential long-term exposure to hazardous materials or pollutants through air, water, or soil pathways if not properly managed	Require a toxicological risk assessment and mitigation plan
	arsenic, heavy metals	
	Comprehensive toxicological analysis of leachate, groundwater, airspace, plume, flaring, and network effects is complex.	With the complexity of all of the environmental testing posted elsewhere, merely taking any one of the signs of environmental and human impact may yet still paint an incomplete picture. Toxicological effects may not actually be seen unless comprehensive testing within the ecological matrix is observed, as synergistic effects from various pollutants may not be observed from individual contaminants observed. This is a difficult testing space to evaluate, but current technology is building to accommodate air and water combined testing. Some effort should be made to consider that toxicological space as that effort has not been adequately seen in the CUP. **Therefore**, it is strongly recommended that a vetted, comprehensive toxicological analysis approach become a requirement for any approved CUP and indeed continued monitoring at CBL. Without systemic understanding of the toxicological effects, individually considered contaminants may not show the full impact of the proposed changes.

ENVIRONMENTAL IMPACTS		
Topic/Issue	**Potential Impacts**	**Thoughts on Recommendation**
Water Pollution ***(surface &/or ground)***	Huge concern. Not sure how to separate out leachate, soil, toxicology that all seem to relate to the nasty stuff in the water coming from the landfill.	Recommend requiring the most stringent applicable standards for monitoring and ameliorating, with independent monitoring of that monitoring.
	Leachate seepage could contaminate groundwater or nearby surface water bodies, especially during extreme weather events	approval with conditions: Strengthen barriers and conduct hydrogeologic studies to guide water protection
	post waste water treatment of leachate, it will go into our waterways with unfilterable PFAs and other potential toxins. This will eventually be in our oceans. Landfills are not allowed to be built currently on wetlands. Coffin Butte was sited well before EPA developed guidelines for safer citing of landfills, see attached guidelines. It is sited on wetlands and a tributary of? Soap Creek runs right by it. • EPA landfill siting recommendations: • Oregon Wetlands Map • Oregon USA Water/Wetlands	
	• See also Leachate discussion • Arsenic Issues & Groundwater • PFAS pollution Documents available: ❖ LandfillRelatedWaterQualityIssues.pdf ❖ J Geier to BoC groundwater arsenic Aug 2024.pdf	• Arsenic Issues & Groundwater Numerous documents, with focus on the "LandfillRelatedWaterQualityIssues.pdf" report suggest that the situation with Arsenic contamination is not fully settled. My reading of the material suggests that there could be potential leak issues or contamination from the landfill infrastructure, though indeed better evidence is needed and evidence to the contrary is presented. **Therefore**, without additional evidence, the BC PC is recommended to take particularly close look at whether combined evidence here or elsewhere can constitute a clear and present danger to local environment and groundwater. **It is not currently clear that the CUP presents a danger to environmental impact and several important gaps in testing and knowledge seem to remain.**
	Those who rely on well water and live around the landfill or Soap Creek may be exposed to the leachate toxins.	

ENVIRONMENTAL IMPACTS		
Topic/Issue	**Potential Impacts**	**Thoughts on Recommendation**
Monitoring ***(general &/or specific)***	Huge concern. Based on press reports, Republic has been less than stellar in monitoring and ameliorating methane emissions	I think strong monitoring is super important.
	Need for expanded and more frequent monitoring of air, water, and soil quality due to the scale of the proposed expansion	approval with conditions: Set mandatory monitoring frequency, real-time data access for the public, and independent oversight of monitoring results
		There has clearly been issues with CBL's monitoring standards as the EPA and DEQ continue to show CB's violations. **Due to these violations, the expansion request should be denied because there CB is not showing trustworthy information or sharing about the air and water quality data.**
Regulations ***(general &/or specific)***	Expansion must comply with state and federal regulations regarding landfill operation, emissions, water protection, etc.	CUP approval contingent upon full regulatory compliance with DEQ, EPA, and county requirements, and routine compliance verification
Other?	Climate resilience concerns	
	My understanding is that Coffin Butte, because of local geology/soil, is not a sight that would be selected for a start-from-scratch landfill. The landfill is there only because of the old Camp Adair dump.	If the expansion is granted, specify that no further expansion will be allowed. After the 5 or 6 years "bought" by the expansion, shut the place down. Permanently. Begin planning now for a new appropriate site.
	Consideration of the "natural" ecology of the landspace to have its own voice.	See below comments within Nework/Systemic effects.

Links to be included above under "Air Pollution" & "Greenhouse Gas Emissions":
https://cdn.sanity.io/files/xdjws328/production/657706be7f29a20fe54692a03dbedce8809721e8.pdf
https://www.opb.org/article/2025/01/18/epa-inspection-coffin-butte-methane-leak/#:~:text=An%20Environmental%20Protection%20Agency%20inspection,the%20town%20of%20Adair%20Village.
Recent report that includes CB. Methane emissions are an issue here:
https://cdn.sanity.io/files/xdjws328/production/b562620948374268b8c6da61ec1c44960a8d5879.pdf

HUMAN IMPACTS		
Topic/Issue	**Potential Impacts**	**Thoughts on Recommendation**
Local Residents / Community		Vocal residents are quite opposed to the expansion. If we do not expand, the county is yet to come up with options for where our waste will go.
	Increased traffic, noise, and perceived risks may affect quality of life. Expansion could raise long-term concerns about property values and environmental health	approval with strong community engagement: Require a community liaison, grievance mechanism, and public outreach before and after expansion
	local smell complaints are common among local residents	
	Local Residents & Community documents available • Benton County Talks Trash Final Report: bctt_final_report_4-11-2023.pdf -	• Local Residents & Community The Benton County Talks Trash initiative, spurred by the original 2021 CBL CUP and general public outcry, is an important summary of the local, historic, and community perspectives related to this CUP. As public comment will likely corroborate, there is a very mixed and vocal community, especially those within close proximity to the landfill, that have concerns. NIMBYism is a constant issue with any large project, though indeed the backyard being a landfill is more dramatic than many. There is important consideration and network effects with the consideration of local residents. Shall the concerns of a vocal minority lead the discussion, even when they are the ones most impacted by those changes? Generally, it would be the assumption from the ENRAC Board that this is true—externalized pollution has been a classical and on-going environmental justice issue, especially when that minority, however vocal, is denied its rights and due process—and even then—to resist a distant majority willing to sacrifice a portion of health and well being elsewhere. **Therefore**, it is **extremely important** that any evidence that the above environmental impacts to local residents be considered with the greatest of weight towards the recommendation or denial of this present CUP. The planning commission needs to carefully incorporate all those voices, views, and evidences of impact.

		Therefore, due to numerous concerns within the BCTT report and issues raised about further expansion of the CBL, **the present CUP application should be denied.**
Odor	Landfill expansion may lead to intensified odors, particularly during warmer months or operational changes	approval with conditions: Install additional odor control systems and require real-time odor monitoring with public reporting
	• Odor Issues Odor is a complex metric. What can be smelt by humans is not linearly associated with what may be present in air and air samples, even if testing were possible at every instance. Perhaps similarly, a variety of VOCs and various airborne pollutants are not detectable at all by scent and constitute a difficult monitoring and regulation problem.	• Odor Issues Odors may be considered a carrier metric for various other pollutants, VOCs, and quality of life around an undesirable infrastructure.

HUMAN IMPACTS		
Topic/Issue	**Potential Impacts**	**Thoughts on Recommendation**
Social/Societal	I am curious about the future impacts of the landfill on society. 10, 25, 50 years from now?	
	Risk of inequitable burden on low-income or marginalized communities; perception of being a 'dumping ground.'	approval with equity assessment: Conduct a social equity impact analysis and engage directly with impacted residents.
	• Targeting minority, low-income neighborhoods for hazardous waste sites • Environmental and socio-economic impacts of landfills • The Hidden Damage of Landfills • Which came first, people or pollution? Assessing the disparate siting and post-siting demographic change hypotheses of environmental injustice	Those living around landfills are seen to experience high rates of cancers, birth defects, and other health issues due to the toxins released into the soil, air, and water. Aside from health issues, landfills also decrease property values which could make it difficult or near impossible for residents near the landfill to sell their homes and move away. In addition, all the news and controversy surrounding CBL may lower home values even more and even deter people from moving to the area. Landfill siting and regulating processes seem to follow “the path of least resistance” (Mohai and Saha 2015) which is how CBL and Republic Services has been exerting its power. This means that when there are little resources being dedicated to the opposition, the landfill owners have a stronger voice in the matter. Low income and communities of color have been seen to be targeted for landfills and other toxic sites. Rural landowners near CB are being targeted here. **The landfill expansion request should be denied, as it is causing many harmful impacts to Benton County residents and has the possibility to cause health issues like cancer and birth defects.**
Other?	Mental well-being concerns among community members	
	• Chronic stress puts your health at risk	The stress of this toxic landfill is not doing good for community members and residents around CBL. Stress in combination with the other issues of the landfill can drive health problems for our locals.

ECONOMIC IMPACTS		
Topic/Issue	**Potential Impacts**	**Thoughts on Recommendation**
Economics		If the landfill does expand, it can help to maintain the jobs that are already employing those who work at the landfill and the waste haulers.
	Could result in job creation, increased tax revenue, and economic growth locally, but also pose long-term infrastructure costs	approval with conditions: Request an economic cost-benefit analysis and transparent budgeting for public infrastructure use
	county will have decreased income if landfill does not expand Human health value must be considered.	
	• Benton County Economics documents available: Supporting Documents: ❖ Basic_Economics_of_Coffin_Butte_Landfill.pdf ❖ Benton County Talks Trash Final Report: bctt_final_report_4-11-2023.pdf ❖ SPLG_Waste.pdf	• Benton County Economics Of note in the provided report, BC stands to continue and increase benefit fairly significantly in the associated costs and use fees of hosting CBL within Benton County. While there is nothing necessarily wrong with that, it is important to make clear and transparent that this is happening. Economics and politics always make corroborations, but to understand them and their implications is key. However, of greater note in this report and as raised in BCTT reports and commentary, the elimination of intake caps is most concerning. With a noted recent pattern from 2019 onward and changes in the regional landfill options, CBL has increased to near present intake capacity. The CUP, if approved, would eliminate any cap on intake, allowing significant increases in waste intake from regional outlets. While it is acceptable to assess the longevity of the present intake and fill rates as stated in the CUP, my reading is that it is not mandated or regulated how long that capacity need remain as stated. The pending SMMP and further changes in local and regional solid waste and material processing is encouraging. However, it is consistently noted that Republic and other waste management corporations have consistently dragged and prevented in providing actionable alternatives to landfill use—it being cheaper and easer to continue with old practices than spurn new activity, collaborations,

		real and demonstrable recycling and composting options, and creative solutions within the current system of waste management. As such, extending the CBL and approving the CUP does not put due economic pressure on BC, infrastructure, and cultural practices in order to instigate better SMMP and waste management practices. It only extends the inevitable need to do so, and worryingly so. It bears repeating, Republic Services is a for-profit, publicly traded corporation. They stand to continue to extract wealth from our local trash infrastructure and culture. **Therefore**, without better consideration, coordination, and pressure to change current waste management practices, **the present CUP application should be denied.**
Ratepayers & Fees		If the landfill does expand, fees may not change. Maybe a different rate style could help to alter how much waste is entering the landfill.
	may increase if landfill is farther away	
	Residents in Benton County do not have an equitable choice in its decision for waste disposal. The provided options constitute a local monopoly and should be redressed.	Changes to the CUP and CBL functioning will likely change operation rates as expected in future system management. That said, creative solutions to equitable and sustainable distributions of the costs of CBL and CUP activity is recommended. E.g., income based cost burden, community, city, and county partnership and subsidy in that cost, and other environmental justice based solutions should be included. As Republic Services is a for-profit corporation, Benton County, City of Corvallis, and the residents should not merely be supporting the profits of said corporation when there is little to no competition for residents to choose from for waste and recycling options.
Other?	City of Corvallis already stopped taking leachate for wastewater treatment, which was financial loss	

SYSTEMIC/NETWORK EFFECTS		
Topic/Issue	**Potential Impacts**	**Thoughts on Recommendation**
Regional Impacts		If the landfill doesn't expand, I am not sure where our trash will go.
	Could shift regional waste dynamics; some counties may become more reliant on Benton County for disposal (?)	approval with regional coordination: Encourage regional waste planning and develop an inter-jurisdictional framework for impact management
	• History of Coffin Butte • What is the Typical Lifecycle of a Sanitary Landfill? • Coffin Butte Site Life Working Group Report	With the SMMP and future mandated task force, the region is trying to scramble to create a waste reduction plan in preparation for the closure of CBL. While the expansion may provide more time for a stronger material management plan, it comes at the detriment to the community and the environment. There are already major impacts to the region, since the landfill is set to close in the near future, with and without the expansion. A normal lifespan of a landfill is 30 to 50 years and CB has been used since the 1940s with Camp Adair. Benton County shares that the lifespan of CB has been "historically overestimated". **The expansion should be denied so the landfill can close at its expected date in 2038. It is well past the average lifespan of landfills, and we have other options instead of expanding.**
		As with other mentions in the document (see waste transport below), the coordination of waste management and options therein should be led more at the state and industry level to come into accord with the needs and desires of residents. While jurisdictions are in place, further state and local mandates for that sharing of the load and buy-in from regional interests for better outlets (see Eugene/Springfield recycling efforts) would be important to see.

SYSTEMIC/NETWORK EFFECTS		
Topic/Issue	**Potential Impacts**	**Thoughts on Recommendation**
Sustainable Materials Mngt.		This section is crucial to consider.
	Expansion may disincentivize upstream waste reduction, reuse, and recycling if capacity is too easily available	approval with conditions: Require landfill operator to invest in or support waste diversion programs and tracking of material flow
	"Recycling" has long been touted as a solution to waste management, but between industry producers and waste-handlers, has been a façade of disinformation from many angles.	Real recycling options would be encouraging, and the new Eugene/Springfield management system access agreement or similar proposed local deployment would go a long way to encourage and engender confidence in Republic Services / CBL waste streams, and in consideration with the SMMP. Since Republic is a for profit corporation, I think increased investment would improve their image dramatically. That's outside of the realm of this CUP directly, but as systems connect, it would be nice to see those. Without seeing those examples of industry led improvements, the status quo operations are not recommended.
Waste Transport ***(additional mileage, GHG emissions, traffic, roads, etc.)***		I think this is important to consider. The landfill is already here, so expanding means that another one will not have to be built yet. If it is not expanded, we will have to truck our waste further. Is there potential to use the trains?
	Increased truck traffic could worsen road conditions and contribute to emissions, especially if haul distances increase	approval with conditions: Include traffic impact analysis, road maintenance agreements, and transportation-related emission offset programs
	It seems like this is something that Benton County is currently working out and they have more details than ENRAC.	
	Some kind of waste transport is guaranteed; minimizing that with more efficient and lower carbon options is helpful. Consolidation and shipping is often a better solution than pick-up truck transport. All of which depends on where trash is coming from.	While GHG emissions from carbon based transport are key, consolidation and location of waste pick-up is a large portion of that calculus. Corvallis and Benton County are relatively close, but if more trash (without a intake cap) comes from further away, there may be less of a conservation of carbon footprint unless those further waste regions are consolidating their transport. This is a tricky analysis, and further examination is warranted depending on variables of intake cap, locations of accepted waste-streams, impacts of other waste disposal opening and closing, improved recycling, composting, and SMMP efforts, etc.

	Risk of future inter-county political tensions or resistance to further expansion proposals	approval with planning safeguards: Establish a landfill lifecycle strategy
Other?	Exit Strategies Rights of land spaces and ecologies to exist. See Toxicology above as a Systemic/Network Effect	Agreed, in any future solution, a clear and public CBL exit strategy seems vital and necessary. Even if this CUP is approved, that approval will likely continue to wane, and everyone wants a better solution with more options and SMMP solutions to prevent need for landfill at any location. Idealistic, but still important to consider in the long term. While an "environmental" consideration, I put this consideration of the rights of ecologies to exist without the direct need for human utilization. Indeed, a nod towards the proposed land use within the CUP will change the ecology of that land significantly and there is both building if nascent recognition and understanding that ecologies should have their own voice and independence in that relationship to humans and the built environment. That said, a stewardship model of the landspace would be an important consideration of the wetlands that will be destroyed in the current CUP. Is stewardship of our lands, respectful of those lands, consider the CUP a good use case for its destruction? See Toxicology comments above; noted that they are systemic issues.

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Additional Comments from ENRAC Members

As ENRAC members, our voices are diverse and intend to hold the follow space for our individual comment. That said, not all ENRAC members will fully agree with these personal statements, but agree that they should have that space here over individually submitted commentary.

From Charlene Carroll, M.D. – March 21, 2025

Overall recommend not expanding landfill. it was a poor initial siting, and there are local wetlands that cannot be protected from the leaching toxins and PFAS due to landfill contents. The landfill and repercussions that result will effect the area and our water for a long time, possible forever. (PFAS are considered forever chemicals). Expanding the landfill will only worsen this issue.

Yes, this will increase the cost of getting rid of garbage, and decrease income to the county.
Human health is invaluable, and this cost cannot be overstated.

From Jason Schindler, current ENRAC chair – 2025-04-14

Dear Planning Commission, Benton County Commissioners, Staff, et al.,

I have to write this piece because our process necessitated its reflection. It is not complete, though it would be difficult to say any part of this decision-making process could or would be, even at time of writing.

As with most things, what most of environmental action and consideration really requires is a good story that can conceptualize and narrativize the data, facts, experiences, and influences that play upon the complicated task at hand. Our process in ENRAC does not encourage that well, in fact eludes it quite intentionally I believe. But as I have been appointed its chair and have the background to accommodate this task, it is also my need to encapsulate and present what I have experienced.

Therefore, our mission, from the Benton County Commissioners (BC PC) and BC Planning Commission:

From: “5.3 Delegation of BCC 77 Duties from SWAC to ENRAC - 240702 - Order D2024-048.pdf”

> *NOW THEREFORE IT IS HEREBY ORDERED, the Environment & Natural Resources Advisory Committee is delegated the duties and responsibilities formerly assigned to SWAC in BCC 77.305 without further action by the Board. This delegation is limited to “review and make recommendations through the Planning Official to the Planning Commission regarding the Site Development Map Plan and narrative.”*

But this mandate has taken on a variety of articulated forms, largely from BC staff, from apparently needing to assess the CUP on ENRAC’s base of expertise, to considering what documents and resources we were interested and willing to find (many included above), to a consensual and binding vote, to merely providing

some commentary and recommended reviews to the BC PC, many overlapping with varying degrees of clarity. To point, we are all variously qualified volunteers with extremely limited direct expertise and available time to do so, nor was much time given for such a task.

While every opportunity to allow ENRAC to make its own decisions and assessments has been voiced by BC staff, and they have taken every opportunity to be supportive and helpful, additional concerns are noted below. They are noted in difference to the voicing of BC staff since the functionality of meetings, conducting our meetings, and patterns of interaction constitute a different and indirect level of interference and BC preference.

Relationship to VNEQS (https://www.coffinbuttefacts.org/), the online portal and vocal discussion community to deny the landfill expansion, has understandably been straining between BC. However, VNEQS activists have been directly vilified by staff in meetings (e.g., “they’re not good people”). Similar sentiment was levied against the outgoing and dissolved SWAC board as well. While this is taken with a grain of salt, as well as an obfuscation about what exactly happened within SWAC and the complicated history (some of which is piecable by BC Talks Trash reporting), it is still clear that BC staff have a clear and present preference and some chips that may not evidence a level playing field.

Most recently, and demonstrably to the operation of the ENRAC board, only now, under more direct scrutiny, are public meetings laws and regulations, active and enforceable for over a year, being clearly articulated and enforced to ENRAC meetings and practices (though, indeed, other boards seem similarly complicated and confused in how their carry their activity and public meetings practices, e.g., DSAC). The laid-back culture of ENRAC has generally allowed for a sense, if underutilized, that collaboration and communication was easily allowable. Understandably and problematically, present public meeting laws, as articulated by BC staff, were articulated to **not allow** for direct communication between board members on any aspect of deliberation, most communications synchronous or asynchronous assumed to contain deliberative aspects, resulting in communications being constantly filtered, documentation sharing constrained, and all meetings and contents required to be made public while the process of making them public has been curtailed or impossible. While this has not been the functional operation of ENRAC since its reformulation in 2020, the recent scrutiny with the CUP mandate has activated this application of public meeting laws and made our process even more onerous, especially that we do not have the processes or practices in place before needed to allow good board functioning. Nor do these public meeting laws seem applied regularly or accurately as I don’t believe that this is fully true in every case. It is recognized that the legislative thrust for these public meetings laws engender transparent and accountable deliberations, and that is important, but the ability to function as ENRAC desired or was led to believe seems curtailed by both the mandate to now abide by those rules and few practiced solutions to allow for that activity.

Additionally, in the process of ENRAC’s deliberations as the CUP has been approved and deemed complete for ENRAC’s assessment, with the above changes to process, the expedited nature of that assessment has been further encouraged by BC staff, suggesting too numerously in options that a simple vote, whatever assessment of documents and process ENRAC desired, could be done quickly and easily—moving on to next projects of the ENRAC board. This has generated a deleterious function of ENRAC to serve the original mandate above, devaluing and expediting our perspective, however distributed in the Planning Commission’s purview. While it is understandable that our timeframe was short, a certain amount of rushing the process and lip service paid to our important role in assessing the CUP is noted. The additional speediness and willingness to skip the

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laborious part of assessing the entirety of the CUP (1200+ pages) and any amount of introduced documentation, has been notedly present.

As such, it is difficult to get a sense that ENRAC is particularly enabled or empowered to do the best job it can do to assess the particularly important activity we have been tasked with. Perhaps this is by a certain kind of bureaucratic design, and while no sense of that is directly perceivable from BC staff—there remains a bureaucratic and institutional inertia against a sense of ideal functioning, adequate review, and democratic thriving.

At time of writing, ENRAC has made their decision and done the best it could to provide a summary and detailed assessment of the CUP and important concerns for that recommendation. I hope that the Planning Commission considers closely what level of actionable precaution and consideration of data should be included to assess the CUP Application. There will always be more data and more opinions, more arguments and important vital considerations to every aspect of BC, community, residents, region, and environment. ENRAC understands the BC PC to have a more regimented and policy angle on its approval process, will be assessing and accumulating copious public comment and existing documentation, and we hope to support that endeavor. But, to point, ENRAC makes its assessment without those regimented needs and hopes to encapsulate a different and environmentally driven perspective herein.

Thank you for considering our recommendation,
Jason Schindler

Benton County Exhibit 2 (BC2)

- Adair Rural Fire Protection District response letter

From: aaron@adair-rural-fire.com
To: Benton Public Comment
Subject: Deny LU-24-027
Date: Monday, April 21, 2025 4:29:20 PM
Attachments: ARFD Coffin Butte 21Apr25 FEMA Combined.pdf

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I have attached written testimony from Adair Rural Fire Protection District regarding recommended Denial of LU-24-027. With the testimony, I have also attached a FEMA document referenced in my testimony, regarding Landfill Fires, which should remain attached as additional information for the record.

Aaron C. Harris, EMT/RN
Fire Chief

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ADAIR RURAL FIRE & RESCUE

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April 21, 2025

Dear Planning Commissioners,

I am writing to you today in conjunction with the Board of Directors of the Adair Rural Fire Protection District, on behalf of our volunteer firefighters and more importantly, the community we are dedicated to serving.

We intend to highlight four concerns pertinent to the current land use application to expand Coffin Butte Landfill, LU-24-027. Namely, the impacts on property tax values, traffic risks, fire risks, and sustainability of the volunteer firefighter department. Until the County has answers to the questions posed below, we believe that any approval is premature.

1) The Adair Rural Fire & Rescue budget is funded by property taxes from residential and commercial properties in our 18 square mile District, including the City of Adair Village and neighborhoods on Tampico, Soap Creek, Wiles, Military, Robison, Calloway, and Arboretum. We already have a much smaller budget than comparable fire districts in the area, and we rely on every dollar of property tax revenue we receive to serve our community.

It is well documented that residential areas close to landfills experience diminished property values. According to the Vasarhelyi at the Environmental Center at University of Colorado Boulder (2021), “Large landfills, on average, decrease the value of land adjacent to it by 12.9%.” What analysis has been completed by the County to estimate the impact on property values within the vicinity of the landfill if the expansion is approved? The District suggests such impacts include those on property value calculations in Corvallis, North Albany, and Philomath. This analysis should include impacts related to air quality, water quality, traffic risks, and roadside trash in order to determine long-term property value forecasts within the Adair Fire District boundaries. Both a reduction of property values and a reduced desire to build new homes within our District will place an undue burden on our ability to continue to respond to and serve the medical, traffic accidents, and fire needs of our District.

2) There has been a significant increase in daily truck trips to the landfill over the last 5 to 10 years. Has the County performed an analysis on vehicle trips, motor vehicle collisions, and road conditions during this time? Has the County analyzed data with surrounding counties, along major travel routes from counties that transport to Coffin Butte Landfill? Has there been an increased burden on emergency services along these routes? If the annual tonnage cap is lifted (an expected consequence of any expansion), what additional burden will be placed on our District and those emergency response districts between Coffin Butte and each county that transports waste to our county? How will that burden be compounded if there is also a corresponding drop in property tax revenue?

3) I have attached a document developed by FEMA's National Fire Data Center, addressing the characteristics and risks associated with landfill fires. One specific topic of note is the impact of methane leaks on the severity of landfill fires, particularly when the levels of methane become

explosive. Coffin Butte is currently involved with an EPA investigation regarding methane leaks, including results of recent inspections that show explosive levels. According to the same document,

> "Landfill fires are particularly challenging to the fire service. A large landfill fire will generally require numerous personnel and significant amounts of time to contain. Both of these circumstances can strain a jurisdiction, particularly one dependent on volunteer staffing" (FEMA, 2005).

Has the County developed a complete understanding of the ramifications of the recent EPA inspections and ongoing administrative process? Has the County conducted an analysis of how additional waste placement on the south side of Coffin Butte Road and associated methane production will impact the safety and risk burden placed on Adair volunteer firefighters, all other Benton County fire agencies, and our surrounding mutual aid partners, Albany Fire and Polk County Fire?

4) Adair Rural Fire & Rescue is staffed by two part-time officers, and 12 currently trained volunteers, down from historical highs of 20+ volunteers. As air, water, traffic, and property value concerns change over-time, there is an increased risk that the Adair Fire Department could become unsustainable. If the department experienced an inability to recruit and retain volunteers, the fire insurance for residents in our District will be significantly negatively impacted from the current ISO Rating of 3. This would result in large increases in yearly insurance premiums for property owners in the District, and potentially the inability to obtain fire insurance at all. Fire insurance is required for anyone who has a mortgage and recommended for all structures. This would place a significant burden on all residents and businesses in the District.

Please thoroughly consider the burdens placed on our community as you consider this land use matter. Without proper answers to these questions, it is not possible to verify that the proposal will not place an undue burden on public resources and the citizens served by those resources.

Sincerely,

Aaron C. Harris
Chief, Adair Rural Fire & Rescue

FEMA (May 2002). *Landfill Fires: Their Magnitude, Characteristics, and Mitigation.* FEMA, US Fire Administration, National Fire Data Center. https://www.sustainable-design.ie/fire/FEMA-LandfillFires.pdf

Vasarhelyi, Kayla (2021, April 15). *The Hidden Damage of Landfills.* University of Colorado Boulder, Environmental Center. https://www.colorado.edu/ecenter/2021/04/15/hidden-damage-landfills

LANDFILL FIRES

THEIR MAGNITUDE, CHARACTERISTICS, AND MITIGATION

MAY 2002/FA–225

Federal Emergency Management Agency
United States Fire Administration
National Fire Data Center

AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

FA–225

LANDFILL FIRES

THEIR MAGNITUDE, CHARACTERISTICS, AND MITIGATION

MAY 2002

Prepared by

TriData Corporation
1000 Wilson Boulevard
Arlington, Virginia 22209

for

Federal Emergency Management Agency
United States Fire Administration
National Fire Data Center

U.S. FIRE ADMINISTRATION
MISSION STATEMENT

As an entity of the Federal Emergency Management Agency, the mission of the U.S. Fire Administration is to reduce life and economic losses due to fire and related emergencies through leadership, advocacy, coordination, and support. We serve the Nation independently, in coordination with other Federal agencies and in partnership with fire protection and emergency service communities. With a commitment to excellence, we provide public education, training, technology, and data initiatives.

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ACKNOWLEDGMENTS

The United States Fire Administration greatly appreciates the help of the following persons who provided information or reviewed this report:

Rodney Slaughter	Rodney Slaughter is the President of Dragonfly Communications Network, a fire service training and consulting firm.
Todd Thalhamer	Todd Thalhamer, P.E., is a waste management engineer with the California Integrated Waste Management Board. Mr. Thalhamer specializes in investigating and mitigating landfill and tire fires for the State of California.
Dr. Tony Sperling	Dr. Sperling is the President of Sperling Hansen Associates and the founding partner of Landfillfire.com (http://www.Landfill-fire.com). Since 1997, he has specialized in landfill fire risk reduction training and landfill fire extinguishment on more than 30 landfill fire projects.

EXECUTIVE SUMMARY

Landfills can be controversial in and of themselves. Homeowners and business owners tend not to support the siting and development of landfills in their neighborhoods due to perceived notions about noxious fumes, health and environmental effects, and adverse influences on property values. Fires occurring in landfill sites are an ongoing, complex problem that has existed for decades.

Although relatively uncommon, fires in landfills generally receive substantial media attention and have the potential to become politically damaging events. Landfill fires threaten the environment through toxic pollutants emitted into the air, water, and soil.

Landfill fires are particularly challenging to the fire service. A large landfill fire normally requires numerous personnel and a significant period of time before it is contained. Both of these circumstances can strain a jurisdiction, particularly one dependent on volunteer staffing.

Landfill operators, members of the fire service, and community residents need to learn as much as possible from past experience to prevent and mitigate future landfill fires.

REGULATION. In 1976, Congress passed the Resource Conservation and Recovery Act (RCRA), which gave the Environmental Protection Agency (EPA) the authority to control hazardous waste from "cradle-to-grave." RCRA covers the generation, transportation, treatment, storage, and disposal of hazardous waste and provides a framework for the management of non-hazardous wastes. A turning point in landfill regulation and remediation occurred in 1980, first with the "Superfund" legislation, followed by the Hazardous and Solid Waste Amendments (HSWA) in 1984, which finally gave the EPA regulatory authority over landfills. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), known as Superfund, governs closed and abandoned hazardous material waste sites, provides for the liability of persons responsible for the release of hazardous materials at these sites, and established a trust fund to provide for cleanup where no responsible party could be identified.

CHARACTERISTICS. The most common type of landfill is one that is designed to accept municipal solid waste (MSW). Other types of landfills include hazardous materials landfills, construction and demolition landfills, and industrial landfills. Each type of landfill has specific characteristics based on the type of waste it is designed to accept.

The passage of liquid through solid waste in a landfill creates leachate, which contains potentially dangerous pollutants. As such, landfills must operate in a manner that protects the environment, particularly surface and ground waters, from leachate contamination. To do this, landfill designs generally incorporate a composite liner and a leachate collection system, and landfill procedures require that the waste collected each day be completely covered.

Because of the methods normally adopted to deposit, compact, and cover waste in landfills, the decomposition of waste is largely anaerobic, which results in the production of large quantities of methane and carbon dioxide. Landfills are the largest source of methane emissions in the United States; in 1999, 35 percent of methane emissions were from landfills. Methane is highly flammable and plays a large role in the ignition of landfill fires.

EXTINGUISHING LANDFILL FIRES. The different dynamics, characteristics, and regulations of landfills and the fires that occur in them suggest that firefighting tactics need to be determined on a case-by-case basis depending on the materials buried in the landfill, which materials have ignited, depth of the fire, and the fire's ignition source. Challenges explored in this report include wind/weather; water supply; multi-agency response; personnel safety; access to, access by and maneuverability of heavy equipment; logistics; environmental impact; and landfill contents (potentially hazardous or illegal).

PREVENTION. Fire prevention actions can reduce property damage and the risk of injury and death, as well as decrease health and environmental hazards associated with landfill fires. As a rule, the cost of prevention is less expensive than the cost of fighting and cleaning up a fire. In many cases, particularly at larger landfills, fire prevention activities are mandated by law. The principal methods for landfill fire prevention include effective landfill management and appropriate methane gas detection and collection.

STATISTICAL ANALYSIS. Data from the National Fire Incident Reporting System (NFIRS) does not include MSW landfills as a fixed property use category. Rather, the NFIRS data set includes a category for "dump or sanitary landfill" under NFIRS Fixed Property Use code 932. Although this definition is broader than the definition of a landfill, it is the closest match available in NFIRS. Based on extrapolation of the NFIRS data, each year in the United States an average of 8,400 dump and landfill fires are reported to the fire service. This represents less than a half percent of all reported fires. Undoubtedly, some landfill fires go unreported because they burned undetected or were on private property and extinguished by the landfill operator. Reported fires are responsible for less than 10 civilian injuries, 30 firefighter injuries, and between $3 and $8 million in property loss each year.[1] Deaths (civilian or fire service) are rare in these fires. Since NFIRS represents a sample of data, it may be that fatalities occurred during the study period and were not reported or captured in the data.

CASE STUDIES. A sample of landfill fires throughout the world sheds light on the landfill fire problem. Waste disposal practices and the regulation of landfill sites are similar in the comparison countries. Landfill fires have been investigated and studied in more detail in these jurisdictions than in the United States. In addition to presenting U.S. case studies, this report includes brief synopses of interviews and media reports detailing landfill fires in the United States and the lessons that were learned from them.

[1] National estimates are based on NFIRS data (1996–1998) and the National Fire Protection Association's (NFPA) annual survey, *Fire Loss in the United States*.

LANDFILL FIRES

THEIR MAGNITUDE, CHARACTERISTICS, AND MITIGATION

Fires occurring at landfill sites across the United States are an ongoing, complex problem that has existed for decades. Landfill fires threaten the environment through toxic pollutants emitted into the air, water, and soil. These fires also pose a risk to firefighters and civilians who are exposed to the hazardous chemical compounds they emit. The degree of risk depends in part on the contents buried in the landfill, the geography of the landfill, and the nature of the fire. There can be great difficulty in the detection and extinguishment of landfill fires, which is compounded because these fires often smolder for weeks under the surface of the landfill before being discovered.

This report was prepared by TriData Corporation, Arlington, Virginia, under contract to the Federal Emergency Management Agency, U.S. Fire Administration (USFA), National Fire Data Center. It presents an overview of the landfill fire problem. Issues examined include the landfill components that create fire hazards; the effect of Environmental Protection Agency (EPA) regulations and landfill cleanup efforts; a profile of landfill fires including their characteristics, methods of extinguishing, and safety issues for firefighters; prevention efforts to reduce landfill fires; and past examples of significant landfill fires and lessons learned.

SOURCES OF DATA

Data on the number of municipal solid waste (MSW) landfill sites in the United States and their current regulations regarding disposal, including those open for disposal and those retired from service, were obtained from the EPA. Data and regulation information pertaining to the Superfund project, including current maps outlining ongoing landfill cleanup efforts, were also obtained from the EPA.

The EPA derives their landfill statistics from *BioCycle* magazine, which conducts an annual survey called "The State of Garbage in America." *BioCycle* magazine sends the survey to state officials and follows up the collected data with phone calls, e-mails, and letters to obtain as complete and accurate information on each participating state as possible. The survey collects data on MSW disposal practices in the United States, including information on national recycling rates, number of municipal solid waste landfills, and disposal rates.

Other information on landfill definitions, landfill dynamics, landfill regulations, and chemical compounds contained in emissions were derived from several sources within the EPA.

Landfill fire statistics presented here are based on data from the National Fire Incident Reporting System (NFIRS). NFIRS, established in 1975, is a data system maintained by USFA and today is the largest fire data set in the world. Not all fire departments participate in NFIRS, but the distribution of participants in NFIRS is reasonably representative of the entire nation, even though the sample is not random. Since the data set is incomplete and represents only a sample of American fire departments (<40 percent), many of the numbers in this analysis are national estimates or percentages rather than raw totals or absolute numbers.

Technical information on the characteristics of landfill fires was gathered from sources ranging from the textbook *The Essentials of Firefighting*[2] to various international studies on landfill fires.

Interviews were conducted with fire department representatives who have dealt with landfill fires. Examples of these fires are included in the report, along with lessons learned by the departments in suppressing the fires. Media reports (newspapers, magazines) provided further information about those fires discussed during the interviews.

WHY STUDY LANDFILL FIRES?

Landfills tend to be controversial in and of themselves. Homeowners and business owners may not be inclined to support new siting or development in their areas due to perceived notions about noxious fumes, health effects, and adverse influences on property values. As such, landfill fires can raise political issues and have implications for elected officials on election day. Further, the costs associated with fire suppression and environmental monitoring during a landfill fire can be enormous. This raises questions as to who is responsible for those costs—the municipal jurisdiction, a private company that operates the landfill, a combination of both, or some other entity.

Although relatively uncommon, fires in landfills generally receive substantial media attention. In some cases, landfill fires can smolder for weeks, producing odorous and noxious smoke that can be a community annoyance and that pose a health risk to civilians, firefighters, and others who are exposed.

Depending on the type of landfill and its contents, the smoke from a landfill fire may contain dangerous chemical compounds, which can cause respiratory disorders and other medical conditions. Even if the smoke is benign, it can still aggravate existing respiratory conditions and reduce visibility around the landfill. In addition, contrary to conventional thinking, the use of large amounts of water to suppress a landfill fire can actually make the fire worse by increasing the rate of aerobic decomposition, which increases the heat available inside the landfill. Further, runoff from suppression efforts can overwhelm a landfill's leachate collection system and contaminate ground or surface water sources.

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[2] *Essentials of Firefighting 4th Edition*, International Fire Service Training Association, 2001.

Landfill fires are particularly challenging to the fire service. A large landfill fire will generally require numerous personnel and significant amounts of time to contain. Both of these circumstances can strain a jurisdiction, particularly one dependent on volunteer staffing. Depending on the type and location of the fire, extinguishing it may require specialized personnel and equipment that may not be immediately available. For example, fires involving hazardous materials require specially trained personnel who are equipped with specialized protective gear. Underground fires generally necessitate the use of heavy equipment (bulldozers, excavators, etc.) to dig out burning waste to be extinguished. Fire may also compromise the structural integrity of a landfill, posing a collapse hazard for personnel operating on the fireground.

Because these fires are relatively uncommon, it is important for communities and the fire service to learn as much as possible from past experience to prevent and mitigate future landfill fires and, if one occurs, to understand the best methods for extinguishing it.

CHARACTERISTICS OF LANDFILLS

Landfills have a variety of unique characteristics, which are primarily determined by the type of waste they are designed to accept. Landfills are regulated by different agencies at the federal, state, and local levels. (Regulatory mechanisms are discussed in detail later in this report.)

The characteristics of landfills constructed before 1984, however, may not conform to those discussed in this section. Prior to 1984, no federal agency had the jurisdiction to regulate landfills. Although some state-based agencies may have had regulatory authority before then, older landfill sites may have accepted both hazardous and nonhazardous waste if they were in operation prior to federal or state regulation. Further, older facilities may not have been constructed with leachate collection systems, gas-monitoring systems, or composite liners that meet the specifications required today.

MUNICIPAL SOLID WASTE LANDFILL. The most common type of landfill is designed for the disposal of municipal solid waste. MSW includes household waste such as product packaging, food scraps, furniture, clothing, and grass clippings. In 1999 alone, Americans generated nearly 230 million tons of MSW.[3] Table 1 illustrates the components of the MSW produced in 1999 by material category. Only 57 percent of this waste, however, went to a landfill for disposal; the remainder was either recovered through recycling (28 percent) or incinerated (15 percent).[4]

The Code of Federal Regulations (CFR) defines an MSW landfill (MSWLF) as "a discrete area of land or an excavation site that receives household waste, and that is not a land application unit, surface impoundment, injection well, or waste pile…MSWLF unit may also receive other types of RCRA [Resource Conservation and Recovery Act] Subtitle D wastes, such

[3] U.S. Code of Federal Regulations, 40 CFR 258.2 (Title 40–Protection of Environment Chapter I–Environmental Protection Agency. Part 258 – Criteria For Municipal Solid Waste Landfills).

[4] *Municipal Solid Waste Basic Facts*, Environmental Protection Agency, Office of Solid Waste, January 4, 2002. http://www.epa.gov/epaoswer/non-hw/muncpl/facts.htm.

Table 1. Components of MSW Produced in 1999 (prior to recycling)[5]

Component	Percent of Waste
Paper	38.1
Yard Waste	12.1
Food Waste	10.9
Plastics	10.5
Metals	7.8
Rubber, Leather and Textiles	6.6
Glass	5.5
Wood	5.3
Other	3.2

as commercial solid waste, nonhazardous sludge, conditionally exempt small quantity generator waste and industrial solid waste. Such a landfill may be publicly or privately owned."[6]

The passage of liquid through the solid waste in a landfill creates leachate. Leachate is defined as "a liquid that has passed through or emerged from solid waste and contains soluble, suspended, or miscible materials removed from such waste."[7] As such, MSW landfills must operate in a manner that protects the environment, particularly surface and ground waters, from leachate contamination. To do this, MSW landfills generally use a combination of a composite liner and a leachate collection system. A composite liner "combines an upper liner of a synthetic flexible membrane and a lower layer of soil at least 2 feet thick with a hydraulic conductivity of no greater than 1×10^{-7} cm/sec"[8] (Figure 1). A leachate collection system consists of a network of pipes that collect the leachate. The collected leachate is typically pumped to the surface of the landfill so that it can be treated and decontaminated. "The leachate collection system must be designed to keep the depth of the leachate over the liner to no greater than 30 centimeters."[9]

While an MSW landfill is in operation, waste is disposed of in layers. These layers are compacted to the smallest practical volume and covered with earthen material at the end of each operating day, except at facilities exempt from cover placement or that use an alternate daily cover such as a tarp.

When a landfill reaches its capacity for waste disposal, a final cover is constructed. The final cover must be designed and constructed to minimize the flow of water into the closed landfill. It must also contain an erosion layer to prevent the disintegration of the cover. This layer must be composed of a minimum of 6 inches of earthen material capable of sustaining plant

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[5] *Municipal Solid Waste in the United States: 1999 Facts and Figures,* Environmental Protection Agency.
[6] U.S. Code of Federal Regulations, 40 CFR 258.2 , op. cit.
[7] Ibid.
[8] *Criteria for Solid Waste Disposal Facilities: A Guide for Owners/Operators,* Environmental Protection Agency, EPA/530-SW-91-089, March 1993.
[9] Ibid.

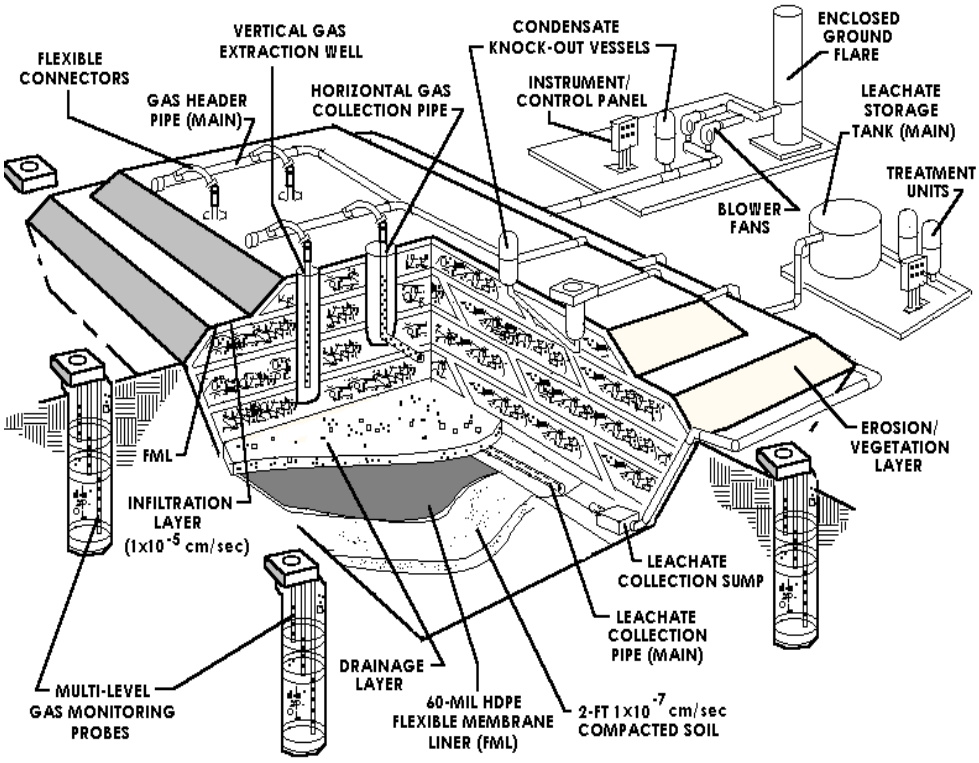


Figure 1. Landfill Components[10]

growth. An independent engineer must certify that the landfill was closed in accordance with federal regulations. For the next 30 years, landfill owners or operators are required to maintain the integrity of the final cover, monitor groundwater and methane gas, and continue leachate management. Finally, the property deed must reflect the property's prior use as a landfill, which restricts the future development of the site.[11]

OTHER TYPES OF LANDFILLS. Some types of waste (e.g., industrial waste and hazardous waste) cannot necessarily be disposed of in an MSW landfill. Instead, these materials must be disposed of in specially designed landfills or in MSW landfills in limited quantities.

Construction and Demolition. Waste from construction and demolition (C&D) projects, including untreated lumber, drywall, plaster, plumbing materials, etc., is not considered MSW. These wastes can be deposited either in MSW landfills or in specially constructed C&D landfills that are required to meet less stringent regulations than MSW landfills. Based on anecdotal remarks by landfill fire suppression professionals, C&D landfills are at a much higher risk for a significant fire than other types of landfills.[12]

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[10] Courtesy of the California Integrated Waste Management Board.

[11] *Criteria for Solid Waste Disposal Faciliities,* op. cit.

[12] From information received in e-mail correspondence with Dr. Tony Sperling, P.Eng.

Industrial. Each year, about 7.6 billion tons of industrial waste are generated and managed by manufacturing facilities. The majority of this waste is wastewater or non-wastewater sludges and solids. Nearly 97 percent is wastewater managed in surface impoundments; the remainder is managed in landfills, waste piles, and land application units.[13] Industrial waste is classified as neither MSW nor hazardous waste under RCRA Subtitle C, which places industrial landfills under the regulatory authority of states and local government, not the federal authorities.

Hazardous Materials. In 1999, 1.4 million tons of hazardous waste were disposed of in landfills.[14] Hazardous waste landfills are similar in character and design to MSW landfills, but they are required to meet more stringent regulations for leachate collection and decontamination.

LANDFILL EMISSIONS. Landfill emissions are the result of the decomposition of organic materials in the landfill (including yard waste, household waste, food waste, and paper). Because of the nature of the construction of landfills, this decomposition is anaerobic[15] and results in the production of large quantities of methane (which is highly flammable) and carbon dioxide. In fact, landfills are the largest source of methane emissions in the United States, accounting for 35 percent of methane emissions in 1999.[16] MSW landfills generate about 93 percent of U.S. landfill emissions; industrial landfills account for the remaining emissions.[17] Methane emissions from landfills are affected by site-specific factors such as waste composition, available moisture, and landfill size.[18] Approximately 28 percent of the methane generated in landfills in 1999 was recovered.[19] The remainder of landfill-generated methane was dispersed in the air.

Approximately 50 percent of gas emitted from landfills is methane; carbon dioxide accounts for about 45 percent, and the remainder is composed of nitrogen, oxygen, hydrogen, and other gases.[20] Both methane and carbon dioxide are greenhouse gases that pose environmental problems. Of the two gases, methane is far more potent than carbon dioxide. Methane has a global warming potential (GWP)[21] of 21 over a 100-year period. This means that on a kilogram-for-kilogram basis, over a 100-year period, methane is 21 times more potent than carbon dioxide in causing climate change.[22]

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[13] *Guide for Industrial Waste Management*, Environmental Protection Agency, EPA530-R-99-001, June 1999.

[14] *National Biennial RCRA Hazardous Waste Report*, Environmental Protection Agency, EPA530-S-01-001, June 2001, p. ES-8.

[15] An *anaerobe* is an organism, such as a bacterium, that can live in the absence of atmospheric oxygen. Conversely, an *aerobe* is an organism that requires oxygen to live.

[16] *Inventory of U.S. Greenhouse Gas Emissions and Sinks,* Environmental Protection Agency, EPA 236-R-01-001, April 2001, p. ES-19.

[17] U.S. Methane Emissions 1990-2000: Inventories, Projections, and Opportunities for Reductions, Environmental Protection Agency, EPA 430-R-99-013, September 1999 , p. 2-1.

[18] Inventory of U.S. Greenhouse Gas Emissions and Sinks, op. cit.

[19] Ibid.

[20] *Landfill Methane Outreach Program*, Environmental Protection Agency, FAQ Sheet, June 2001.

[21] The term *global warming potential* has been developed by the EPA to compare the ability of each greenhouse gas to trap heat in the atmosphere relative to another gas. This measurement of GWP relies on carbon dioxide as the reference gas. The GWP of a greenhouse gas is the ratio of global warming (both direct and indirect) from one unit mass of a greenhouse gas to one unit mass of carbon dioxide over a set period of time.

[22] Climate Change, Methane and Other Greenhouse Gases, Environmental Protection Agency, July 2001.

Current EPA regulations under the Clean Air Act and the New Source Performance Standards and Emissions Guidelines specify that many landfills must collect and combust landfill gas (regulated by size of the landfill). To comply with these regulations, landfill owners can either burn the gas off by flaring[23] it or capture the gas by installing a "landfill gas-to-energy" system. (This is discussed in detail later in this report.)

In addition to regulations governing the emission of landfill gases, federal law also regulates the incineration or open burning of waste. Federal law specifically prohibited open burning of MSW at municipal landfills in 1979 (40 CFR 257).[24] The incineration of MSW is strictly regulated by a variety of federal, state, and local policies.

NUMBER OF LANDFILLS. The amount of MSW produced in the United States has risen substantially over the past 50 years, from 88.1 million tons in 1960 to 230 million tons in 1999.[25] On the other hand, the number of landfills has significantly decreased over the last 10 years, from about 8,000 in 1988 to about 2,200 in 1999.[26] Figure 2 shows the decline over the past 14 years; Figure 3 and Table 2 show the number of landfills per state. This decrease in the number of landfills is generally due to stricter regulations imposed by the EPA regarding landfill gas emissions, safety regulations, and content regulations of a landfill. Over the same period, the size of the remaining landfills has grown steadily to accommodate the increased production of MSW.

The number of landfills recorded by the EPA, however, does not take into account all of the individual, and in many cases illegal, dumping sites that were common in the early 1980s. Many businesses, factories, and enterprises had their own dumping sites where they disposed of various types of unregulated wastes. This was a widespread practice before environmental groups began lobbying against such sites and publicizing links between diseases such as cancer and the dumping of hazardous chemicals and toxic wastes that were contaminating water, soil, and air.

THE DEVELOPMENT OF LANDFILL REGULATION.[27] The EPA was established in 1970 after scientists, elected officials, and citizens recognized the need to protect the environment. The new agency was pieced together from programs elsewhere in the federal government, including from the Department of Health, Department of the Interior, and Food and Drug Administration. It was not until 1984 that the EPA gained regulatory authority over landfills. Over the intervening years, various legislative acts have strengthened the EPA's regulatory authority over these sites.

In 1976, Congress passed the Resource Conservation and Recovery Act (RCRA), which gave the EPA the authority to control hazardous waste from the "cradle-to-grave." RCRA covers the generation, transportation, treatment, storage, and disposal of hazardous waste and provides a

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[23] In this context, *flaring* is the controlled burning of methane collected from a landfill.

[24] "Volume III–Area Sources, Chapter 16, Open Burning," R*evised Final: Emission Inventory Improvement Program Document Series,* Environmental Protection Agency, Section 2.1, January 2001.

[25] *Municipal Solid Waste in 1999: Facts and Figures,* Environmental Protection Agency. Some EPA sources quote this numbers as being closer to 2,300.

[26] *Environmental Fact Sheet, Municipal Solid Waste Generation,* Environmental Protection Agency, 1998.

[27] Information on federal regulations was taken from the EPA website, Major Environmental Laws. http://www.epa.gov/epahome/laws.htm.

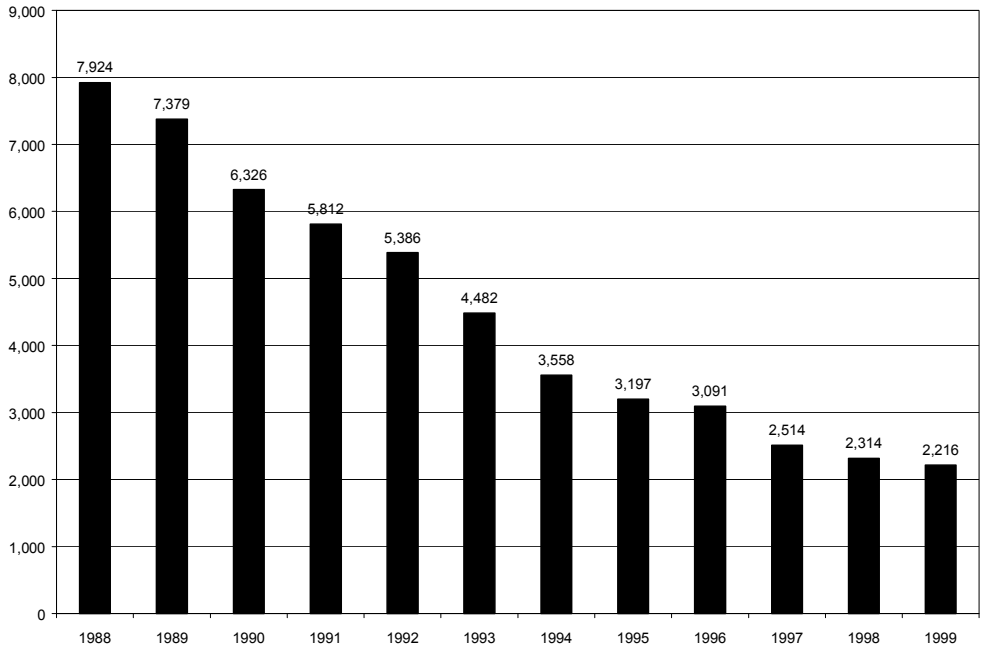


Figure 2. MSW Landfills in the United States, by Year[28]

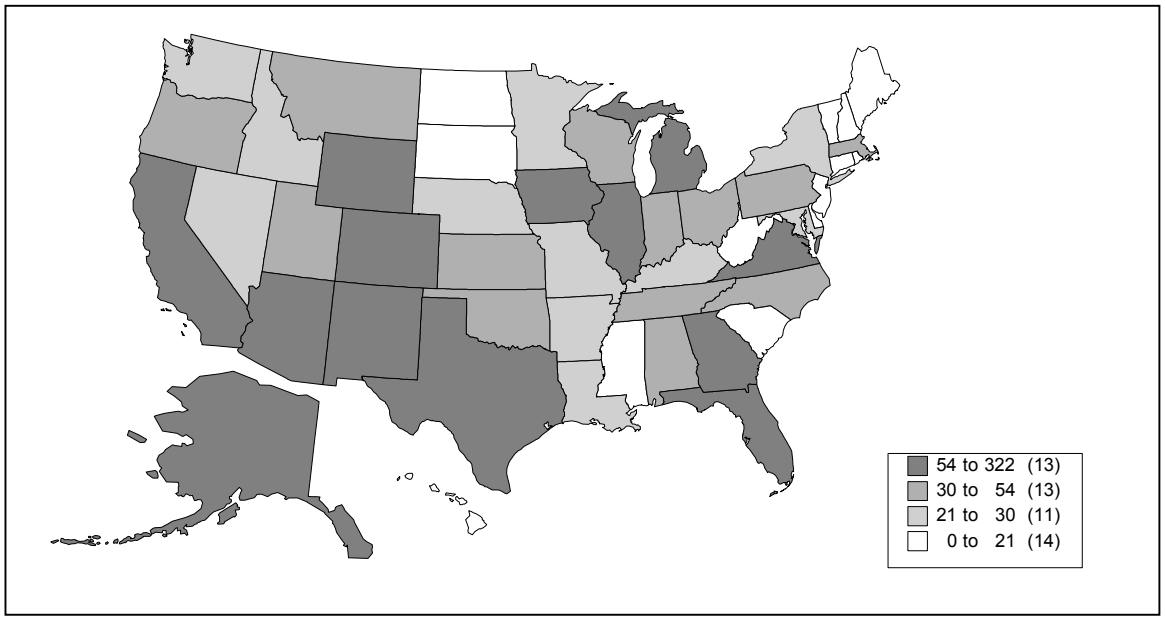


Figure 3. Distribution of Landfills[29]

[28] *Municipal Solid Waste in 1999*, op. cit., p. 15.
[29] *BioCycle,* June 1999.

Table 2. Landfills by State[30]

State	Landfills	State	Landfills	State	Landfills
Alabama	30	Kentucky	26	New York	28
Alaska	322	Louisiana	25	Ohio	52
Arizona	54	Maine	8	Oklahoma	41
Arkansas	23	Maryland	22	Oregon	33
California	188	Massachusetts	47	Pennsylvania	51
Colorado	68	Michigan	58	Rhode Island	4
Connecticut	3	Minnesota	26	South Carolina	19
Delaware	3	Mississippi	19	South Dakota	15
District of Columbia	0	Missouri	26	Tennessee	34
Florida	95	Montana	33	Texas	181
Georgia	76	North Carolina	35	Utah	45
Hawaii	8	North Dakota	15	Vermont	5
Idaho	27	Nebraska	23	Virginia	70
Illinois	56	Nevada	25	Washington	21
Indiana	45	New Hampshire	19	West Virginia	19
Iowa	60	New Jersey	11	Wisconsin	46
Kansas	53	New Mexico	55	Wyoming	66

framework for the management of nonhazardous wastes. RCRA focuses only on active and future facilities.

The turning point in landfill regulation and remediation occurred in 1980, first with the Superfund legislation, then by the Hazardous and Solid Waste Amendments (HSWA) in 1984, which finally gave the EPA regulatory authority over landfills.

Technically known as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Superfund legislation governs closed and abandoned hazardous material waste sites, provides for the liability of persons responsible for the release of hazardous materials at these sites, and establishes a trust fund to provide for cleanup where no responsible party could be identified.

In 1984, the HSWA amended RCRA. HSWA required the phasing out of land-based disposal of hazardous waste and gave the EPA regulatory authority over landfills. The final major piece of legislation, the Superfund Amendments and Reauthorization Act (SARA), was passed in 1986 as an amendment to CERCLA. SARA increased the participation of states in the Superfund program and expanded the size of the cleanup trust fund.

In recent years, federal, state, local, and private programs have increased the emphasis placed on reducing the production of municipal waste to conserve resources and reduce pollution while delaying the entry of waste into the waste collection and disposal system. “Source

[30] Ibid.

reduction" focuses on designing, manufacturing, purchasing, or using materials in ways that reduce the amount or toxicity of trash created.

Some such programs include "pay-as-you-throw," where residents pay for each can or bag of trash they have collected for disposal rather than funding this collection by a flat rate or through the tax base. This provides tangible financial benefits for households that reduce the amount of waste they produce. Other programs target businesses and corporations in an effort to promote waste-reducing manufacturing processes and business practices.[31] The benefits of these practices include a reduction of the combustible material that enters the waste stream. Although MSW facilities will still contain large amounts of combustible materials, this reduction in waste can be a factor in the reduction of landfill fires.

CHARACTERISTICS OF LANDFILL FIRES[32]

Landfill fires fall into one of two categories, surface and underground fires. Depending on the type of landfill and type of fire, landfill fires can pose unique challenges to the landfill/ waste management industry and the fire service. This section addresses the particular challenges and the specific types of fires found in landfill sites and describes their characteristics and causes.

SURFACE FIRES. Surface fires involve recently buried or uncompacted refuse, situated on or close to the landfill surface in the aerobic decomposition layer, generally 1 to 4 feet in depth.[33] These fires can be intensified by landfill gas (methane), which may cause the fire to spread throughout the landfill.

Surface fires generally burn at relatively low temperatures and are characterized by the emission of dense white smoke and the products of incomplete combustion. The smoke includes irritating agents, such as organic acids and other compounds. When surface fires burn materials such as tires or plastics, the temperature in the burning zone can be quite high. Higher temperature fires can cause the breakdown of volatile compounds, which emit dense black smoke. Surface fires are classified as either accidental or deliberate.

Surface fires include the following:

- *Dumping of undetected smoldering materials into the landfill.* Hot load fires are caused by the disposal of refuse that is still burning on arrival to the landfill (e.g., cleared brush).
- *Fires associated with landfill gas control or venting systems.* Landfill gas control systems can themselves pose a fire hazard. Landfill gas (predominantly methane) can be

[31] "Source Reduction and Reuse," Environmental Protection Agency, April 23, 2002. http://www.epa.gov/epaoswer/non-hw/muncpl/sourcred.htm.

[32] Much of this section represents a synopsis of a report prepared for the New Zealand Ministry of the Environment. The report, *Landfill Guidelines: Hazards of Burning at Landfills*, was published in December 1997.

[33] E-mail correspondence with Todd Thalhamer, California Integrated Waste Management Board.

ignited as it escapes from the vents or from leaks in the collection pipe network. Excessive gas extraction can also be a fire cause. The vacuum created by excessive extraction can increase the airflow and thereby increase the oxygen level in the landfill, which can cause underground fires (as discussed further in the following section).

- *Fires caused by human error on the part of the landfill operators or users***.** Landfill operators and users can cause fires through careless smoking on the landfill, which can ignite waste or landfill gas. Also, as some hazardous substances can ignite when mixed, operators must take care to prevent the dumping of reactive materials into the landfill.

- *Fires caused by construction or maintenance work*. Fires can occur while construction and maintenance takes place, including fires caused by sparks from vehicles used in the landfill (dump trucks, bulldozers, backhoes, etc.). A surface fire could also be ignited when drilling or while driving metal pipes through layers of buried waste if a hard object buried in the landfill is struck. Usage of welding or electrical equipment on site poses a fire hazard, due especially to the increased presence of methane gas.

- *Spontaneous combustion of materials in the landfill*. The mixing of certain materials in a landfill can result in spontaneous combustion. Even in small quantities, some chemicals can ignite if exposed to one another. Also, some materials, such as oily rags, can spontaneously combust under certain conditions. Spontaneous combustion can also result from bacterial decomposition, which is discussed in more detail later in this section.

- *Deliberate fires, which are used by the landfill operator to reduce the volume of waste*. Landfills contain refuse such as dry garden waste, grass, leaves, and branches. Sometimes these materials are deliberately set on fire to reduce refuse volumes, reduce operating costs, and increase a landfill's operating life. This is an accepted practice under strictly controlled conditions.[34] Uncontrolled, these deliberate fires could escalate into larger fires, cause explosions, or create hazardous products from the ash and residue burned.

- *Deliberate arson fires, which are set with malicious intent*. Arson is a serious problem in the United States; therefore, it is not surprising that landfills are targets for malicious fires.

UNDERGROUND FIRES. Underground fires in landfills occur deep below the landfill surface and involve materials that are months or years old.[35] These fires are generally more difficult to extinguish than surface fires. Underground fires also have the potential to create large

[34] This controlled combustion at landfills is regulated by U.S. Code of Federal Regulations, 40 CFR 60 (Title 40 – Protection of Environment Chapter I – Environmental Protection Agency. Part 60 – Standards Of Performance For New Stationary Sources).

[35] This report addresses operating landfills. Closed landfills are subject to a variety of restrictions on future development, maintenance, etc. It would be difficult to determine the frequency of fires in closed landfills because such sites are likely to be coded in NFIRS according to their property use at the time of the fire (e.g., open land, park, golf course).

voids in the landfill, which can cause cave-ins of the landfill surface. Further, they produce flammable and toxic gases (such as carbon monoxide) and can damage leachate containment liners and landfill gas collection systems.

The most common cause of underground landfill fires is an increase in the oxygen content of the landfill, which increases bacterial activity and raises temperatures (aerobic decomposition). These so-called "hot spots" can come into contact with pockets of methane gas and result in a fire. Of particular concern with these long-smoldering, underground fires is the fact they tend to smolder for weeks to months at a time. This can cause a build up of the byproducts of combustion in confined areas such as landfill site buildings or surrounding homes, which adds an additional health hazard.

Underground fires are often only detected by smoke emanating from some part of the landfill site or by the presence of carbon monoxide (CO) in landfill gas. In the event of an underground fire, CO may be present at toxic levels near the landfill's surface. Generally an underground fire can be confirmed by:[36]

- Substantial settlement over a short period of time.
- Smoke or smoldering odor emanating from the gas extraction system or landfill.
- Elevated levels of CO in excess of 1,000 parts per million (ppm).
- Combustion residue in extraction wells or headers.
- Increase in gas temperature in the extraction system (above 140°F).
- Temperatures in excess of 170°F.

To confirm a subsurface fire using CO, the results must be acquired through quantitative laboratory analysis (using portable monitors may result in artificially high concentrations). In California, levels of CO in excess of 1,000 ppm are considered a positive indication of an active underground landfill fire. Levels of CO between 100 and 1,000 ppm are viewed as suspicious and require further air and temperature monitoring. Levels between 10 and 100 ppm may be an indication of a fire but active combustion is not present.[37]

HEALTH EFFECTS OF LANDFILL FIRES. In addition to the burn and explosion hazards posed by landfill fires, smoke and other byproducts of landfill fires also present a health risk to firefighters and others exposed to them. Smoke from landfill fires generally contains particulate matter (the products of incomplete combustion of the fuel source), which can aggravate pre-existing pulmonary conditions or cause respiratory distress. As with all fires, those in landfills produce toxic smoke and gases. The danger and level of toxicity of these gases depend on the length of exposure one has to them and on the type of material that is burning.

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[36] *Response to Landfill Fires Guidance Document*, California Integrated Waste Management Board, Internal Bulletin 2001.
[37] Ibid.

Underground fires can result in CO levels in excess of 50,000 ppm—the Occupational Safety and Health Administration (OSHA) permissible exposure limit for CO is 50 ppm. OSHA standards prohibit worker exposure to more than 50 parts of the gas per million parts of air averaged during an 8-hour time period. Carbon monoxide is harmful when breathed because it displaces oxygen in the blood and deprives the heart, brain, and other vital organs of oxygen, which can cause permanent damage or death.[38]

Another serious concern in landfill fires is the emission of dioxins. Accidental fires at landfills and the uncontrolled burning of residential waste are considered the largest sources of dioxin emissions in the United States.[39] The term *dioxins* refers to a group of chemical compounds with similar chemical and biological characteristics that are released into the air during the combustion process. Dioxins are also naturally occurring and are present throughout the environment. However, exposure to high levels of dioxins has been linked to cancer, liver damage, skin rashes, and reproductive and developmental disorders.[40]

EXTINGUISHING LANDFILL FIRES

This section is not intended to address or recommend specific tactical approaches for landfill firefighting. It is important to note that the different dynamics, characteristics, and regulations of landfills and the fires that occur in them suggest that tactics need to be determined on a case-by-case basis depending on the materials buried, which materials have ignited, depth of the fire, and the fire's ignition source. This section explores some of the challenges posed in the suppression of landfill fires.

WIND/WEATHER. Wind and inclement weather can increase the health hazards for firefighters operating on the fireground (e.g., in extremely hot or cold weather) and can directly affect fire spread.

WATER SUPPLY. The use of water to suppress landfill fires is controversial. The application of large volumes of water may actually exacerbate a fire by contributing to the process of aerobic decomposition. Further, adding water to the landfill creates additional leachate, which may overwhelm the leachate collection system in the landfill (if one exists). If the collection system is overwhelmed, the additional leachate could contaminate ground and surface waters surrounding the landfill. Depending on the landfill's location, there might not be an adequate supply of water available for fire suppression. Firefighters may have to establish a water supply using tankers and nearby static water sources (e.g., lakes, reservoirs).

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[38] *OSHA Fact Sheet, Carbon Monoxide Poisoning*, U.S. Department of Labor, Occupational Safety and Health Administration, 2002. http://www.osha.gov/OshDoc/data_General_Facts/carbonmonoxide-factsheet.pdf

[39] *Questions and Answers About Dioxins*, Environmental Protection Agency, July 2000, p. 6. http://www.epa.gov/ncea/pdfs/dioxin/dioxin%20questions%20and%20answers.pdf.

[40] Idem, p. 4.

Foam is an important consideration in landfill fire suppression. There are two primary types of firefighting foam. Class A foam is a special formulation of hydrocarbon surfactants. These surfactants reduce the surface tension of water, which provides for better water penetration and increased effectiveness. When aerated, Class A foam coats and insulates fuels, protecting them from ignition. Class B foam is used to extinguish fires involving flammable and combustible liquids. It is also used to suppress vapors from unignited spills of these liquids.[41] As with all fires, there are advantages and disadvantages to using foam during fire suppression operations on landfills. The on-scene incident commander makes the decision to use foam based on the specific tactical situation at hand.

MULTI-AGENCY RESPONSE. A major landfill fire will likely require the expertise of personnel from multiple agencies (e.g., the EPA, Department of Natural Resources). Some fire departments have Standard Operating Procedures in place that define all landfill fires as hazardous materials incidents, which require a specialized response. To ensure that all personnel (regardless of their agency affiliation) are operating according to the same plan, landfill fires require a strong Incident Command System.

PERSONNEL SAFETY. Fires, particularly those underground, can undermine the integrity of the landfill, which could cause a collapse under the weight of landfill employees, firefighters, or equipment. Such a collapse could necessitate a confined space, trench, or other type of technical rescue operation in addition to fire suppression.

Given the potential adverse effects of exposure to burning landfill contents or the smoke produced by a landfill fire, personnel may have to use specialized personal protective equipment, which may be difficult to obtain.

ACCESS TO AND MANEUVERABILITY OF HEAVY EQUIPMENT. To access waste below the landfill surface or move burning waste away from the landfill, it may be necessary to use heavy equipment such as bulldozers. Landfill operators may already own this equipment and have staff trained in its use. If not, this equipment will need to be located and brought to the fireground. If a fire affects the structural stability of a landfill, operating heavy equipment on the landfill surface would be dangerous. Finally, depending on the landfill's location and design, operating heavy equipment on the site could be quite difficult.

LOGISTICS. As with any protracted fire suppression operation, Incident Commanders at landfill fires must address a variety of logistical concerns to facilitate operations. These include rotating personnel on a regular basis, compensating personnel for overtime spent operating at the landfill or filling in at fire stations in the jurisdiction, keeping firefighters on the landfill hydrated and fed, and, keeping records for future reimbursement. (Depending on the nature and location of the incident, local fire departments can seek reimbursement from the federal government or the landfill operator for costs associated with fire suppression.)

ENVIRONMENTAL IMPACT. The smoke and runoff from landfill fires can be dangerous to those living in the area and to the environment. It is important that air and water quality issues

[41] *Essentials of Firefighting 4th Edition*, International Fire Service Training Association, 2001, p. 500.

be addressed early in a fire suppression operation to prevent contamination as much as possible. As mentioned earlier, water used to suppress a landfill fire can overwhelm a facility's leachate collection system, if one exists (older facilities may have been constructed prior to regulations requiring leachate collection systems).

LANDFILL CONTENTS. Fires occurring in landfills where hazardous wastes are buried can be particularly difficult. In past years, illegal dumping of hazardous and toxic materials in landfills and other dumping sites was relatively common. When a fire occurs and rescue workers have wrong or misleading information about the buried contents (e.g., illegal or unknown toxic or radioactive wastes), the fire suppression operation can be extremely dangerous.

Although not a landfill fire, the Wade Dump fire in February 1978 clearly illustrates the dangers posed by fires involving unknown hazardous materials. Firefighters responded to a suspected tire fire at an abandoned rubber shredding plant on the Delaware River outside of Philadelphia. They were unaware that the property's owner and namesake, Melvin Wade, had transformed the plant into one of the most toxic hazardous waste dumpsites in U.S. history. By the night of the fire, more than 3 million gallons of cyanide, benzene, toluene, and other chemicals were stored on the site—plus thousands of junk tires. The burning chemicals produced multicolored smoke and noxious fumes, which alerted firefighters to the unusual nature of the fire they were fighting. Intensified by chemicals and other fuels, the fire raged for hours. Drums of chemicals exploded, injuring firefighters and even damaging fire trucks. As the night progressed, firefighters and other emergency workers noticed that the chemicals were dissolving their protective gear and making it difficult for them to breathe; more than 40 firefighters were sent to a nearby hospital for treatment. Over the past 20 or more years, dozens of those who were present at the Wade Dump fire have become ill, and many have died from cancers and other diseases. Melvin Wade and others responsible for creating the toxic site were found criminally responsible for their actions.[42]

LANDFILL FIRES: STATISTICAL ANALYSIS

Data from the National Fire Incident Reporting System (NFIRS) does not include MSW landfills as a fixed property use category. Rather, the NFIRS data set includes a category for "dump or sanitary landfill: included are refuse disposal areas, trash receptacles, and dumps in open ground" (NFIRS Fixed Property Use code 932). Although this definition is broader than the definition of a landfill, it is the closest match available in NFIRS. As such, despite the broader definition, this section refers to these fires as *landfill fires* for the sake of clarity.

Based on extrapolation of the NFIRS data, each year in the United States an average of 8,400 landfill fires are reported to the fire service. This represents less than a half percent of all reported fires. Undoubtedly, some landfill fires go unreported because they burned undetected or they were on private property and extinguished by the landfill operator. Reported fires are responsible for less than 10 civilian injuries, 30 firefighter injuries, and between $3 and

[42] This paragraph is a synopsis of an investigative report published by the *Philadelphia Inquirer* in April 2000.

$8 million in property loss each year.[43] Deaths (civilian or fire service) are rare in these fires; since NFIRS represents a sample of data, it may be that fatalities occurred during the study period and were not reported or captured in the data.

TYPE OF LANDFILL FIRES. Table 3 shows the five types of fires that occur on landfills. The prevalence of refuse fires is not surprising, but it is interesting that other types of fires occur on landfill properties. Vehicle fires involve dump trucks, compactors, and other vehicles commonly found in landfills. Brush fires may occur when landfill fires spread to the surrounding lands. Structure fires at landfill sites probably involve small offices or other facilities constructed for the landfill staff.

Table 3. Types of Fires Occurring on Landfills[44]

Type of Fire	Percent of Fires
Refuse	77
Trees, brush, grass	12
Outside structure, where material burning has value	6
Vehicle	4
Structure	1

CAUSES OF LANDFILL FIRES. Over half of the landfill fires reported to NFIRS have no information available as to the primary ignition factor. This makes it particularly difficult to accurately pinpoint the cause of landfill fires. Of those fires with reported ignition factors, nearly 40 percent are of an incendiary or suspicious nature. Another 20 percent are attributed to lit or smoldering materials that have been abandoned or discarded, which include cigarettes, matches, or ashes that were discarded without being properly extinguished. Spontaneous heating accounts for about 5 percent of landfill fires. Other leading factors influencing fire ignition include rekindling from a previous fire and inadequate control of open fires.

WHEN LANDFILL FIRES OCCUR. Landfill fires occur most often between March and August. This half-year period accounts for nearly 60 percent of landfill fires, with the peak (11 percent) occurring in July (Figure 4). This monthly incidence of fires generally applies to the major causes of landfill fires (incendiary/suspicious and smoldering materials). Rekindled fires and spontaneous ignition fires, however, are exceptions. Rekindled fires have a peak period in April and May that accounts for one-third of these fires with an additional peak in July (15 percent). Landfill fires that result from spontaneous combustion gradually increase as the weather warms, dropping in September. The peak period, however, occurs in October and November, when 22 percent of the spontaneous combustion fires occur. Figure 5 illustrates the incidence of spontaneous combustion fires by month.

[43] National estimates are based on NFIRS data (1996–1998) and the National Fire Protection Association's (NFPA) annual survey, *Fire Loss in the United States*.

[44] U.S. Fire Administration NFIRS data (1996–1998).

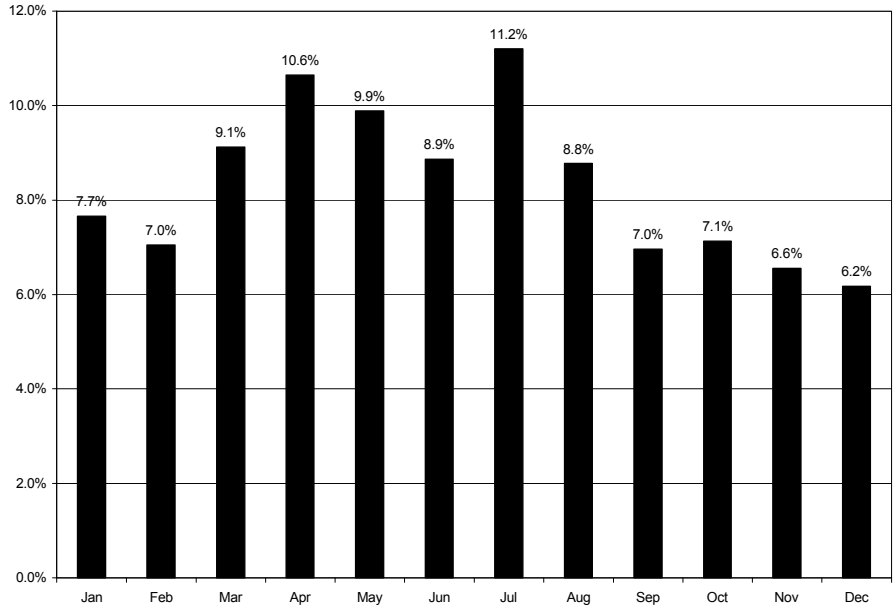


Figure 4. Incidence of Landfill Fires by Month[45]

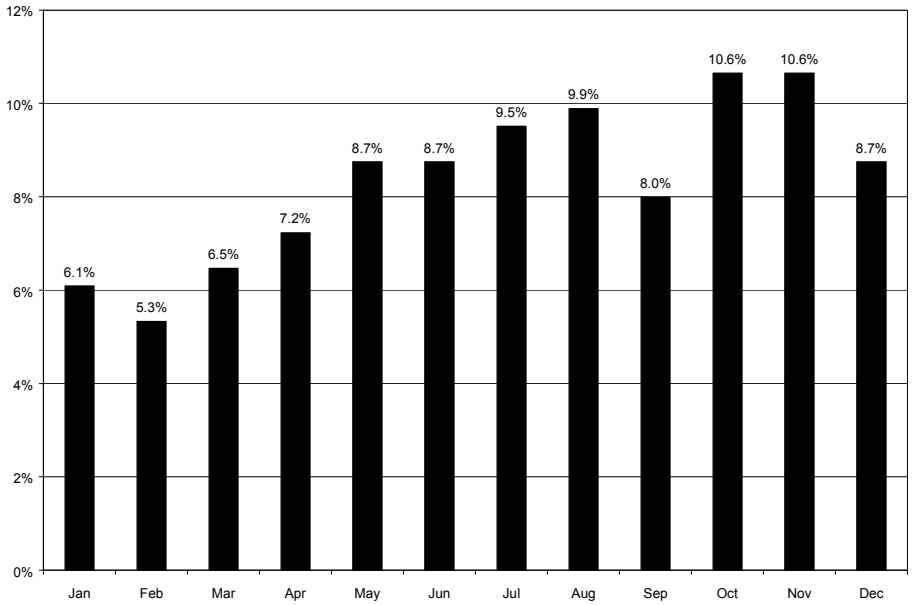


Figure 5. Incidence of Spontaneous Combustion Landfill Fires by Month[46]

[45] Ibid.
[46] Ibid.

The spring peaks in rekindled fires and the fall peaks in spontaneous combustion fires may result from increased winds during these months as many landfills may have inadequate caps (particularly if they use alternate daily covers) to prevent air infiltration. Inadequate caps can allow large volumes of air to enter the landfill, accelerating the oxidation reaction. The air intrusion is due, in part, to the differential in barometric pressure between the landfill and the atmosphere. This condition occurs most frequently in the late fall and spring with the large, naturally occurring atmospheric changes in conjunction with land surface heating and cooling. The increased oxidation raises the temperature in the landfill and can increase spontaneous combustion events. Some of the rekindled fires may be the result of earlier smoldering underground fires that, with the increase in airflow brought by winds, are oxygenated enough to break through to the surface.[47]

LANDFILL FIRE PREVENTION

Fire prevention can reduce property damage, injury, health, and environmental hazards of landfill fires. The cost of prevention is usually much less expensive than the cost of fighting and cleaning up a fire. In many cases, particularly for larger landfills, fire prevention activities are required by law. This section outlines some of the principal methods in landfill fire prevention.

LANDFILL MANAGEMENT. Effective landfill management is a vital key to efficient landfill fire prevention tactics. Management measures include prohibiting all forms of deliberate burning, thoroughly inspecting and controlling incoming refuse, compacting refuse buried to prevent hot spots from forming, prohibiting smoking onsite, and maintaining good site security.

METHANE GAS DETECTION AND COLLECTION. Landfill gas emissions can be a hazard to the environment and to the health of residents surrounding landfill sites. Methane gas, a flammable gas, can present a fire hazard. Federal regulations require all MSW landfill operators to monitor the emission of methane on a quarterly basis. If methane levels in or around the landfill become explosive, the landfill operator must take immediate steps to mitigate the danger. The operator must also implement a remediation program to prevent future explosive buildups.[48]

Federal regulations currently require MSW landfills that opened after November 8, 1987, and have a capacity of over 2.5 million cubic meters to install a gas collection and control system.[49] These regulations, however, affect only about 4 percent of operating landfills in the United States as the vast majority of landfills do not have such a large capacity.[50] Some states, however, (e.g., California) have stricter regulations for gas collection systems, which affect a higher percentage of facilities; these jurisdictions may include closed facilities as well.

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[47] E-mail correspondence with Dr. Tony Sperling and Todd Thalhamer.

[48] U.S. Code of Federal Regulations, 40 CFR 258.23 (Title 40–Protection of Environment Chapter I–Environmental Protection Agency. Part 258 – Criteria for Municipal Solid Waste Landfills).

[49] U.S. Code of Federal Regulations, 40 CFR 60.33c (Title 40–Protection of Environment Chapter I–Environmental Protection Agency. Part 60 – Standards of Performance for New Stationary Sources).

[50] *Air Rule for Municipal Solid Waste Landfills*, Environmental Protection Agency, January 10, 2002. http://www.epa.gov/reg3artd/airregulations/ap22/landfil2.htm.

Methane gas collection systems actively remove landfill gas using gas recovery wells and vacuum pumps with an interconnected pipe network. Operators must take care to ensure the system is not overdrawn, which can lead to fire ignition. Once the gas is collected, landfill owners/operators have two choices: (1) burn off the gas (flaring); or (2) convert the gas to an energy commodity.

Flaring. Burning landfill gas is the method most large landfills use (as opposed to the more costly waste-to-energy projects). Burning the landfill gas converts methane to carbon dioxide, which not only is less harmful to the environment, but also destroys the components of landfill gas that cause odor, stress vegetation, create smog, and increase the risk for fire or explosion.

Shallow gas venting trenches or gas venting pipes can also be installed in the landfill's surface. These vents allow gas from interior regions of the landfill to escape naturally to the surface where flares can burn off the gas.

Converting Landfill Gas to Energy. The conversion of landfill gas to energy turns this landfill byproduct into a marketable resource. The converted gas can be used to generate electricity, heat, or steam. According to the EPA, landfill gas is the only renewable energy source that, when used, removes pollution from the atmosphere.[51] By converting the landfill gas to energy, the harmful emissions causing global warming are removed from the air and converted to a useful form such as electricity to power a home. Reducing landfill gas emissions is imperative as it reduces local ozone levels and smog formation while simultaneously decreasing explosion and fire risks and unpleasant odors produced by the landfill.[52]

As of September 2001, the EPA estimates that there were more than 335 landfill gas recovery and utilization projects operating in the United States; another 500 landfills are considered good candidates for future program development.[53]

CASE STUDIES

A sample of landfill fires throughout the world sheds light on the landfill fire problem. Waste disposal practices and the regulation of landfill sites are similar in the comparison countries. Landfill fires have been investigated and studied in more detail in several countries outside the continental United States. The concluding portion of this section contains brief synopses of interviews and media reports detailing landfill fires in the United States and the lessons that were learned from them.

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[51] Landfill Methane Outreach Program, *Frequently Asked Questions*, Environmental Protection Agency, updated June 5, 2001. http://www.epa.gov/lmop/faq.htm.

[52] Ibid.

[53] Landfill Methane Outreach Program, *Current Projects and Candidate Landfills*, Environmental Protection Agency, January 10, 2002. http://www.epa.gov/lmop/projects.htm.

FINLAND.[54] An experimental study that sheds significant light on methods of extinguishing landfill fires was conducted in Finland in 1993. The study was conducted in two parts: a questionnaire was distributed to landfill operators throughout Finland, and an experimental landfill was constructed with similar characteristics to an MSW landfill. To determine the most effective methods for extinguishing landfill fires, an underground fire was ignited and allowed to burn in the experimental landfill. The fire was extinguished by smothering it with soil and dousing it with water.

From the questionnaires, the study determined that most landfill fires are small and tend to be of short duration. It concluded that using soil and water to extinguish the fires was insufficient and that a potentially significant factor in landfill fires is the improper compaction of waste in the landfill. The study suggested that one way to prevent landfill fires is to sufficiently compact all waste buried in the landfill site. Only one-quarter of the fires reported to the study team were underground; those fires were particularly difficult to extinguish and tended to last over 2 months. In fact, for underground fires, it was found that covering the smoldering refuse with layers of soil actually prolonged some fires. Another serious concern raised in the study was that by using water to extinguish landfill fires, the runoff could contaminate the surrounding soil and ground water.

Ultimately, based on both the questionnaire and the experimental landfill, the study concluded that the most effective way to suppress landfill fires is by digging out the burning material and cooling it with water, soil, or snow.[55]

CANADA.[56] In November 1999, a fire ignited at the Delta Shake and Shingle Landfill, a C&D landfill outside Vancouver, British Columbia. Although smoke and steam had been emanating from the landfill for weeks, the fire was finally discovered when flames broke through the landfill surface. The landfill operator originally attempted to extinguish the fire without fire department assistance; his efforts only served to exacerbate the fire. After several weeks, residents began to complain about the smoky haze hovering over Vancouver, and officials were concerned about air and water contamination from the suppression efforts. Ultimately, local officials declared a state of emergency and requested assistance from both the private sector and the provincial government.

To contain the fire and starve it of oxygen, officials covered the burning materials with a thick layer of refuse. Next, they determined that although using high-pressure water worked to extinguish the surface fire, it did not extinguish the burning refuse underground. To increase the water's effectiveness, firefighters misted the water and added Class A foam. Once the fire was contained, the firefighters used heavy machinery to excavate burning materials and move them to

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[54] Ettala et al., "Landfill Fires in Finland," *Waste Management & Research* (1996) 14, pp. 377-384.

[55] Other landfill fire suppression professionals, however, have found that landfill fires can be extinguished by excavating and extinguishing the burning debris layer-by-layer using soil and a suppressant agent, or simply by temporarily shutting down the gas extraction system.

[56] Sources for this section: "Landfill Fire in Delta Gets Provincial Emergency Funding," British Columbia Ministry of Environment, Lands, and Parks. Press Release 330-30:ELP99/00-340, November 30, 1999. Sperling, Tony. *Extinguishing the Delta Shake and Shingle Landfill Fire: Case Study*, Sperling Hansen Associates, January 18, 2002. http://www.landfillfire.com/delta1.html.

areas offsite where they could be fully extinguished. Firefighters used infrared technology to determine which loads were "hot" and required extinguishment and which ones were cool enough to be left alone. After the materials were fully extinguished using foam and water, they were returned to the reconstructed landfill.

A private contractor involved in the suppression effort summarized the following as lessons learned from this fire:

- Soil berms are effective at containing fire spread.
- Trenches that do not fully penetrate the refuse pile are ineffective; trenches should only be excavated if they penetrate the full thickness of the refuse to inert material.

HAWAII. In the late 1990s, fires in legal and illegal landfills were a serious concern for officials on all of the Hawaiian Islands. In July 1996, a fire at an illegal dumpsite in Lualualei, Oahu, attracted government and media attention. The site contained municipal waste, C&D debris, and hazardous materials. After explosions involving gas cylinders or drums, the State Department of Health hired a hazardous waste contractor to remove drums containing chemicals and some hazardous waste. Despite the attention, government officials had difficulty shutting down the dumpsite, as the property changed hands over the years and the cost of cleaning up the site exceeded the land's value.[57]

In January 1998, an odd odor at a C&D landfill in Ma'alaea led to the discovery of an underground fire.[58] Efforts to extinguish the fire with carbon dioxide were unsuccessful and, while the fire was contained, it smoldered for months.

Hawaii has less rigorous air quality standards than other areas of the United States because of its tradewinds, low population density, and isolation. Contractors are allowed to burn brush before depositing it in landfills. This practice decreases the waste volume and amount they are charged for using the landfills. Burned material goes through two inspection sites to check for "hot loads." In the Ma'alaea fire, it appears the ignition source was a smoldering palm tree. Palm trees are spongy inside and, though the outside may have appeared cool, the inside was still simmering. Once inside the landfill, the tree continued to smolder until it ignited surrounding waste.

Although relatively small, the fire sparked a debate involving the landfill operator, EPA, and different divisions of the Department of Health. The debate revealed that there were no regulations on methods to control landfill fires. This motivated government officials to develop guidelines that address underground fires and study the health effects of landfill fires. Also, the fire emphasized the need to thoroughly inspect suspected hot loads to ensure that smoldering materials do not accidentally enter the landfill.

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[57] "State Health Department To Close Illegal Dump in Lualualei," *Environment Hawaii*, Volume 11, Number 3, September 2000.

[58] "Ma'alaea Landfill Sparks State Effort To Develop Guidelines," *Environment Hawaii*, Volume 9, Number 4, October 1998.

OTHER EXAMPLES. The following examples were taken from media reports and interviews with fire officials in the affected jurisdictions. These examples shed light on firefighting tactics and local concerns associated with landfill fires.

Fairfax County, Virginia.[59] Fairfax County Fire Station 19 (Lorton) has two landfills within its call range. In November 2000, a fire broke out at the I-95 Landfill, near Lorton, VA. A 250-foot by 50-foot pile of debris, consisting of trees, stumps, and mulch, was ignited. Firefighters used water and foam to control and extinguish the fire. A fire technician who participated in the suppression effort stated that the most important tactic used in the fire was having firefighters and machinery overhaul the burning or smoldering areas to ensure that the fire did not rekindle.

Cumberland County, North Carolina.[60] In July 1998, flames at a landfill sent plumes of smoke over a large area. Firefighters were forced to contain the fire and let it burn since it was too hot for water to extinguish it effectively. An estimated 26 trailer loads of mulch were in the landfill. The mulch was very finely packed, the heat remained at the core, and water would not have cooled or extinguished the fire. Firefighters assured the fire did not spread to nearby tire piles by digging a ditch all around the fire, containing it. The fire burned itself out after several weeks.

Montezuma County Landfill, Colorado.[61] In June 2001, smoke from this 6-acre fire spread high over the Montezuma Valley. The 320-acre landfill was filled with compressed, baled trash and municipal and industrial waste.[62] Attempts were made to douse the fire with water, but they were ineffective. State landfill officials and other experts decided the best way to attack the blaze was to remove the smoldering bales of refuse, break them apart, and extinguish them individually. The cause of the fire was not determined. Landfill officials reported that confining the fire and smothering it proved to be the most effective method of extinguishing it.

Danbury, Connecticut.[63] In 1996 and 1997, numerous underground landfill fires occurred at the Danbury city landfill. These fires were caused by spontaneous combustion of decomposing waste and were rekindled and continued smoldering underground over 18 months. Different underground "hotspots" increased the intensity of landfill odors. These fires in the 47-acre landfill were the subject of extensive media coverage and residential complaints. As elsewhere, water was ineffective in extinguishing these fires, and its use added to the stench, causing additional citizen complaints. Residents filed lawsuits for damages caused by exposure to hydrogen sulfide gas from the smoke. As a result of the lawsuits, the landfill was forced to close. A 40-foot high permanent flare had to be installed to burn off landfill gas and reduce the odors.

Bend, Oregon.[64] A youth fell into a burning sinkhole on the site of an old landfill and suffered third-degree burns across 30 percent of his body. The youth and his friend had noticed a thin trail of smoke coming from the ground while walking home and went to investigate. There

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[59] Telephone interview with David Sweedland, Technician, Fairfax County Station 19, and *I-95 Landfill Debris Fire*, Fairfax County Fire and Rescue Department News Release, November 7, 2000.

[60] *Landfill Fire Continues To Burn,* WRAL 5 Cumberland County News, July 30, 1998.

[61] "Landfill Fire Fills Valley With Smoke," *Cortez Journal,* June 19, 2001.

[62] Telephone interview with Montezuma County Landfill official.

[63] *The News-Times*, Danbury, CT, December 1996–October 1997.

[64] "Youth Slips Into Burning Bend Sinkhole," *The Oregonian,* December 28, 1991.

was a small hole at the surface. While investigating the hole, the ground collapsed around the youth. The sinkhole was on a parcel of park district land on the outskirts of Bend, Oregon. The former landfill was owned by the county, and the land was later given to the park district. The original dump was used for wood waste. The decomposing waste smoldered and ignited through spontaneous combustion. Burned out pockets caused the landfill's earthen cover to weaken and collapse. Most of the problem areas were along the edges of the landfill where the earthen cap was the thinnest. The park district originally planned to put children's baseball fields on an unused portion of the old landfill, but reconsidered after conferring with the local Department of Environmental Quality.

Colerain Township, Ohio.[65] In 1996, the Colerain Township landfill experienced a major landslide that filled a nearby limestone quarry with acres of landfilled waste. The quarry was being excavated to hold additional waste in the landfill site when the landslide occurred. The area that had collapsed was dangerous; garbage was exposed and equipment was buried underneath, which made removal of the waste dangerous. The landfill officials could not move equipment to the site due to enormous voids in the exposed area; they feared bulldozers would be swallowed into the pile.

A series of four fires subsequently ignited, covering a 35-acre area. The first was a small 100-square-yard fire ignited by lightning. The second fire was as a result of combustion of decomposing waste and lasted 7 days covering a 20-acre area. Firefighters used pumped water and heavy equipment to tear down the fire area and then smothered it with dirt. Fifteen to 20 million gallons of water were used in the 7-day period. The last two fires were also a result of spontaneous combustion, but they were smaller in size. Water and heavy equipment were used to extinguish these two fires as well. Ultimately, restoring the landfill took approximately 2 years to complete.

San Bernardino County, California.[66] In 1999, funding was approved for the cleanup of a smoldering fire at an illegal dumpsite in Cajon Pass. The illegal dumpsite had been in operation for about 3 years. At the time of the fire, the dumpsite contained 200,000 cubic yards of waste, which filled an area about 60 feet high and 450 feet long. Most of the waste consisted of rubble, telephone poles, railroad ties, whole trees, shrubs, and large stumps. About 80,000 cubic yards (60,000 tons) were organic wastes, which spontaneously ignited, causing the fire. The smoldering fire posed a significant risk to nearby residences, wildlands, power lines, and railroad tracks, and it threatened serious water contamination. Agencies from the state and local level were involved in the funding effort.

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[65] Telephone interview with Ohio Colerian Township Dept. of Fire and EMS Fire Chief Bruce Smith.

[66] *State Waste Board Approves Funding for Cajon Pass Dump Cleanup,* California Integrated Waste Management Board, May 27, 1999, 99-053. http://www.ciwmb.ca.gov/pressroom/1999/may/nr053.htm.

CONCLUSION

Landfill fires are not common occurrences. When they do occur, however, they tend to attract a great deal of public attention and challenge the fire service. Illegal dumping continues to be a problem for regulatory agencies and the fire service. Illegal sites are particularly hazardous to firefighters, because the firefighters may be unaware of the presence or nature of chemicals or other toxic substances involved in the fire. Landfill fires in regulated facilities also challenge Incident Commanders, who must make a series of tactical decisions in a situation far different from that found at a "normal" structure fire.

Closed landfills are another area of concern, from both a regulatory and a fire service perspective. By federal law, landfill operators must commit to maintaining a landfill for at least 30 years after it has closed. Landfills continue to emit methane and other dangerous gases even after they are closed. As a result, buildings constructed on former landfills are often required to have automatic methane detectors, which sound an audible alarm in the event that methane levels become unsafe. Construction on closed landfills must not damage the final cover or the existing liners and leachate collection system. The true implications of closed landfills are not clear, largely because, for data collection purposes, these sites are likely coded not as landfills but as the property use at the time of an incident (fire, explosion, etc.).

Through EPA regulation and cleanup efforts of landfills, landfill fires are less likely to contain toxic chemicals than they were decades ago. Also, fire departments are gaining the experience to more efficiently and safely extinguish the fires that occur. Working in conjunction with the public and landfill operators, the fire service can reduce the occurrence of landfill fires, thereby better protecting the public, the environment, and emergency responders.

Benton County Exhibit 2 (BC2)

- Oregon Department of Transportation (ODOT) Region 2 email response

From: CHILDRESS Arielle <Arielle.CHILDRESS@odot.oregon.gov>
Sent: Tuesday, May 13, 2025 12:28 PM
To: LINER Duane J <Duane.J.LINER@odot.oregon.gov>; Joe Bessman <Joe@transightconsulting.com>
Cc: KURTZ Gordon P <gordon.p.kurtz@bentoncountyor.gov>; KNECHT Casey <Casey.KNECHT@odot.oregon.gov>; FELDMANN James <James.FELDMANN@odot.oregon.gov>
Subject: RE: TIA OR99W Hwy 091 MP 73.75 MP FW: Coffin Butte Landfill

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Duane,

I reviewed the submitted TIA and Response to Comments for the Coffin Butte Landfill Expansion development in Benton County and have no comments. It is our understanding that no direct access to a state highway has been proposed. Under such circumstance, this analysis has been required under the authority of the County and ODOT is serving as an additional reviewer.

Please let me know if you have any questions or I can help with anything else.

Thanks!

Arielle Childress, P.E. (she/her/hers)
Traffic Analysis Engineer
ODOT Region 2
455 Airport Rd. SE, Bldg. B, Salem, OR 97031
(971) 208-1290

From: LINER Duane J <Duane.J.LINER@odot.oregon.gov>
Sent: Tuesday, April 29, 2025 10:41 AM
To: CHILDRESS Arielle <Arielle.CHILDRESS@odot.oregon.gov>; Joe Bessman <Joe@transightconsulting.com>

Cc: KURTZ Gordon P <gordon.p.kurtz@bentoncountyor.gov>; KNECHT Casey <Casey.KNECHT@odot.oregon.gov>; FELDMANN James <James.FELDMANN@odot.oregon.gov>
Subject: TIA OR99W Hwy 091 MP 73.75 MP FW: Coffin Butte Landfill

Arielle and Joe,

Joe,

Per this email I will be asking our ODOT Region 2 Traffic Analysis Engineer to review the items you attached to your email. This will take a couple of weeks. As such I will not have comments for you today regarding the original TIA and recent supplement you included in your email. I can provide a general comment of: If any work in highway right of way is proposed by the applicant, or required by the County, then the applicant would need to first obtain a permit from ODOT prior to commencing any work in highway right of way.

Ps – I have cc'd the County (Gordon) on this email so he is aware of your request and our intent to review.

Arielle,

Please review the submitted original TIA and recent supplement.

Thank you

- duane

Duane James Liner, P.E.
Development Review Coordinator
ODOT - Region 2
541-757-4140



From: KNECHT Casey <Casey.KNECHT@odot.oregon.gov>
Sent: Monday, April 28, 2025 4:26 PM
To: Joe Bessman <Joe@transightconsulting.com>; LINER Duane J <Duane.J.LINER@odot.oregon.gov>
Subject: RE: Coffin Butte Landfill

Thanks Joe. I've got Duane Liner copied on this too. He's the development review coordinator in District 4 (Linn, Benton, Lincoln).

Duane – Can you take a look and see if there is anything concerning that we would need to address before the hearing tomorrow night?

Casey Knecht, P.E.
ODOT Region 2

From: Joe Bessman <Joe@transightconsulting.com>
Sent: Monday, April 28, 2025 3:10 PM
To: KNECHT Casey <Casey.KNECHT@odot.oregon.gov>
Subject: Coffin Butte Landfill

This message was sent from outside the organization. Treat attachments, links and requests with caution. Be conscious of the information you share if you respond.

Hi Casey,

I've been working with Republic Services on the Coffin Butte regional landfill expansion just west of Highway 99W. As you're probably aware, the current site is filling up so they are moving directly south across Coffin Butte Road to continue their operations. This will have no impact on Highway 99W relative to the current site; Coffin Butte is a *Collector* and a *Freight Route*. The plan is to retain the current scales on the north side of Coffin Butte Road so that we keep that ¼ mile storage bay, with no change in residential access or circulation. Transfer trucks will take the residential materials across the street. Commercial trucks will have to weigh in, then turn right (west) onto Coffin Butte Road, then make a left to enter the new expansion area (with a new left-turn lane and improved Coffin Butte Road).

Let me know if you have any questions or comments, I had assumed Benton County had shared a copy with ODOT but it doesn't sound like that has happened. The enclosed includes the original TIA and a recent supplement. My expectation is that tomorrow evening's hearing will be extended, if there's a short note you could provide when you've had a chance to review this that would be very much appreciated. As always, if you or your team have any questions please call me on my cell phone below.

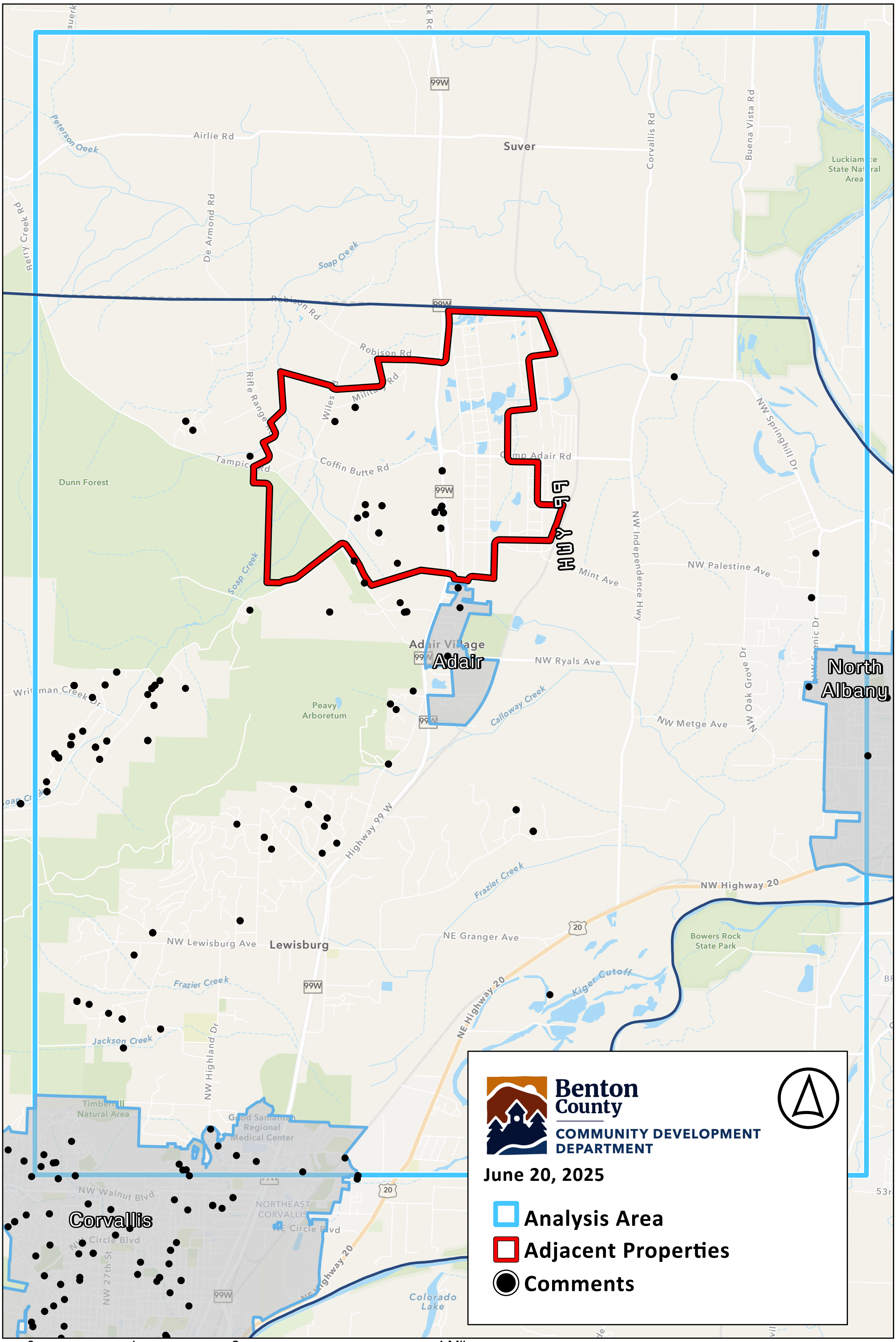
Thank you!
Joe

Joe Bessman, PE
(Licensed in OR, WA, ID)
Principal, Owner

Transight Consulting, LLC
Bend, Oregon
cell: (503) 997-4473
email: joe@transightconsulting.com

LU-24-027 Supplemental Staff Report to Benton County Planning Commission

Benton County Exhibit 3 (BC3)
Map of Testimony within Analysis Area



County of Benton, Oregon State Parks, State of Oregon GEO, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USFWS, County of Benton, Oregon State Parks, State of Oregon GEO, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

LU-24-027 Supplemental Staff Report to Benton County Planning Commission

Benton County Exhibit 4 (BC4)
Benton County Notice to Outside Agencies

From:	SCHUETZ Petra
To:	Larissa Gladding
Subject:	FW: Land Use Application Agency Referral for Coffin Butte Landfill Expansion | Conditional Use Permit | LU-24-27
Date:	Monday, April 14, 2025 12:30:18 PM
Attachments:	image007.png image008.png image009.png image011.png LU-24-27 - ODFW comments - 2025.pdf

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Found in Spam.

From: STACK Joseph P * ODFW <Joseph.P.STACK@odfw.oregon.gov>
Sent: Monday, April 14, 2025 9:29 AM
To: SCHUETZ Petra <petra.schuetz@bentoncountyor.gov>; publiccomment@bentonor.gov
Subject: FW: Land Use Application Agency Referral for Coffin Butte Landfill Expansion | Conditional Use Permit | LU-24-27

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Petra,

I had attempted to send in agency comments related to the Coffin Butte Landfill Expansion permit on Friday, but received an email back over the weekend saying the message could not be delivered. It looks like I had typed in the wrong domain having used the @benoncountyor.gov instead. Thanks for adding these comments to the record.

Cheers,
Joe

Joe Stack
Regional Habitat Biologist
Oregon Dept of Fish and Wildlife
South Willamette Watershed District
Office: 541-757-5301/ Cell: 541-650-2840

From: STACK Joseph P * ODFW <joseph.p.stack@odfw.oregon.gov>
Sent: Friday, April 11, 2025 4:31 PM
To: publiccomment@bentonor.gov
Subject: RE: Land Use Application Agency Referral for Coffin Butte Landfill Expansion | Conditional Use Permit | LU-24-27

Please accept the following comments related to the Coffin Butte Landfill expansion project.

Cheers,

Joe

Joe Stack
Regional Habitat Biologist
Oregon Dept of Fish and Wildlife
South Willamette Watershed District
Office: 541-757-5301/ Cell: 541-650-2840

From: SCHUETZ Petra <petra.schuetz@bentoncountyor.gov>
Sent: Thursday, March 20, 2025 5:03 PM
To: Benton Public Comment <PublicComment@bentoncountyor.gov>
Cc: STACK Joseph P * ODFW <joseph.p.stack@odfw.oregon.gov>; WINGARD Patrick * DLCD <patrick.wingard@dlcd.oregon.gov>; FOOTE Hilary * DLCD <hilary.foote@dlcd.oregon.gov>; jarod_jebousek@fws.gov; Kruger Scott <scott.kruger@bentoncountyor.gov>; BYER Laurel <Laurel.Byer@bentoncountyor.gov>; odotr2planmgr@odot.oregon.gov; CAMARATA Mary * DEQ <Mary.CAMARATA@deq.oregon.gov>; WILLIAMS Becky * DEQ <Becky.WILLIAMS@deq.oregon.gov>; Rian Amiton <rian.amiton@corvallisoregon.gov>; Pat Hare <pat.hare@adairvillage.org>; MCGUIRE Sean <Sean.McGuire@bentoncountyor.gov>
Subject: Land Use Application Agency Referral for Coffin Butte Landfill Expansion | Conditional Use Permit | LU-24-27

You don't often get email from petra.schuetz@bentoncountyor.gov. Learn why this is important

Agency Referral

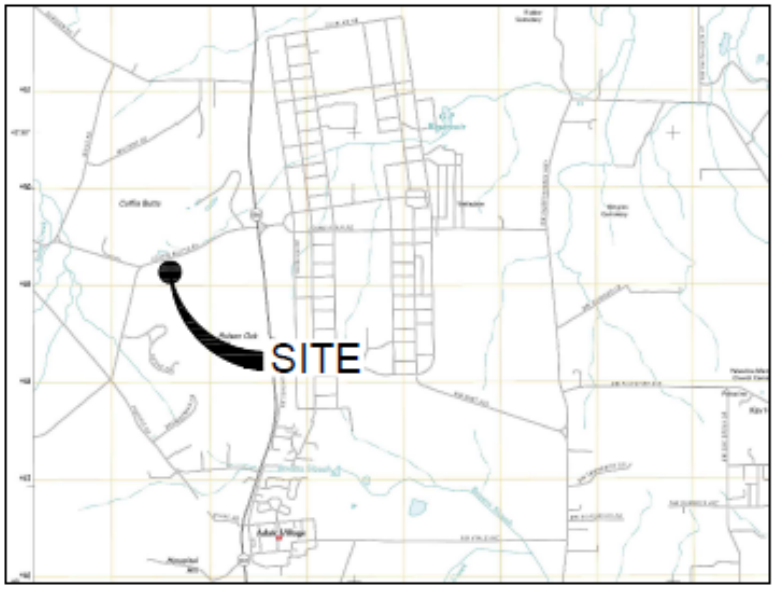
Agency Referral partner comments are an essential part of a successful land use application process. Benton County appreciates your time and attention to this review. Comments are due no later than **Friday, April 11, 2025**.

Request: Expansion of Coffin Butte Landfill
Application identifier: LU-24-27
Type of land use application: Conditional Use Permit
Applicant: Jeff Condit on behalf of Valley Landfills, Inc a.k.a. Republic Services
Application Details: Please use this link to the **application materials**. The application and all documents and evidence used by the applicant are available are also available for inspection at the Benton County Planning Division located at 4500 SW Research Way, Corvallis OR 97333.
Please upload your formal comments to **publiccomment@bentonor.gov**. If your organization chooses *not* to comment, please reply to this email with that intent.
Contact: Petra Schuetz | Planning Director | petraschuetz@bentoncounty.or.gov

Site location:

29175 COFFIN BUTTE ROAD

CORVALLIS, BENTON COUNTY, OREGON 97330



U.S.G.S. MAP

U.S.G.S 7.5 MIN. TOPOGRAPHY MAP,
LEWISBURG QUADRANGLE, OR, DATED 2011

SCALE IN FEET

0 5000 10000



SITE MAP

SCALE IN FEET

0 600 1200

Petra Schuetz
Interim Community Development Director
Email: petra.schuetz@bentoncountyor.gov
bentoncountyor.gov

LU-24-027 Supplemental Staff Report to Benton County Planning Commission

Benton County Exhibit 5 (BC5)
Benton County Reviewing Consultants' Credentials

Contents:

- Winterbrook Planning firm bio and resume
- Maul Foster Alongi (MFA) and sub-consultants firm bios and resumes
- Kellar Engineering – firm bio and resume

Benton County Exhibit 5 (BC5)

- Winterbrook Planning firm bio and resume

WINTERBROOK PLANNING

Firm Bio - Contract Planning

Winterbrook Planning has provided land use, environmental planning, and permitting services for public and private clients throughout the Northwest for over twenty years. Winterbrook's expertise is concentrated in planning and land use permitting for municipalities. We also help cities with current and long-range land use planning, environmental assessments, and other services such as comprehensive plan and zoning code revisions. We have an extensive working knowledge of applicable statutes, goals, administrative rules, framework and functional plans, and case law applicable to permit approvals.

Winterbrook has provided on-call planning services to dozens of Oregon cities and counties throughout the state. The staff at Winterbrook have decades of experience collaborating with state and local officials to resolve complex land use and environmental problems. We work closely with other allied disciplines in land use field: civil and hydrological engineers, landscape architects and architects, economists, land use lawyers, surveyors and specialized environmental scientists.

In all its work, Winterbrook advances the planning goals and requirements of each jurisdiction, while maintaining the highest standards of professionalism and integrity. Winterbrook understands public sector work increases the need for transparency and communication and has been able to work effectively with all project stakeholders, including applicants, neighbors, and city and county planning officials.

JESSE WINTEROWD, AICP

PROFESSIONAL EMPLOYMENT

Managing Principal
Winterbrook Planning, Portland, OR 2019-present.

Project Manager
Winterbrook Planning, Portland, OR, 1998-2019.

Intern
Wallis Engineering, Vancouver, WA, 1997.

EDUCATION

Master of Urban and Regional Planning
Portland State University, 2006.

Bachelor of Arts
Wesleyan University, 1997.

PROFESSIONAL MEMBERSHIP

American Planning Association

Project Management Institute

PROFESSIONAL CERTIFICATIONS

AICP #026890

PMP #5470189

Jesse Winterowd has over 26 years of experience covering hundreds of projects – managing project teams in long-range planning analyses for cities and counties, preparing development and permit applications for private and public clients, and serving as a contract planner for several jurisdictions.

He has extensive experience working with municipal and regional plans and development codes, in cities and counties throughout the Metro region, the Pacific Coast, the Willamette Valley, and Southern and Eastern Oregon.

The brief list below highlights a selection of Jesse's recent contract planning and temporary staff augmentation projects.

SELECTED PROJECTS:

- **Columbia County:** Application intake, completeness review,prepare staff reports and hearings presentations, agency coordination for major projects; Comprehensive Plan and Development Code updates including Goal 5 program restructuring; staffing assistance for remand review; multiple presentations to Planning Commission and County Board (2021-present)
- **City of Turner:** Prepare staff reports and hearings presentations for multiple development code updates, zone changes, and development applications; ongoing contract planning services for application review, code interpretation; multiple presentations to City Council (2021-present)
- **City of Aumsville:** Prepare comprehensive plan text amendment, staff report and findings for UGB expansion; presentations to Planning Commission, City Council and County Board of Commissioners; application intake, completeness review and applicant coordination for a major conditional use development; annexation review (2022-present)
- **City of Sublimity:** Prepare staff reports and findings for UGB expansion for public facility; code amendment; presentations to City Council (2021-2024)
- **City of Astoria:** Prepare staff reports, findings, development code and comprehensive plan amendments, and zone change to facilitate development of a region-serving hospital designed to survive a Cascadia event within the tsunami inundation zone; extensive coordination with City and project team engineers and architects; multiple presentations to Planning Commission and City Council (2022-2023)
- **City of Wilsonville:** Manage staff augmentation and application intake, completeness reviews, staff reports for multiple Type I-II land use applications (2021-2023)
- **City of Island City:** Prepare dozens of staff reports, hearing presentations, and coordinate with citizens for Type I-IV land use reviews including conditional uses, multiple UGB amendments, updates to comprehensive plan and development code, and annexations (2001-2023)

Benton County Exhibit 5 (BC5)

- Maul Foster Alongi (MFA) and sub-consultants firm bios and resumes

April 18, 2025

Benton County, Oregon

Third-party Review – Proposed Expansion of Coffin Butte Landfill

From: Ellery Howard
3140 NE Broadway
Portland, OR 97232
971-544-2139

To: Petra Schuetz
Interim Director
Benton County Community Development Department
4500 Research Way
Corvallis, OR 97333

Re: Third-party Review – Proposed Expansion of Coffin Butte Landfill

Dear Petra Schuetz:

Maul Foster & Alongi, Inc. (MFA) is pleased to submit this team overview letter for the third-party review of the conditional use permit application submitted by Valley Landfills, Inc. for the Coffin Butte Landfill Expansion. MFA has been contracted by Benton County to provide a comprehensive review of the application, leveraging our local expertise in solid waste and related environmental issues in Oregon and throughout the Pacific Northwest.

MFA is an established consulting firm offering integrated services in engineering, environmental science, planning, Geographic Information Systems (GIS), environmental data management, communications and public outreach, and health and safety. With offices located in Seattle, Vancouver, and Bellingham, Washington; Portland, Lake Oswego, The Dalles, and Bend, Oregon; and Coeur d'Alene and Kellogg, Idaho, MFA delivers innovative and award-winning professional services to a diverse range of industry and municipal sectors.

Our multidisciplinary team, comprising engineers, environmental professionals, planners, construction managers, and industrial hygienists, routinely provides high-quality consulting services to municipal clients. These services include solid waste engineering, permit compliance, stormwater management and design, environmental monitoring and reporting, air permitting and Title V compliance, methane monitoring and mitigation, and infrastructure support.

MFA is presently engaged in offering engineering services and permitting assistance for several solid waste facilities in Oregon, including a solid waste transfer station proposed to be located in Polk County. We have no prior engagements with the applicant and there are no conflicts of interest.

In reviewing the application package, MFA brings the following expertise to this project:

- Solid Waste Engineering: Our solid waste engineers and environmental specialists reviewed the landfill expansion application documents for consistency with local and state regulations.
- Stormwater Management: MFA's stormwater experts evaluated the proposed stormwater systems and associated calculations relative to the applicable local standards.
- Noise Assessment: MFA's industrial hygienist conducted a detailed review of the noise assessment describing how the proposed expansion would impact the surrounding community with consideration to allowable noise standards.
- Air/Odor Modeling and Permitting: Our air quality experts evaluated odor documentation, including odor dispersion model study, to confirm if the potential impacts to the nearby properties are accurately identified.

MAUL FOSTER ALONGI

In addition to our in-house expertise, we partnered with the following firms to provide specialized reviews:

- Columbia West Engineering (CWE) reviewed the geotechnical approach in the applicant's submittal to determine the stability and safety of the proposed landfill expansion.
- Landfill Fire Control Inc. (LFCI) conducted a review of the fire risk assessment information submitted by the applicant, providing critical insights into fire prevention and control measures based on real world experience derived from responding to landfill fires around the world.

Attachment A contains resumes for team members, including those of our subconsultant partners.

Please contact us if you have any questions.

Sincerely,

Maul Foster & Alongi, Inc.

Ellery Howard
Project Manager

Erik Bakkom, PE
Principal Engineer

Attachment

Resumes



Ellery Howard PE

Senior Engineer
ehoward@maulfoster.com | 208.664.7884

Ellery Howard is a skilled professional engineer with over 30 years of experience in engineering design, as well as construction observation and coordination. He excels at assembling and managing diverse teams to accomplish multifaceted projects for local governments or private entities. Clients appreciate Ellery's focus on understanding their goals and his leadership of project teams that address those goals.

Ellery's broad design experience includes landfills and transfer station planning, water storage and distribution systems, water source design and development, as well as sanitary and storm sewer systems. His planning experience includes water and sewer master plans and hydraulic water model development and calibration. He has also been involved in project management for a number of projects, both large and small, throughout Idaho, Washington, Oregon, and Montana.

Education

- BS, Civil Engineering: University of Idaho

License/Registration

- Professional Civil Engineer: Idaho, No. 10004

Certifications

- 40-Hour HAZWOPER Training
- OSHA 30-Hour Construction Training

Relevant Projects

Solid Waste Design and Analysis

Landfill Analysis and Operations, Boundary County, Idaho

Ellery has worked with this facility for over 20 years. He was project manager for a landfill lifetime analysis and the development of a landfill site operating plan. He assisted the facility with landfill closure cost estimates and updates, site surveys, cell and cover material volume analysis, preliminary transfer station planning, permit updates, and coordination with regulatory agencies. He also designed and coordinated the permitting and construction of gas-extraction wells and a unique solar-powered gas-venting system. A recent project includes siting and permitting an air curtain incinerator to dispose of natural wood debris.

Infrastructure Planning and Construction

Confidential Client, The Dalles, Oregon

Ellery led a design-build team in assessing existing infrastructure and the successful segregation and construction of several natural gas, sewer, and water infrastructure projects to serve a large private facility on over 100 redeveloped acres. The design-build approach saved the client a significant amount of time and money as MFA served as the general contractor.

Land Planning and Annexation

Private Clients, Spokane, Washington and Amity, Oregon

Ellery provided the infrastructure assessment and planning for over 600 acres that included a technology park, shopping center, and light and heavy industrial areas. Project accomplishments included the development of a new land use category and zone (Technology Mixed Zone), creation of urban renewal districts, and a unique and specialized method for reuse of industrial wastewater.

Ellery Howard PE

Stormwater

Stormwater Management Alternatives, Hillyard Industrial Area, City of Spokane, Washington

Ellery was project manager for the investigation and analysis of a potential regional stormwater system in the Hillyard Industrial Area to catalyze development. The analysis was developed in coordination with the City and Northeast Public Development Authority and was intended to inform the decision makers as they develop the framework and policies for creating a regional stormwater utility in this area.

Water Supply and Treatment

Water System Facility Planning, Bayview Water and Sewer District, Bayview, Idaho

As project manager, Ellery led the water system facility planning effort to investigate and evaluate aging infrastructure in the Bayview Water and Sewer District's existing water system. Tasks associated with the project included preparation of construction cost estimates for recommended improvements. The project also included significant public involvement and community outreach.

New Water System, Coeur d'Alene, Idaho

Ellery supported permitting, design, and construction management for a new private water system that included wells, transmission and distribution lines, a booster pump station, a fire pump, and a 175k-gallon welded steel reservoir. The project included development and implementation of several unique methods to reduce the naturally occurring arsenic in one of the wells to avoid treatment.

Potable Water and Wastewater System Design, USDA Forest Service, Idaho and Montana

Ellery served as project engineer for the design of new potable water and wastewater systems for Forest Service facilities, including a unique solar-powered well pump system. This project included the repair/rehabilitation design of existing systems and general civil engineering work at remote campgrounds, work centers, and ranger stations.

Wastewater Collection and Treatment

Water and Wastewater Facility Construction, Hayden, Idaho

Ellery was project manager for the permitting, design, and construction of multiple projects for water and wastewater facilities for a church camp, including a 1-million-gallon lagoon and Class C reuse system with treatment on a forested site, water system upgrades, play field design and construction, permitting and siting of cabins in steep locations, and source well development.

Construction Wastewater Design and Permitting, Coeur d'Alene, Idaho

Ellery supported the design and coordination of a unique collection system and permitting for the treatment of wastewater from a concrete resurfacing project for a construction company on an interstate highway bridge over Blue Creek Bay on Lake Coeur d'Alene, Idaho.

Unique Projects

Contract Engineering Services, City of Hayden, Idaho

Ellery was project manager providing contract engineering services to the City of Hayden. Work included preapplication meetings and review and approval of site plans, plats, construction plans, and other documents.

Water Rights Permitting and Engineering Design, Hauser, Idaho

Ellery supported U.S. Army Corps of Engineers permitting and water rights permitting as well as civil engineering design for the mass excavation and lining of a 5-acre private pond (18 feet deep) that is aerated and capable of supporting aquatic life. The project also involved diverting adjacent streams into the impoundment and then returning them to their natural downstream course.



Erik I. Bakkom PE

Principal Engineer
ebakkom@maulfoster.com | 503.501.5217

Erik Bakkom has 27 years of experience in environmental engineering, with expertise in the areas of solid waste facility planning and design, brownfield/industrial site cleanup, and sediment remediation. Erik routinely works with diverse groups of engineers, scientists, planners, ecologists, and regulatory specialists. Erik has led the design and construction efforts for landfills and complex remediation projects in Oregon, Washington, and Idaho. Solid waste experience includes preparing solid waste management plans; design and construction quality assurance oversight for landfill systems and transfer stations; waste acceptance plans; evaluation of compost and recycling facilities; landfill acquisition due diligence; environmental support for landfill operations; and hazardous waste management. Erik is a civil engineer licensed in Oregon, Washington, and Idaho.

Education

- BS, Environmental Engineering: New Mexico Institute of Mining and Technology

Licenses/Registrations

- Civil Engineer:
  Oregon, No. 72200
- Washington, No. 43788
- Idaho, No. 15529

Certifications

- 40-Hour Hazardous Waste Operation Training and 8-Hour Hazardous Waste Operation Refresher Training
- Asbestos Awareness Training

Professional Associations

- American Society of Civil Engineers
- Western Dredging Association

Relevant Projects

Solid Waste

Solid Waste Landfill Cell Construction, Washington

Erik was principal in charge for the construction oversight of subgrade preparation for two new cells totaling approximately 20 acres. MFA worked closely with the client, design engineer, and construction contractor to clear existing wooded vegetation, extend run-on control and diversion structures, install hydraulic gradient controls to manage multiple springs below the proposed liner, and then prepare subgrade soils to receive the liner in future years. The scope of work included public bid assistance, full-time contractor oversight and documentation, coordination with the design engineer, and coordination of geotechnical testing for subgrade soils and imported materials in order to certify construction of two cells prior to installation of the liner.

Waste Acceptance and Plan Preparation, Washington

Erik is the principal engineer for the preparation of a comprehensive waste acceptance plan and review of waste-disposal applications received by the County for nonroutine wastes, including contaminated soils, contaminated sediments, and various industrial wastes. When the client requested assistance with their waste acceptance program because of staffing changes, MFA reviewed the existing program and identified areas with ambiguous instructions or where solid waste regulations were not being consistently implemented. MFA worked closely with the landfill manager and solid waste transfer company to develop an update to the waste acceptance plan that would provide consistency for implementation by both entities. Along with the development of the plan update, MFA provides technical review of solid-waste-disposal applications for nonroutine wastes to be disposed at the landfill.

Solid Waste Landfill Closure, Washington

Erik managed the design, permitting, and construction for the final closure of a 25-acre landfill. MFA designed an alternative landfill cover system that includes a vegetated soil cover, surface water drainage layer, impermeable plastic liner, impermeable clay geocomposite liner, and landfill gas collection layers with a horizontal gas collection system. The comprehensive design includes improvements to facility stormwater

management and the refurbishment of an existing landfill gas flare. The scope of work included public bid assistance, full-time oversight of construction activities, implementation of the geomembrane/geocomposite liner quality assurance program, and construction documentation to certify closure.

Solid Waste Landfill Closure and Redevelopment, Oregon

Erik was responsible for the preparation of documentation and details for closure of this former city landfill as part of redevelopment as a multi-use sports complex. He oversees annual environmental monitoring for landfill gas and groundwater to comply with permit requirements and to demonstrate that engineering controls remain effective for the high school sports complex. Erik worked closely with the MFA site development lead engineer to integrate the landfill closure features (soil cap, membrane liners, venting systems) to maximize the synergistic benefits for both the property owner and the site developer, leading to the closure of this previously abandoned landfill and its reenergized use as a state-of-the-art high school sports complex with significant community value. MFA's grading and surface water management design for the sports complex was tailored to address Oregon's landfill final cover requirements. Erik oversaw the design for the methane gas control systems to prevent intrusion into occupied spaces in the locker room and the concessions area.

Solid Waste Landfill Mapping, Washington

Erik is the principal in charge for semiannual aerial mapping services in support of semiannual volume assessment of landfill waste placement within the 150-acre developed footprint. MFA uses unmanned aerial aircraft and photogrammetry to document conditions at the active and inactive areas of the landfill. Mapping deliverables include a high-resolution orthoimage and high-density ground elevations. Aerial images are collected with a half-day effort, and then processed with surveyed ground targets and client-specified checkpoints. Quality control calculations typically result in an error of less than 0.5 feet.

Municipal Solid Waste Landfill and Planning Support, Washington

Erik oversaw services that were provided to the County in support of their solid waste program and landfills. Services included engineering design and construction services for maintenance and closure of the County Landfills; development and administration of the County's waste acceptance program to ensure that prohibited wastes (Washington dangerous waste and federal hazardous waste) were not inadvertently placed in the landfill; facility stormwater assistance, and solid waste management plan development and maintenance.

Solid Waste Management Plan for Municipalities, Oregon and Washington

Erik is the principal in charge for the preparation of solid waste management plans for municipalities in Oregon and Washington. The updates periodically address document structure changes to address changes to the state guidelines These plans address detailed evaluation of local conditions (physical conditions and demographics), solid waste collection, recycling, organic materials management, special waste handling, to satisfy state guidelines. In preparing the solid waste management plan, MFA works closely with local solid waste managers, waste and recycling facilities, and solid waste advisory committees, to develop a detailed description of the local system, management requirements, a projection of solid waste generation over a 20-year planning period, and then establishes goals and actions that are necessary to maintain system capacity over the planning period.

Waste Acceptance Assistance, Landfill Facility, Oregon

Erik manages requests from an Oregon landfill for assistance with the regulatory review of wastes that are proposed for disposal in the landfill. Assistance is typically requested when non-routine contaminated and out-of-state waste streams are under consideration. MFA provides an evaluation of waste acceptability with consideration to federal and state regulations. A detailed understanding of Oregon and California solid and hazardous waste regulations is required.

Solid Waste Landfill Postclosure Assistance, Oregon

Erik is the principal in charge for assistance with the management of two closed municipal landfills, following its formal closure and redevelopment as a high school sports complex. Activities include general environmental consulting services, environmental assessment of groundwater and landfill gas conditions, annual update of financial assurance, and assistance with long-term management plans.

Erik Bakkom PE

Solid Waste Landfill Entrance Scales, Washington

Erik managed the design of and oversaw construction of a new inbound and outbound scales complex at this operating landfill. The project required that the scales be incorporated into the existing entrance layout and that access to the administrative office be maintained. The bid package was developed to incorporate the requirements for a new scales hardware and software system that had been procured separately by the municipality. MFA assisted the municipality with obtaining permits and supported the municipal bid process. MFA also provided special inspection services during construction, as well as expert opinion regarding a defective concrete pour that had resulted in a suspected cold-joint.

Solid Waste Landfill Postclosure Facility Use Assessment, Washington

Erik developed the postclosure facility use assessment to document various conditions at a county-owned property containing a former landfill. The document is intended to record institutional knowledge of property assets, liabilities, easements, and various deed conditions for reference by the county in evaluating options for long-term use.

Solid Waste System Assessment for Municipality, Washington

Erik was project manager for the assessment of solid waste facilities, programs, and policies to aid this county with long-term capital funds planning. The assessment also provided an evaluation of needs in the county to include in the update of its solid waste management plan. Information regarding the county's current solid waste system was prepared and reviewed, after which patterns of waste generation and population growth were evaluated to enable the identification of strategic solutions for future solid waste issues. Concepts for future programs and facilities for solid waste management were developed and considered with an advisory committee. The study presents recommendations for modifications to existing facilities, proposes new facilities, and identifies opportunities to enhance diversion and recycling in the county.

Landfill Permit Renewal for Municipal Landfill, Washington

Erik prepared a renewal of a landfill permit. The permit renewal included a request to allow the use of ash, which currently must be landfilled, as an alternative daily cover material at the landfill.

Landfill Development and Closure Planning for Municipality, Oregon

Erik assisted with the preparation and revision of a landfill development and closure plan. Tasks included revising the landfill capacity estimates and grading plan and designing a stormwater diversion channel. During a subsequent task, Erik assisted with the preparation of documents and drawings for the closure of a 10 acre portion of the landfill. He also designed the stormwater drainage plan to convey runoff away from the slope and to minimize erosion.

Woodwaste Landfill Design, Oregon

Erik was the principal in charge for the design of a new woodwaste landfill cell at this remote facility. Erik worked with the client and the Oregon DEQ to prepare a design report and engineered plans that satisfy current regulatory requirements for lined industrial-waste-disposal cells. MFA collaborated with the environmental consultant in preparing an update to the environmental site characterization report and surface water conditions.



Cem Gokcora PE

Senior Engineer
cgokcora@maulfoster.com | 971.713.3573

Cem Gokcora has over 20 years of experience in civil engineering, including site development, utility design, stormwater conveyance and treatment design, water systems design, solid waste facility design, and compliance assistance. His areas of expertise include project management, site development design (residential, commercial, and industrial), land-use entitlement, site development planning and permitting, stormwater management, and construction cost estimating. Cem understands how to develop site plans that optimize client objectives relative to site and regulatory constraints and has successfully permitted projects within numerous jurisdictions in Washington and Oregon. He is proficient at preparing accurate development budgets and cost estimates, and detailed schedules covering design, permitting, and construction activities. He has adeptly led and managed multidisciplinary teams, ensuring successful project delivery.

Education

MS, Engineering and Technology Management:
Portland State University

- BS, Civil Engineering:
Middle East Technical University

Licenses/Registrations

- Professional Civil Engineer:
California, No. C 88736
- Professional Civil Engineer:
Idaho, No. 17290
- Professional Civil Engineer:
Oregon, No. 70867 PE
- Professional Civil Engineer:
Washington, No. 54676

Certifications

- 40-Hour HAZWOPER Training
- First Aid, CPR, and AED Training

Relevant Projects

Brownfield Site Redevelopment for Large Industrial Warehouse Facility, Portland, Oregon

Cem led the design and permitting (with multiple agencies) effort for redevelopment of a former concrete structure manufacturing facility, a portion of which overlaid a former closed construction and demolition debris landfill, to a large-scale industrial warehouse complex (approximately 675,000 square feet of building area in total). The former facility, located along Columbia Slough and with a permitted outfall, is a registered DEQ environmental cleanup site. Cem assisted the design team with preparation of the remediation design submittal package, and coordinated with the DEQ's Cleanup Division for review and approval of the selected remedy. He prepared site civil components of City of Portland building permit application. These included design drawing sets for on-site features including landfill gas mitigation systems, and stormwater report Cem led the construction quality assurance program and provided the DEQ with periodic remediation construction progress updates.

Industrial Stormwater Permit Compliance, Treatment/Infiltration System Design and Permitting, and a Level 3 Engineering Report, Industrial Park, Vancouver, Washington

Cem assisted the design team with on-call NPDES stormwater permit compliance services to a large waterfront industrial park with over 100 tenants. He has designed and permitted several stormwater infiltration facilities as well as Level 3 stormwater treatment measures required to meet NPDES permit benchmarks. Cem also provided construction assistance services during implementation of the first-phase improvements.

Design for Public Water System Improvements, The Dalles, Oregon

Cem has led the engineering effort for a privately funded public water system improvement project in the City of The Dalles, which includes construction of two production wells, two 1.2-million-gallon welded steel tanks, a booster pump station with up to 9,000 gallon-per-minute pumping capacity. Cem coordinated the design of the well

houses, booster pump station, reservoirs and electrical system design. He is currently managing engineer of record services including construction oversight.

Design Review for East Fork Nine Mile Creek Initial Waste Consolidation Area and Infrastructure Construction, Kellogg, Idaho

Cem assisted the design review team with their review of the 90% design report, hydrological calculations, and the associated plan set for haul roads, the surface and base drainage system, and the quarry plan. He also reviewed the engineer's estimate of probable costs.

Bailing Facility Design and Permitting for a Private Solid Waste Transfer/Recycling Station, Toledo, Oregon

Cem assisted a private solid waste transfer/recycling facility with a temporary bailing facility design and permitting. The permitting effort included coordination with the City of Toledo and the Lincoln County Building Department to obtain a Conditional Use Permit, an Excavation/Fill Permit, and a Building Permit. Cem managed the design team, which included a geotechnical consultant, a structural consultant, a surveyor, and the membrane structure supplier, and coordinated with the contractor for site planning, earthwork, building layout, slab design, and evacuation plan (for life safety and wind protection of the membrane structure).

Tennant Way Landfill Closure, Cell 3, Longview, Washington

Cem coordinated with a geotechnical subconsultant and the Cowlitz County Building and Planning Department to prepare an alternative cap evaluation report. He was part of the design team that prepared an engineering report for the proposed closure, and also drafted the engineering plan set for construction, including the subgrade, stormwater, and landfill gas collection plan, along with associated landfill stormwater/gas collection details. Cem assisted the client with remaining capacity calculations for the active landfill cell and coordinated with the Washington State Department of Ecology on estimating the postclosure period timeframe, based on landfill gas generation modeling results. Cem prepared bid documents for closure construction, and assisted the county during the bid and construction period. He managed the construction quality assurance team overseeing the construction of the closure project, ran weekly construction meetings, and coordinated resolution of the contractor's requests for information. Cem authored the postconstruction report and coordinated with the County for jurisdictional postclosure requirements.

Nespelem Transfer/Recycling Station, Nespelem, Washington

Cem helped the design team to put together the bid documents for Nespelem Transfer/Recycling Station. He edited the contract form provided by the client, to address the project-specific components. Cem was involved in the site, grading, and utility design (including an on-site septic system) for the subject site. He assisted the design team with the preparation of technical specifications for structural fill construction and compaction below the proposed transfer station building, a package sanitary pump station, on-site sanitary and water systems, a pre-engineered steel building, access road construction, a modular scale house, and a truck scale.

Landfill Remediation Planning, Bend, Oregon

Cem assisted the design team with construction cost estimates (landfill mining, waste sorting, re-landfilling, backfilling of remediated landfill areas) in an effort to develop a phasing plan consistent with available funding.

Construction Oversight and Contract Administration for Municipal Solid Waste Landfill Cell Earthwork, Castle Rock, Washington

Cem led construction quality assurance services for earthwork construction for a new cell at the municipal landfill. His responsibilities included coordination with the design engineer, field CQA officer, contractor, and county construction manager regarding field questions, submittal reviews, change orders, and payment application reviews; conducting weekly meetings to report progress to all stakeholders, including the county solid waste manager, Ecology, the county public health department; completing periodic inspections; and certification of the completed construction with a construction certification report.



Derek Heitz CPSWQ

Project Environmental Scientist
dheitz@maulfoster.com | 816.878.2362

Derek Heitz has nearly a decade of experience working with industrial clients on environmental compliance and due diligence efforts. His expertise includes providing clients with NPDES compliance support; performing pollutant source evaluation and control studies; identifying current and legacy contamination sources; identifying data gaps in prior due diligence efforts; designing, installing, and maintaining treatment systems for stormwater, process water, and ex situ groundwater treatment; characterizing and disposing of hazardous and dangerous wastes; and conducting Phase I and II ESAs. He has a strong working knowledge of industrial facilities and processes and their potential on-site and off-site impacts. Derek has expertise in developing site-specific plans for pollution prevention and spill prevention, control, and countermeasures; performing facility inspections; determining and abating pollutant point sources; and providing permitting assistance, proof-of-concept testing, and contractor oversight; and he frequently serves as project manager on various environmental compliance and cleanup projects. Derek also has experience in providing clients support in litigation matters ranging from responding to third-party Clean Water Act claims to responsible party research and contaminant source identification and fingerprinting for environmental cleanup allocations.

Education

- BS, Environmental Geology: University of Washington

Certifications

- CESCL and CPSWQ
- 40-Hour HAZWOPER Training
- TSA TWIC
- DOT and IATA HAZMAT Transport

Professional Associations

- Northwest Environmental Business Council—Conference Planning Committee Member
- Solid Waste Association of North America
- Washington Public Ports Association
- Tacoma-Pierce County Chamber
- Manufacturing Industrial Council of South Sound
- Tacoma Propeller Club
- Northwest Association of Environmental Professionals

Relevant Projects

Compliance Support

Metal-Recycling Facility Stormwater Compliance Support, Seattle, Washington

Derek is providing long-term support and facility oversight for a metal-recycling facility that has been operating for over 100 years. Services include coordination with regulatory authorities, oversight of a monthly self-monitoring program, source control evaluations, and subcontractor oversight for a retrofit of a stormwater treatment system. Recent project work includes a source evaluation study using a PCB-detection dog to identify potential contamination in metal scrap source materials and on-site areas, an update of their Permit to add an additional discharge point, multiple updates to structural source control Best Management Practices (BMPs), characterization and disposal of multiple waste streams, completion of Washington State Dangerous Waste Annual Reporting, updates to their Slug and Spill Control Plan and Compliance Calendar, and assistance with vendor coordination and contracting

Woodwaste Landfill Solid Waste Permit Compliance Support, Ketchikan, Alaska

Derek is providing long-term solid waste permit compliance assistance for a woodwaste landfill that has been in post-closure monitoring since the late 1990s. He has acted as the compliance program manager for the facility since 2021, working with the client, other consultants and service providers, and acting as a negotiating lead with regulatory agencies. Services have included permit renewal assistance, long-term monitoring of stormwater and leachate discharges, management and update of facility's BMP and Comprehensive Landfill Monitoring Plans, landfill cap maintenance, oversight of multiple mixing zone analyses, and annual program auditing, and quarterly and annual compliance reporting to state and federal agencies.

Derek Heitz CPSWQ

Municipal Solid Waste Landfill Permit Compliance Support, Ketchikan Alaska

Derek is providing long-term solid waste permit compliance assistance for Deer Mountain Landfill, a municipal solid waste landfill owned and operated by the City of Ketchikan. He has acted as the compliance program manager for the facility since 2021. During this time, he has coordinated with the client to complete annual reporting of stormwater discharges, cap maintenance for closed cells, BMP maintenance and monitoring for operational spaces, permit renewals, and expansion of Permit coverage to include landfilling of municipal wastewater biosolids.

Metal-Shredding/-Recycling Facility Stormwater Treatment Retrofit, Washington State

Derek assisted a metal-shredding and -recycling facility with troubleshooting and optimization of their existing stormwater treatment system. Troubleshooting and optimization efforts provided greater capture of total PCB concentrations in the facility's stormwater discharges. Derek completed multiple rounds of bench- and field-scale pilot testing to evaluate appropriate inline chemical treatment doses and appropriate adsorptive media contact times.

Construction Waste Transfer Facility Stormwater Treatment Optimization, Tacoma, Washington

Derek assisted a client with startup and troubleshooting of an existing stormwater treatment system at their construction materials recycling facility. The client had acquired a competing business, and the staff responsible for system O&M left during the acquisition. He worked with the facility to test functionality of existing equipment, develop a stopgap O&M plan for the system, and determine appropriate chemical doses to allow for appropriate system operations. Derek created a long-term O&M budget, including costs and levels of effort for retrofit or replacement of outdated and unreliable equipment, before project closeout.

Glass-Recycling Facility Stormwater Compliance Support, Seattle, Washington

Derek provided subcontractor support for a glass-recycling facility that required treatment for TSS and metals at multiple stormwater outfalls covered by an industrial stormwater general permit. Derek coordinated with multiple parties to combine all outfalls into two separate treatment facilities, allowing for different treatment of the two stormwater discharges. A gravity filtration treatment was implemented on the outfall for basins with lower pollutant loading, and flocculant-enhanced sand filtration was implemented on the basins with elevated TSS and metal concentrations. Additional support included equipment wet weight estimations, media lifespan calculations, long-term O&M cost calculations, and construction permitting support.

Meat Processing Plant Regulatory and Compliance Support (Confidential Facility)

Derek is assisting a meat processing plant with updating multiple regulatory and compliance programs that are required of their facility. The Client acquired a business that had historically not met monitoring, reporting, and recordkeeping requirements. These gaps and liabilities led the Client to terminate the contract with their previous consulting agency and rebuild much of their environmental program. Derek worked with the Client's staff and counsel to update multiple internal and permit-required documents associated with discharges of their process and stormwater, as well as assisting with employee exposure risk assessments, updates to documentation associated with onsite water wells, changes to waste disposal recordkeeping practices and procedures. All efforts were completed to decrease risk and liability associated with site operations, and many of the actions were fast-tracked to quickly bring the facility into compliance with regulatory requirements. Bulk Fueling Facility Stormwater Compliance Support, Seattle, Washington

Derek assisted a facility with updating their stormwater program to comply with requirements outlined in a Clean Water Act settlement. Work performed included revising the facility SWPPP and on-site recordkeeping associated with stormwater sampling. Additionally, Derek coordinated the design and installation of a multistage stormwater treatment system that targeted suspended solids, turbidity, and dissolved zinc concentrations. Proof of concept on treatment design included bench-scale testing of facility stormwater runoff, and final system design included particulate filtration and adsorptive polishing with a proprietary media. Procurement and installation of treatment equipment were expedited to meet the timeline required by the order.

Trucking and Warehousing Facility Environmental Compliance Support and Lease Termination Assistance, Portland Oregon

Derek assisted a client with a client with compliance with their 1200-Z Permit for multiple years. The client operated on a property that was a listed orphan site maintained by Oregon Department of Environmental Quality (DEQ), and existing contamination

remained in the subsurface in multiple areas of the property. Derek coordinated with the client to ensure that their operations would not disturb or contribute to the subsurface contamination. As part of this work, Derek updated their existing SWPPP and BMPs, trained business staff on site-specific environmental practices, developed a stormwater sampling training document for their system operator, and assisted with development and submittals of Discharge Monitoring Reports, and Tier I and Tier II corrective actions. After facility closure, Derek assisted the client with completion of a termination of a lease they held for a rail spur they held on the property. This included excavation of stained surface soils, contaminant fingerprinting to compare any potential petroleum staining to the remaining coking coal contamination from the orphan site, and multiple rounds of reporting and communications with the property owner and their environmental representatives.

Due Diligence and Environmental Auditing of Tenant Facilities, Auburn and Shelton, Washington

Derek assisted a client with due diligence prior to a business acquisition. The client intended to acquire a timber product processing and wholesaling business and requested that the assessments of each of the business's two facilities were fast-tracked to meet purchase contracting requirements. Both facilities were leaseholds, and the client was interested in determining existing conditions at each, including potential current or legacy environmental impacts and existing regulatory compliance issues, if any. Derek conducted the Phase I ESAs and compliance auditing for both facilities. Recognized environmental conditions and compliance gaps were identified at both facilities, including potential groundwater and drinking water contamination, missing environmental documentation. Other issues discovered during the assessments included health and safety issues associated with indoor air particulate concentrations, lack of Industrial Stormwater General Permit coverage at either facility, lack of an SPCC Plan at a facility that met the petroleum storage volume threshold requirements. Findings were reported to the client to allow for planning for corrective actions prior to completion of the business acquisition.

Warehousing Stormwater Compliance Support and Property Subdivision Support, Milwaukie, Oregon

Derek has provided long-term support and facility oversight for multiple owners of a multi-tenant warehousing facility that has since been subdivided and sold to multiple parties. Services have included compliance with each owner's 1200-Z Industrial Stormwater Permit, maintaining the facility's SWPPP and SPCC plans, tenant SWPPP training, stormwater sampling and completion of Discharge Monitoring Reports, and Tier I and Tier II corrective actions. Additionally, Derek coordinated with Oregon Department of Environmental Quality, the client, and multiple prospective purchasers during the process of subdividing the parcel and selling the subparcels to multiple buyers. Derek retained multiple subparcel purchasers as clients after the completion of the property transactions, coordinating with each to ensure that no conflicts of interest existed in the contracting or work performed.

Sand and Gravel Stormwater Treatment Retrofits, Washington State

Derek assisted a client with retrofit of subbasin stormwater treatment systems at three facilities with coverage under the Washington State sand and gravel general permit. Retrofits were specific to each facility and included pH correction, flocculant pretreatment, increased solids settling capacities, and remote system supervisory control and data acquisition. Site-specific O&M plans and housekeeping schedules were developed.

Boatyard Facility NPDES Compliance Support, Washington State

Derek provided NPDES compliance support and facility oversight for a recreational marina facility permitted under Ecology's boatyard general permit. He updated the facility's SWPPP, prepared training materials, provided training to facility staff, and coordinated stormwater compliance sampling and reporting. Derek completed studies to evaluate current and legacy pollutant sources, including point source studies, runoff/run-on evaluations, and dye-tracing of existing subgrade stormwater and wastewater infrastructure.

Construction Material Supply Manufacturer Stormwater Treatment Budgeting, Seattle, Washington

Derek assisted a client in improving discharges to meet zinc benchmarks listed in the facility's industrial stormwater permit. Galvanized finished product was stored outdoors at the facility with no practical way to isolate it from rainfall. It is likely that truck and forklift traffic also contributed to zinc loading. Bench-scale testing of three treatment trains was performed, followed with a long-

term O&M cost study. Results from this testing and cost estimates for treatment provided the client information necessary to move forward with implementation of stormwater treatment.

Salvage Auto Auction Facility Stormwater Treatment Retrofit, Portland, Oregon

Derek designed and implemented a retrofit and startup of an existing stormwater treatment system for a business that was initiating operations at a new facility. The existing stormwater treatment had been designed for the typical pollutant loading from previous tenant operations, and the client's operations were expected to deliver higher loading of TSS, metals, and petroleum hydrocarbons. Derek's evaluation of the system's existing condition led to fast-tracking repairs and an update of the chemical delivery system. Following system updates, Derek delivered an updated O&M plan and coordinated with regulators to ensure that updates complied with NPDES permit requirements.

Fish-Processing Plant pH-Correction System Design/Build, Puget Sound Area, Washington

Derek worked with a fish-processing plant to design and install a pH-correction and monitoring system that would comply with their King County industrial wastewater permit discharge requirements. Process and wastewater flows were highly variable, including in pollutant loading, primarily because of cleaning practices and the use of lye in production of the plant's finished product. Derek developed a process water treatment train that batch treated the water, limiting the variability and simplifying the pH-correction process to require only a single acid dose. Additional fail-safes, monitoring, automation, and other features were incorporated into the system, greatly decreasing water treatment oversight requirements.

Roofing Product Manufacturer Stormwater Treatment System Installation, Portland, Oregon

Derek assisted a roofing product manufacturing facility that required treatment as part of a Tier II corrective action under their DEQ 1200-Z stormwater permit. Treatment included qualitative and quantitative analyses of untreated stormwater runoff quality, treatment alternative review, proof-of-concept testing, cost-benefit analyses, and design of the final treatment system. Following system design, Derek led costing and procurement efforts to support the client in final installation.

Environmental

Environmental Investigation of Former Sawmill and Plywood Manufacturer, Medford, Oregon

As project manager, Derek oversaw the completion of due diligence environmental site assessments and data gap investigations on a property neighboring a client's facility. Efforts began with a Phase I ESA that identified multiple recognized environmental conditions and data gaps associated with a historical site operation. Derek coordinated additional studies, including composite surface soil sampling across 34 acres, characterization of an on-site treated soil stockpile, and surficial and GPR surveys. Information obtained during these studies was used to coordinate with the DEQ to develop a prospective purchaser's agreement for the property.

Critical Aquifer Recharge Assessment BMP Analysis, Napavine, Washington

Derek assisted a client with portions of a critical aquifer recharge assessment report for a fueling station that is planning to infiltrate stormwater into an on-site shallow drinking water aquifer. As part of this work, he proposed facility-specific BMPs, evaluated efficiencies of proposed infiltration and pretreatment equipment, updated the facility's spill prevention and response plan, and completed quality control review of previous work conducted for the facility. Findings from this work were used as proof of concept to demonstrate that typical stormwater runoff from the fueling station posed no atypical risk to drinking water quality.

Petroleum Vapor Intrusion Assessment at a Semi-Trailer Repair Facility, Tacoma, Washington

Derek assisted with a vapor intrusion investigation at a large, multiparcel, contaminated site that has petroleum and volatile organic compound releases to soil and groundwater from historical industrial operations. The investigation is a component of work to be performed on the Tacoma waterfront under an agreed order administered by Ecology. Historically, free-product oil was disposed of in an unlined holding pond near the facility. The facility consists of two open-air Quonset huts and a shop building. Derek installed vapor pins in locations representative of occupant spaces and collected manometer pressure differential measurements between the sub-slab vapor and indoor air to assess vapor intrusion conditions. He assisted with the successful collection of 11 sub-slab

vapor samples at the property in the summer of 2022. Data evaluation efforts are ongoing and additional investigations are pending; these include the collection of additional sub-slab, indoor air, and ambient air samples planned for 2023.

Environmental Investigation of Former Pulp and Paper Mill, Steilacoom, Washington

Derek assisted with composite and discrete soil sampling at a former pulp and paper mill that is slated for redevelopment as a mixed-use property. This potential property redevelopment requires additional investigation to evaluate potential exposure pathways associated with future use. Regulatory authorities requested additional investigation for the potential presence of dioxins and furans in surface soil related to the former operation of a hog fuel boiler at the property. Additionally, the property is within the Tacoma Smelter Plume boundary, and surface soils may have been impacted by arsenic and lead contamination from the former operation of the Asarco Company copper smelter. Investigations at the property included multiple sampling protocols for the different contaminants of concern: using incremental sampling methodology and discrete sampling for analysis for dioxins and furans in two areas of interest; and using discrete and composite sampling for analysis of soil, forest duff, and sediments contaminated by Tacoma Smelter Plume metals in three areas of interest. Derek assisted in the development of a work plan for Ecology review, prepared for and conducted the field sampling, and provided analysis and reporting of the findings from the investigation.

Wastewater Reuse Permit Application, Brinnon, Washington

Derek assisted a client with the application process for a state permit for generation, distribution, and use of reclaimed water for a proposed recreation community on the Olympic Peninsula. This new community will serve up to 2,400 residents and staff and will include additional amenities such as a golf course, a hotel, convention space, and common areas. The project team planned to treat and reuse all wastewater generated in the community; the reuse would include irrigation of green spaces (including the golf course) and wildfire prevention in forested areas throughout the property. Derek worked with Statesman and members of their project team to compile information and complete an individual reclaimed water permit application with anticipated 100 percent reuse of their community wastewater. The permit application was approved by Ecology in 2023, and construction of the community is anticipated to begin in late 2025.



Bill Beadie CIH

Principal Industrial Hygienist
bbeadie@maulfoster.com | 503.501.5234

Bill Beadie has 28 years of experience in health and safety consulting, with expertise in program development, exposure assessment, risk assessment, and training. Bill has helped clients develop other safety and health programs, such as hearing protection, respiratory protection, confined-space entry, lockout/tagout, emergency response, fall protection, hazard communication, lead compliance, and bloodborne-pathogen programs. He also has experience working with clients to resolve citations issued by regulatory agencies such as OSHA and EPA. Bill's industrial hygiene experience is an integral component of the overall risk assessment services provided by MFA.

Education

- BS, Chemistry/Philosophy: Bates College

Certifications

- Certified Industrial Hygienist: No. 9031 CP
- HAZOP and PHA Techniques for Process Safety and Risk Management
- AHERA Asbestos Supervisor
- NIOSH 582(E) Asbestos

Professional Associations

- American Industrial Hygiene Association (AIHA)
- AIHA Risk Committee—Chair, 2010 to 2011

Relevant Projects

Asbestos, Metals, and Noise Exposure Assessment near an Outdoor Remediation Site, Portland, Oregon

Bill managed the daily chemical exposure assessment tasks during remedial activities at a former shipbreaking site along the Willamette River. He also coordinated noise measurements to assess compliance with DEQ community noise requirements. The exposure data collected during the project were used to resolve concerns about chemical and noise exposure on and near the site.

Chemical and Noise Exposure Assessment for a Roofing Manufacturer, Oregon and California

Bill conducted chemical exposure assessments at multiple sites for a roofing manufacturer. The scope of the assessment included asphalt, silica, dust, fiberglass, formaldehyde, and noise. Data from the assessment were evaluated by a large industry trade group that was preparing comments in response to proposed OSHA standards.

Exposure Assessment during Activities on Historical Metallurgical Mine and Mill Sites, Idaho

Bill designed and coordinated a multiyear exposure assessment for lead, cadmium, arsenic, and total dust, while workers performed various activities on different sites. He defined similar exposure groups and developed an assessment strategy and sampling plan. The assessment included detailed observations, video recordings, real-time monitoring, and integrated sampling. Bill summarized the results in a written report.

Dust, Silica, Asbestos, and Metals Exposure Assessment during Wildfire Debris Cleanup, Oregon

Bill worked with state agencies to plan and conduct community exposure monitoring in populated areas during wildfire debris cleanup in Oregon. The exposure monitoring plan was developed for the Oregon Department of Transportation 2020 Wildfire Debris Removal and Operations Plan. The scope of exposure monitoring included dust, asbestos, and metals. Bill worked with GIS analysts to develop a process to prioritize sites for community monitoring based on demographic data. The prioritization tool

helped ensure that the sampling was conducted consistent with the priorities of state agencies.

Broad-Ranging Health and Safety Program Development for a Synthetic Crude Oil Manufacturing Facility, Portland, Oregon

Bill managed the development of several health and safety programs, including hearing conservation, industrial hygiene, lockout/tagout, personal protective equipment, respiratory protection, hazard communication, emergency planning, hot work, fall protection, and electrical safety.

Broad-Ranging Environmental, Health and Safety Audit for a Confidential Food Manufacturer

Bill collaborated with other MFA staff to audit a broad range of environmental, health, and safety programs for a confidential food manufacturer. The audit was coordinated by the company's legal counsel. The audit scope included approximately 20 health and safety topics, such as hearing conservation, hazard communication, machine guarding, walking and working surfaces, fall protection, means of egress, and fire prevention. The results were summarized in a written report in a format that allowed the client to assign and track follow-up actions for each recommendation.

Health and Safety Program Support for a Construction Company, Portland, Oregon

Bill worked with an interdisciplinary team to provide a wide range of environmental and health and safety support services to a construction company during a multiyear high school renovation project. Support services included the development of health and safety plans; tools for auditing compliance with health and safety requirements; chemical exposure monitoring for lead, dust, and crystalline silica; spill response support; and supplemental assessments for hazardous building materials such as lead and asbestos.

Confined-Space-Program Development for a City Public Works Department

Bill worked on a team auditing a city public works department's confined-space program. The team's responsibilities consisted of the following confined-space-related work: performing and documenting evaluations, providing equipment specifications, and providing training.

Spill Protocol Development, Chemical Manufacturing Company, Hillsboro, Oregon

Bill developed written protocols for responding to incidental spills and uncontrolled releases of hazardous chemicals at a company that manufactures chemicals for the semiconductor industry. Bill collaborated with the client to ensure that the protocols were user-friendly and easy to read in an emergency. Bill recommended grouping similar chemicals together, which allowed approximately 60 different chemicals to be covered in approximately ten protocols.



Chad Darby

Principal Air Quality Specialist

cdarby@maulfoster.com | 971.713.3574

Chad Darby has more than 30 years of professional experience in the air quality science and engineering field, with project management in 35 states and three Canadian provinces. This includes construction and operation permitting; field source testing with EPA, NIOSH, OSHA, and state methodologies; ambient sampling and meteorological station design and installation; pollution-control evaluation (BACT, RACT, LAER); historical compliance investigations (NSR, PSD); multimedia compliance auditing; risk management planning; compliance assurance monitoring planning; MACT applicability; strategy development; and compliance demonstration. Additionally, Chad has prepared numerous air quality and climate sections for environmental impact reports and statements under NEPA, SEPA, and CEQA. Chad regularly provides presentations on air quality topics, teaches classes, and provides expert testimony.

Education

- MS, Mechanical Engineering (environmental emphasis): University of Minnesota
- BS, Physics: Grinnell College

Relevant Projects

Air Toxics and Risk Assessment

Human Health Risk Assessment for a Municipal Landfill, Medford, Oregon

Chad was the principal-in-charge of a Level 3 HHRA for a municipal landfill in Oregon to prepare the facility for future Cleaner Air Oregon permitting compliance demonstrations. The HHRA was completed consistent with the Draft Recommended Procedures for Toxic Air Contaminant Health Risk Assessments published by the Oregon DEQ. TAC emissions were estimated using site-specific sampling data and the Landfill Gas Emissions Model developed by EPA. AERMOD was used to develop an air dispersion model of the facility, which was executed using unit emission rates. An automated spreadsheet-based tool was used to calculate excess cancer risk and chronic and acute noncancer risk estimates and conduct the corresponding culpability analysis. The culpability analysis revealed the toxic emission units and TACs contributing the most to the predicted risk estimates at each receptor location in the modeling domain. To support the analysis, Chad pioneered the use of a drone-mounted methane sensor to determine the source of fugitive emissions from the landfill. Using surface measurements of collected landfill gas to determine ratios of air toxics to methane, the location and concentrations of air toxic emissions could be estimated and modeled as fugitive releases.

Permitting and Human Health Risk Assessment for a Wood-Treatment Facility, The Dalles, Oregon

Chad was the principal-in-charge of a Level 3 HHRA for an existing wood-treatment facility called into the Cleaner Air Oregon program by the Oregon DEQ for purposes of compliance demonstration and permitting. The HHRA was completed consistent with the Draft Recommended Procedures for Toxic Air Contaminant Health Risk Assessments published by the DEQ. Chad provided senior review and oversight on the preparation of the TAC emissions inventory, dispersion modeling using AERMOD, and excess cancer risk and chronic and acute noncancer risk estimates. He also assisted with permitting a

thermal oxidizer and total enclosure to control retort and drip pad emissions. Chad supported public engagement and negotiations with regulatory agencies.

Human Health Risk Assessment for Multiple Wood-Products Facilities, Multiple Locations, Oregon

Chad was the principal-in-charge of the preparation of emissions inventories and performance of dispersion modeling for a wood-products manufacturer with several locations in eastern and southern Oregon for purposes of developing an HHRA for future Cleaner Air Oregon compliance demonstrations. Unit emission rates were modeled in AERMOD for process equipment typical of lumber sawmills and facilities manufacturing softwood and hardwood plywood, laminated veneer, medium-density fiberboard, and particleboard. Predicted ambient concentrations were multiplied by the applicable toxic air contaminant emission rates and divided by risk-based concentrations published by the CAO program. Google Earth was used to display risk isopleths along with the culpability analysis results for client review. For comparison, a risk analysis was also performed using the HARP2 software package, developed by the California Air Resources Board, prior to finalization of the CAO rulemaking. The HARP2 output files were presented to state regulators for discussion and analysis.

Human Health Risk Assessment for a Glass Fiber Manufacturer, Corvallis, Oregon

Chad was principal-in-charge of completion of several HHRA iterations (for purposes of future Cleaner Air Oregon compliance demonstrations) for a specialty glass fiber production facility in Oregon. AERMOD was utilized for air dispersion modeling, and the model was executed using unit emission rates. Predicted ambient concentrations were postprocessed with the toxic air contaminant emission rates and risk-based concentrations published by the CAO permitting program to estimate excess cancer risk and chronic and acute noncancer hazard indices. A corresponding risk analysis was also performed using the HARP2 software package, developed by the California Air Resources Board, for comparison purposes prior to finalization of the CAO rulemaking.

Human Health Risk Assessment for a Wood-Products Manufacturer, Multiple Locations, Oregon

Chad was principal-in-charge of conducting two Level 3 HHRAs for a wood-products manufacturer with two facilities in southern Oregon. Each HHRA was completed assuming the draft Cleaner Air Oregon rules and risk-based concentrations published on June 25, 2018, would apply. Each dispersion model was executed using AERMOD and unit emission rates (i.e., 1 gram per second for nonarea source types). Emission rates and predicted ambient concentrations for each modeled exposure location were postprocessed, using tools developed by MFA staff, to quickly estimate excess cancer risk and chronic and acute noncancer risk. Google Earth was used to display risk isopleths, along with the culpability analysis results, for client review.

Human Health Risk Assessment for an Ethanol Plant, Clatskanie, Oregon

Chad was principal-in-charge of an HHRA, conducted in preparation for the ongoing Cleaner Air Oregon rulemaking, for a biorefinery located in Oregon. Formatted hourly and annual emission estimates from the CAO air toxics submittal were prepared for use in the Hotspots Analysis and Reporting Program Version 2. The HARP2 tool was utilized, only in lieu of the final CAO regulations, to produce conservative overestimates of lifetime excess cancer risk and noncancer hazard indices from residential exposure. The AERMOD dispersion model was based on source exhaust under parameters and building height information obtained from the client. Figures depicting the LECR and hazard index isopleths were overlaid on aerial imagery for review.

Human Health Risk Assessment and Cleaner Air Oregon Permitting, Metal Foundry, Oregon

Chad was the principal-in-charge of evaluation of CAO compliance for a metal foundry in Oregon. An HHRA was completed following the Draft Recommended Procedures for Toxic Air Contaminant Health Risk Assessments published by the Oregon DEQ and included air dispersion modeling using AERMOD. Excess cancer risk and chronic and acute noncancer risk estimates for multiple operating scenarios were evaluated consistent with Level 3 risk assessment procedures. The basis of the HHRA results was an emissions inventory developed using baghouse dust sampling and research into foundry process emission factors for specific alloy combinations.

Chad Darby

Human Health Risk Assessment and Cleaner Air Oregon Permitting, Fish-Processing Facility, Warrenton, Oregon

Chad was the principal-in-charge responsible for the permitting of a new fish-processing facility. Emissions were estimated and pollution control devices were evaluated for odor control. The CAO and criteria pollutant permit applications required a detailed toxic air contaminant emissions inventory, regulatory review, a modeling protocol and report, and a Level 1 CAO HHRA.

Cleaner Air Oregon Air Toxics Support, Numerous Facilities throughout Oregon

Chad has supported dozens of Oregon industrial facilities in the CAO program, ranging from wood treating to aerospace parts manufacturing. He has provided compliance training, emission inventory development, dispersion modeling (AERMOD), and risk assessment. To assist clients by providing quicker in-house risk assessments, Chad managed the development of an automated Level 1 risk assessment tool that has been widely used by clients to determine sources and pollutants that could potentially lead to off-site risks. Chad has assisted clients in reassessing raw material choices and processes to reduce estimated risks. In several cases, Chad has helped clients reduce estimated risks to at or below levels that would trigger the requirement for Oregon permitting.

Selected Permitting and Enforcement Experience

Municipal Waste Landfill Permitting, Eagle Point, Oregon

Chad was the principal-in-charge responsible for a municipal waste landfill's significant permit modification to alter the amount of allowable truck traffic and to permit increased volatile organic compound emissions through the use of existing capacity. Additionally, new emission estimation methods were proposed for the Title V permit to consistently estimate fugitive emission flow rates between the greenhouse gas calculations and the VOC calculations. Emergency authorization through a minor permit modification was obtained to increase truck traffic to accommodate wildfire debris.

Regional Haze Analyses, Multiple Locations, Oregon

Chad was the principal-in-charge of regional haze analyses for eight facilities representing five different companies. Impacts were analyzed using screening criteria, then control-device options were analyzed. Cost estimates were developed for viable control devices and an analysis of the cost-effectiveness of each control was presented. Three facilities were screened out of the assessment. One facility chose to conduct dispersion modeling and visibility impact analyses to determine the impact to three Class I areas within 100 km.

Bark-Drying Operation Modeling and Permitting, Centralia, Washington

Chad was the principal-in-charge of an assessment of the volatile organic compound emissions of an aged bark-drying operation. Dispersion modeling was required under the Southwest Clean Air Agency air toxics rules. BACT and toxics BACT analyses were prepared to demonstrate the available cost-effective controls for emissions. A permit application was developed and submitted to the agency for approval. Based on experimentation with material-handling measures at the facility, operational controls used prior to drying significantly reduced emissions.

Morrow Pacific Project, Coyote Island Terminal LLC Permitting, Oregon

As project director, Chad prepared a complex emissions inventory that included trains, tugboats, oceangoing vessels, transloading equipment, and stationary sources. He calculated the decay rate for methane emitted from coal during the latter's transport and handling. He assisted with the air quality permitting and dispersion modeling for the proposed Coyote Island Terminal at the Port of Morrow, which is designed to handle 8.8 million tons of coal as a U.S. West Coast export terminal for Powder River Basin coal. Chad oversaw a toxicological literature review regarding coal in air and water; development of project recommendations for emission control systems; and public comment support to agencies involved in addressing public concerns, including coal dust, diesel exhaust, and train and tug impacts. Chad studied and evaluated greenhouse gases emitted during transport and handling of coal, spontaneous coal combustion hazards, and dispersion of coal dust to air and water. Parties involved included the Oregon DEQ, Oregon Department of State Lands, National Marine Fisheries Service, U.S. Army Corps of Engineers, State Historic Preservation Office, and four area tribes.

Chad Darby

BACT Analysis and Emissions Inventory, Membrane-Manufacturing Facility, Massachusetts

Chad performed a BACT analysis for the largest emitting sources at a membrane-manufacturing facility. He developed an emissions inventory to estimate emissions due to solvent evaporation losses and transfer losses. Cost-effectiveness values were calculated for wet scrubbing, oxidation (thermal and catalytic), carbon adsorption, and condensation-control technologies.

PSD Permit Application, Wood-Products Manufacturer, Kettle Falls, Washington

Chad completed a PSD permit application for an electrostatic precipitator and wood-fired thermal oxidizer designed to control emissions from direct-fired veneer dryers to achieve compliance with the Plywood and Composite Wood Products MACT and reduce opacity while minimizing greenhouse gas generation at the plant. The oxidizer exhaust system was designed to provide high-energy steam in a heat-recovery boiler to produce electricity in a steam turbine, and to provide low-energy steam for heating log vats and plywood presses.

Construction Permitting, Forest-Products Company, Newport, Vermont

Chad prepared a Permit to Construct application for a new hogged-fuel boiler with fuel oil backup capability. Emissions estimates for the new boiler, dispersion modeling, and a hazardous most stringent emission rate determination were included in the permit application.

Additional Related Landfill Experience

Meteorological Monitoring Station for a Landfill, Medford, Oregon

Chad is the principal-in-charge for the operation of a PSD ambient meteorological monitoring station located at a municipal solid waste landfill near Medford, Oregon. Chad oversees the monitoring program, providing senior review of data management and calibration, audit, and quarterly/annual data reporting.

Landfill Permitting, Idaho

Chad completed permitting for a boiler ash and wood debris landfill; this involved approval of the Idaho DEQ, Panhandle Health District, and Bonner County Planning Department. The permit application required fate and transport modeling based on existing monitoring well data; development of an operations plan; and assessment and planning for nuisance issues, signage, traffic flow, dust suppression, and fire hazards.

Recent Publications, Presentations, and Committee Participation

Darby, Chad. 2021. Regional Haze Fiscal Advisory Committee member. Participated in the analysis of fiscal impacts to business for the State of Oregon as a member of the DEQ advisory panel. May.

Darby, Chad. 2020–2021. Cleaner Air Oregon Rules Advisory Committee member. Participated in the development of new rulemaking for the State of Oregon as a member of the DEQ advisory panel, November 2020–February 2021.

Darby, Chad. 2020. Developer and instructor. Led a four-part training workshop over eight hours that featured lessons learned in assisting facilities with CAO emissions inventories, modeling, risk assessment, and permitting. MFA Cleaner Air Oregon Webinar Series. October–November.

Darby, Chad. 2017. Air Toxics Risk Assessment Workshop. Instructor. Half-day workshop covering topics such as the fundamentals of Oregon's proposed air toxics program, how to develop an emissions inventory, considerations in conducting dispersion modeling, and preparing a comprehensive risk assessment. NCASI West Coast Regional Meeting. September.



Brian Snuffer Zukas, PE

Senior Air Quality Engineer
bsnuffer@maulfoster.com | 971.254.8077

Brian Snuffer Zukas has over ten years of experience in air quality and consulting services, including experience performing technical work in civil and environmental engineering. His specialties include emissions inventory development, air dispersion modeling, human health risk assessments, industrial ventilation system design, AutoCAD design services, and building tools for data management and facility recordkeeping. Mr. Snuffer Zukas has managed or assisted with many projects in the forest products, aggregate mining, waste management, glass fiber, and metal and alloy production industries. He has a strong foundation of technical capabilities and significant experience in preparing air quality permit applications for compliance with federal, state, and local regulations.

Education

BS, Environmental Engineering:
Florida Gulf Coast University, Fort Myers, Florida
BS, Civil Engineering:
Florida Gulf Coast University, Fort Myers, Florida

License/Registration

Professional Engineer, Oregon
No. 95661PE

Relevant Projects

Dispersion Modeling & Health Risk Assessment

Cleaner Air Oregon Permitting for a MDF Manufacturing Facility, Medford, OR

Mr. Snuffer Zukas managed the Cleaner Air Oregon permitting compliance demonstration for a medium-density fiberboard manufacturing facility located in Medford. He assisted with the development of the Oregon Department of Environmental Quality (DEQ) approved toxic air contaminant (TAC) emissions inventory, Modeling Protocol, Risk Assessment Work Plan, and the Risk Assessment Report. Prior to these submittals, Mr. Snuffer Zukas developed and executed several iterations of the dispersion model and Level 3 Health Risk Assessment (HRA) for the facility. Each iteration was based on an analysis of the culpability of the toxic emission units (TEU) and TACs contributing the most to the predicted risk estimates at each modeled exposure location. To support the communication of results to the Client, Mr. Snuffer Zukas assisted in the development of a Google Earth tool presenting the culpability analysis results at each modeled exposure location allowing for refinement of emission estimate assumptions or TEU representations in the dispersion model.

Cleaner Air Oregon Permitting for a Wood Treatment Facility, Eugene, OR

Mr. Snuffer Zukas managed the Cleaner Air Oregon permitting compliance demonstration for a wood treating facility located in Eugene. As project manager, Mr. Snuffer Zukas led the development of the preliminary TAC emissions inventory and dispersion model for the facility. The TAC emission inventory included emissions estimates for work tank/vacuum system, storage tank, dry kilns, natural gas-fired boiler, and the process water treatment system TEUs, among others. He also completed multiple site visits to construct a detailed process flow diagram of the wood treating operation, reviewed facility treatment record database spreadsheets, and drafted the Liquid Sampling Plan approved by the Lane Regional Air Protection Agency.

Brian Snuffer Zukas

Health Risk Assessment for a Municipal Landfill, Medford, OR

Mr. Snuffer Zukas conducted a Level 3 HRA for a municipal landfill in Oregon to prepare the facility for future Cleaner Air Oregon permitting compliance demonstrations. The HRA was completed consistent with the Draft Recommended Procedures for Toxic Air Contaminant Health Risk Assessments published by the Oregon DEQ. TAC emissions were estimated using site-specific sampling data and the EPA Landfill Gas Emissions Model. Mr. Snuffer Zukas used the AERMOD program to develop an air dispersion model representation of the landfill, which was executed using unit emission rates. An automated spreadsheet-based tool, developed by Mr. Snuffer Zukas, was used to calculate excess cancer risk and chronic and acute noncancer risk estimates and the corresponding culpability analysis. The culpability analysis revealed the TEUs and TACs contributing the most to the predicted risk estimates at each modeled exposure location.

Air Quality Permitting, Compliance Support, and Emissions Inventory

Air Quality Compliance and Permit Assistance for a Renewable Fuels Manufacturing Facility, Clatskanie, OR

Mr. Snuffer Zukas managed the Standard Air Contaminant Discharge (ACDP) application and Cleaner Air Oregon permitting process for a proposed renewable fuels manufacturing facility to be located in Clatskanie, Oregon. The proposed facility will receive and process raw oil feedstocks including vegetable oils and animal fats, among others, in order to produce renewable fuel products. To expedite the permitting process, a combined emissions inventory containing criteria pollutant and toxic air contaminant emission estimates was submitted to the Oregon DEQ for review. Mr. Snuffer Zukas assisted in the development of the combined Modeling Protocol and Risk Assessment Work Plan, required for new source review and the CAO compliance purposes. Numerous preliminary dispersion models were developed to demonstrate criteria pollutant emissions from the proposed facility are below the Significant Impact Level. The permit for the proposed facility was issued on August 30, 2022.

Air Quality Compliance and Permit Assistance for a Specialty Glass Fiber Manufacturer, Corvallis, OR

Mr. Snuffer Zukas supported the preparation of a comprehensive Prevention of Significant Deterioration permit application for a specialty glass fiber manufacturing facility located in Oregon. The PSD permit application included a complex process flow diagram of the exhaust routing configuration, a detailed emissions inventory for criteria pollutants and hazardous air pollutants, a Best Available Control Technology assessment, a regulatory applicability analysis, and air dispersion modeling. Mr. Snuffer Zukas also conducted oversight of the extensive source testing campaign undertaken by the facility, which included multiple USEPA Methods. After completion of the source test campaign, Mr. Snuffer Zukas led the development of a source test catalog detailing the source test results and production data for recordkeeping and comparison purposes.

Construction Air Contaminant Discharge Permit and Title V Modification Permit Application, Dillard, OR

Mr. Snuffer Zukas prepared the construction ACDP and Title V modification permit applications for a large wood-products manufacturing complex that produces lumber, plywood, and particleboard in Oregon. The permit applications were prepared in anticipation of converting the existing PB operation to the production of medium-density fiberboard. The permit applications required a detailed emissions inventory including before- and after-construction criteria and hazardous air pollutant emissions estimates, a broad state and federal regulatory applicability analysis, and preparation of state-required forms.

Level 1 Risk Assessment Tool Development, State of Oregon

Mr. Snuffer Zukas prepared a spreadsheet tool to automate Level 1 risk assessment calculations for cancer, chronic noncancer, and acute noncancer risk. The Level 1 tool includes an input page for stack height, distance to the nearest applicable receptor, and daily and annual emission estimates. Using the input data, the Level 1 tool performs all necessary calculations to produce risk estimates, as well as the contribution of each toxic air contaminant and source to the assessed cancer or noncancer risk. This allows facilities to determine which TACs and source assumptions may require further refinement based on the risk culpability. The Level 1 tool was requested and is being used by two universities, as well as numerous industrial facilities throughout Oregon.

Presentations

- Cleaner Air Oregon Program Update: Lessons Learned Webinar Series, November 6, 2023. Virtual (via Zoom).
- Case Study: Problems and Solutions for Air Quality Modeling Meteorology. Developments in NSR Air Permitting Workshop, Air & Waste Management Association, April 17, 2018. Seattle, WA.

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

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April 17, 2025

Maul Foster & Alongi, Inc.
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Coeur d'Alene, ID 83814

ABOUT COLUMBIA WEST ENGINEERING, INC.

Founded in 1999, Columbia West Engineering, Inc. (Columbia West) is a locally owned and operated professional multi-disciplinary geotechnical engineering, environmental consulting, special inspections, and material testing services provider. Our dedicated team comprises 55 professionals, including engineers, geologists, technical personnel, and support staff, all driven by a commitment to delivering high-quality services and innovative, resourceful engineering solutions. Columbia West is proud to hold an A2LA (American Association for Laboratory Accreditation) accredited and ODOT (Oregon Department of Transportation) certified laboratory reinforcing our ability to support our geotechnical and special inspection services.

At the helm of Columbia West is President, Founder, and Majority Owner, **Lance Lehto.** Other key principals and owners of the company are **Shawn Dimke, Najib Kalas, Daniel Lehto, Jason Ordway, Nick Paveglio, and Brett Shipton.** Brett Shipton spearheads our geotechnical engineering services and Jason Ordway leads our special inspection services. Nick Paveglio heads our seismic engineering services. Notably, Brett Shipton, Najib Kalas, Nick Paveglio and Shawn Dimke recently joined Columbia West as principal engineers. Brett, Najib, Nick and Shawn have worked together for over 15 years and add more than 80 combined years of geotechnical consulting experience to bolster our geotechnical engineering team. In line with our growth and commitment to clients and projects in Oregon, we recently opened our Beaverton, Oregon office to enhance our capacity and service delivery.

Columbia West excels in delivering cost-effective geotechnical design options and construction recommendations. Our expertise is geared towards evaluating design options, drawing well-founded conclusions, and offering recommendations that reduce project costs. We are proactive collaborators, fostering open communication with project design and construction teams during construction to ensure projects remain on budget without compromising quality.

Sincerely,
COLUMBIA WEST ENGINEERING, INC.

Shawn M. Dimke, PE, GE
Principal

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc



EXPERIENCE

Over 21 Years

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EDUCATION

Bachelor of Science Civil Engineering
Oregon State University, 2000
Master of Science Geotechnical Engineering
Oregon State University, 2004

REGISTRATION AND CERTIFICATION

Registered Professional Engineer, California, Oregon, Washington
Registered Geotechnical Engineer, Oregon
American Society of Civil Engineers

BIOSKETCH

Shawn Dimke is a principal engineer at Columbia West Engineering, Inc. (Columbia West) with a wealth of experience throughout the Pacific Northwest and urban landscapes in California. Prior to joining Columbia West, Shawn worked at a private prominent Pacific Northwest geotechnical consulting firm for over 20 years as an intern, geotechnical engineer, associate, and principal. Shawn provides and manages geotechnical services on a wide range of projects. He enjoys finding practical solutions and options to best meet the needs of clients and development teams. Whether it is providing quality, reliable, day-to-day geotechnical services or finding innovative solutions to complex geotechnical design and construction challenges, Shawn enjoys collaborating and communicating to contribute to successful projects.

REPRESENTATIVE PROJECT EXPERIENCE

Shawn's project experience includes:

- Infrastructure
- Public Buildings and Facilities
- Education
- Hospitals and Medical Office Buildings
- Commercial
- Industrial
- Large-tract Residential
- High Rise Buildings
- Mixed-Use Developments
- Waterfront Buildings
- Landfills

Shawn's responsibilities include scoping geotechnical engineering projects, project management, client correspondence, project planning, geotechnical engineering and design calculations, report preparation and review, and project specifications preparation. Shawn's career experience includes:

- Geotechnical engineering studies
- Seismic hazard evaluations
- Seismic design for liquefaction and lateral spread hazards
- Slope stability analysis
- Landslide evaluation and mitigation
- Shoring and retaining wall design
- Shallow and deep foundation design
- Finite element modeling
- Geotechnical Instrumentation
- Seepage analysis

Shawn joined Columbia West's geotechnical engineering team in the summer of 2023. He spent the prior 3 years leading a team of senior geotechnical project engineers. At Columbia West, Shawn works as part of the senior management and ownership group to develop business and growth strategies and manages and collaborates with a talented team to provide geotechnical services.

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

JONATHAN A. NASR

EXPERIENCE

9 years



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EDUCATION

Master of Science
Civil Engineering (Geotechnical)
Portland State University 2017

Bachelor of Science
Civil Engineering
Portland State University 2015

REGISTRATION AND CERTIFICATION

Registered Professional Engineer, Oregon

PUBLICATIONS

Nasr, J. and Khosravifar, A. (2018). "The Effects of Long-Duration Subduction Earthquakes on Inelastic Behavior of Bridge Pile Foundations Subjected to Liquefaction-Induced Lateral Spreading." Proc., Geotech. Earthquake Eng. and Soil Dyn. V.ASCE. Reston, Va., 617-625.

Khosravifar, A. and Nasr, J. (2018). "Modified design procedures for bridge pile foundations subjected to liquefaction-induced lateral spreading." DFI Journal - The Journal of the Deep Foundations Institute, DOI: 10.1080/19375247.2018.1436382

BIOSKETCH

Jonathan Nasr is a project engineer at Columbia West Engineering, Inc. (Columbia West). Jonathan has more than nine years of experience in the geotechnical engineering field. While earning his undergraduate degree in civil engineering at Portland State, he got an internship at a local geotechnical consulting company and discovered his passion for the field. He ended up completing his master's degree with an emphasis in geotechnical engineering and never looked back.

Jonathan's career has encompassed a diverse range of projects across multiple regions. He comes to Columbia West from the U.S. Army Corps of Engineers Portland District, where he worked as a geotechnical designer on projects in Oregon and Washington. Before that, he worked as a staff engineer and project engineer at a California-based geotechnical consulting firm with projects ranging from temporary trestle design to seismic site response analysis. Jonathan is known for his adaptable approach and curiosity, consistently applying these strengths to deliver cost-effective geotechnical solutions.

REPRESENTATIVE PROJECT EXPERIENCE

Jonathan's project experience includes:

- Ports and harbors
- Dams and levees
- Federal facilities
- Commercial structures
- Industrial facilities
- Schools
- Transportation infrastructure

Jonathan's young career has included a variety of different project types. Some key analytical skills that he has developed while working on these projects include:

- Seismic hazard analysis
- Site-specific site response analysis
- Ground motion selection for structural analysis
- Ground improvement design
- Shoring design
- Dewatering design
- Slope stability analysis
- Pavement design

Jonathan joined Columbia West's geotechnical engineering team in 2024. He is excited to add his unique skill set and experience to an already well-rounded team.



DR. TONY SPERLING, P.Eng.
President SHA / Landfill Design Engineer
Landfill Fire Control Specialist

PROFILE:

1978 - 1983	B.A.Sc. Geological Engineering, UBC, Geotechnical Option
1981 - 1982	(Summer) Engineering Student and Drill Inspector, B.C. Hydro
1983	(Summer) Mine Geologist, Brenda Mines Ltd.
1984 - 1985	M.A.Sc. Mining Engineering, UBC, Rock Mechanics
1984	(Summer) Geotechnical Engineer, Equity Silver Mines Ltd.
1985 - 1986	(Summer) Geological Engineer, Trigg, Woollett, Olson Consulting Ltd.
1986 - 1990	Ph.D., Geological Engineering, UBC, Ground Water Hydrogeology
1987 - 1988	(Summer) Geotechnical Engineer, Highland Valley Copper
1987 - 1989	Engineering Software Consultant, Sperling GeoComp Inc.
1989 - 1993	Geological Engineer, Gartner Lee Limited
1993 - 1995	Senior Geological Engineer, Gartner Lee Limited
1994 - Present	Lecturer in Solid Waste Management, B.C.I.T.
1995 - 1996	Senior Engineer / President Sperling Engineering Services Inc.
1996 - Present	President and Chief Engineer, Sperling Hansen Associates Inc.
2000 – Present	President Landfill Fire Control Inc.

EXPERIENCE:



Landfill Fire Suppression: Dr. Sperling is an internationally recognized subject matter expert on Landfill Fires. He has accumulated over nineteen years of practical experience in extinguishing landfill fires in North America and around the world. Most recently he served as Incident Commander during the extinguishment of the Vancouver Landfill Phase 4 Fire in June 2018 that required over three weeks to fully extinguish. That $2.5 million project was followed by a high intensity oxygen suppression extinguishment at Whitehorse Landfill where a major fire was fully extinguished in less than 24 hours.

In 2015 he developed a suppression plan for the successful extinguishment of the Iqaluit Landfill fire, a problematic fire that had been burning of many months and cost $3.6 million to extinguish. In 2013 he served as the Technical Advisor to Fire Chief Pablo Tunon and Site Commander in charge of extinguishing the massive Cerro Patacon Landfill Fire in Panama. In 2009, Sperling was tasked as Incident Commander during a three week, $1 million fire extinguishment at Vancouver Landfill. In 2005 Dr. Sperling and the LFCI team directed the extinguishment of the Brother's Recycling Fire in Duncan at a cost of $2 million. In 1999 Dr. Sperling served as Engineer in charge of fire extinguishment strategy for the Delta Shake and Shingle demolition waste fire. The Delta Shake and Shingle Landfill involved a $4 million fire fight and put back of a large DLC landfill with over 300,000 m^3 of waste on fire.

Other major projects in which Dr. Sperling played a key role have included a large DLC landfill in Minnesota, the Campbell Mountain Landfill in Penticton (1997), the Lakes County Landfill Fire in Montana (2014), Calgary Metals Auto Shredder Residue Fire in 2012, the 2004 Vancouver Landfill Fire in Delta, the Atlantic Waste Industries Fire in Maple Ridge and the Hesperia Landfill in Vernon, amongst others.

Landfill Fire Response and Risk Management Plans: Dr. Sperling and the LFCI team have developed fire response plans and prevention strategies for a number of municipal and industrial clients including Weyerhaeuser, Metro Waste in Des Moines, Iowa, the City of Penticton, the County of Colchester in Nova Scotia and the City of Kamloops, Bahamian Govt., Israel Ministry of Environment, Columbia Shuswap Regional District (3 landfills), City of Calgary (3 landfills),

Ecowaste Industries, amongst others. Plans typically include a site audit, preparation of the Incident Command structure, outline of actions and responsibilities of each team member, fire suppression strategies, compilation of required resources, and a contact list.

Landfill Fire Training: To disseminate LFCI's knowledge in landfill fire control and prevention, Dr. Sperling has prepared and delivered more than three dozen courses on fire management that have been presented in Edmonton, Saskatoon, Vancouver, Tel- Aviv, New York, Palm Springs, Calgary, Prince George, San Diego, Truro, Toronto, Halifax, Winnipeg, Comox, Tijuana, amongst many others. Most courses include a full day of class room presentations. Some have also included a practical live fire training exercise on Day 2.

Dr. Sperling has also delivered his Landfill Fire course on line through SWANA's E-Course program on numerous occassions. In 2010 Dr. Sperling was named SWANA's E-Course Instructor of the Year.

Landfill Fire Expert Testimony: In 2015 Dr. Sperling was retained as an expert witness to support the Missouri Attorney General's office in a major lawsuit against the landfill operator of Bridgeton Landfill. This landfill experienced a Self Sustaining Subsurface Exothermic Reaction (SSER). Dr. Sperling advanced the state of knowledge regarding the nature of these reactions and provided conclusive evidence that resulted in an out-of-court settlement of the case.

In 2000 he assisted the B.C. Government in cost recovery of damages on the Delta Shake and Shingle fire. Dr. Sperling and the LFCI team have prepared detailed technical reports documenting fire suppression efforts and costs on the Delta Shake and Shingle Fire ($4 million) and the Brother's Recycling Fire ($2 million). He has also provided professional advice to the province of Nova Scotia in cost recovery and permit litigation at the Colchester Landfill Fire. He has also provided opinions on cost recovery legal actions for the Calgary Metals Fire, Helotes Landfill Fire.



Solid Waste Management: As a landfill design specialist, in the past 28 years Dr. Sperling has concentrated on providing state-of-the-art engineering services relating to the design, operation, monitoring and closure at municipal landfills. He has completed over 1,000 geotechnical assessments, design and operations plans and closure plans for more than 150 landfills, including both large municipal sites such as the Vancouver Landfill in Burns Bog and the Hartland Landfill in Victoria, as well as numerous small rural sites in the Thompson Nicola Regional District, the Regional District of Bulkley Nechako, the Regional District of Okanagan Similkameen and the Regional District of Kitimat Stikine, amongst others. Flagship projects have included design of the Hartland Landfill PVC closure system, design of the Whistler Landfill Expansion lining and leachate collection system and design of slopes and landfill expansion for a large landfill expansion at the Bailey Road Landfill in Chilliwack. A complete list of projects is included overleaf.

Dr. Sperling is also very active in disseminating the art of landfill engineering in B.C. He is a Director of the B.C. SWANA Pacific Chapter and Chair of their Training Committee. He is also a member of SWANA's MOLO faculty. He has taught SWANA's flagship Manager of Landfill Operations (MOLO) course on four occasions. As well, he has specialty courses on landfill operations at Salmon Arm, Smithers, Kamloops and in Burns Lake B.C and three invited courses on groundwater issues to the MoELP waste managers throughout B.C. As well, he has developed and taught two courses on landfill design at the British Columbia Institute of Technology.

Mining: Projects completed in the mining industry include the design of the Valley Pit Dewatering System for Highland Valley Copper, pit design of the Main Zone Pit at Equity Silver Mines for Placer Dome Mines, a technical assessment of acid mine drainage control at Equity, a technical review of ground water control measures for the Lelydorp III bauxite mine in Suriname, South America for N.V. Billiton Maatschappij, a hydrogeological feasibility assessment of developing a diamond mine beneath a lake in Canada's Arctic for Canamera Resources, and most recently, a hydrogeologic review of ARD seepage from Island Copper's sub-marine waste dumps.

Ground Water Modeling: Dr. Sperling has been involved in the development of several computer models for assessing ground water flow. He has developed *COAST*, a sophisticated pre and post processor program for *MODFLOW*, with Dr. R. A. Freeze. Development of this software has resulted in numerous spin-off assignments including three successful modeling courses for nearly 100 regional staff at the B.C. Ministry of Environment, Lands and Parks. He has taught courses on ground water modeling at the University of British Columbia, University of Washington, the University of Wisconsin, and in house courses for ERM in Houston, Texas.

- **Hydrogeotechnical Studies**
  - Port Clements Landfill, Queen Charlotte Islands
  - Lillooet Landfill Hydrogeologic Investigation
  - Hartland Landfill Hydrogeologic Investigation and Leachate Management Concepts
  - Knockholt Sub-Regional Landfill Hydrogeotechnical Assessment, Houston
  - Thornhill Landfill Hydrogeotechnical Study, Terrace
  - Hydrogeological Assessment, City of Vancouver Landfill, Burns Bog, Delta
  - Bailey Road Landfill, District of Chilliwack
  - Crown Packaging Landfill, Vancouver

- **Design and Operations Plans**
  - Port Clements Landfill
  - Campbell Mountain Landfill, Penticton
  - Summerland Landfill
  - Foothills Boulevard Landfill, Prince George
  - Lillooet Landfill
  - Hartland Landfill, Victoria
  - Salmon Arm Landfill
  - Bailey Road Landfill, District of Chilliwack
  - Hope Landfill
  - Burns Lake Landfill, RDBN
  - Granisle Landfill, RDBN
  - Manson Creek Landfill, RDBN
  - Lower Nicola Landfill, TNRD
  - Chase Landfill, TNRD
  - Clearwater Landfill, TNRD
  - Heffley Creek Landfill, TNRD
  - Barriere Landfill, TNRD
  - Westwold Landfill, TNRD
  - Iskut Landfill, RDKS
  - Rosswood Landfill, RDKS
  - Fort St. James Landfill, RDBN
  - Smithers Landfill, RDBN
  - Fraser Lake Landfill, RDBN
  - Vanderhoof Landfill, RDBN

- **Closure Plans**
  - Squamish Landfill
  - Whistler Landfill
  - Final Cover Test Pad Program, Hartland Landfill
  - Premier Landfill, North Vancouver
  - Toppley Landfill, RDBN
  - Old Smithers Landfill, RDBN
  - Perow Landfill, RDBN
  - Ootsa Lake Landfill, RDBN
  - Endako Landfill, RDBN
  - Topley Landing Landfill, RDBN
  - Logan Lake Landfill, TNRD
  - Clinton Landfill, TNRD
  - Lytton Landfill, TNRD
  - Brookmere Landfill, TNRD
  - Clucluz Lake Landfill, RDBN
  - Tatalrose Landfill, RDBN
  - Fort Fraser Landfill, RDBN
  - Old Houston Landfill, RDBN
  - Palling Landfill, RDBN
  - City of Vancouver Landfill

- **Engineering Design and Construction**
  - South Face Closure Design, Hartland Landfill
  - Underdrain Design Concept, Hartland Landfill
  - West Perimeter Diversion Ditch Design, Hartland
  - North and East Face Closure, Hartland
  - North Ravine Closure Campbell Mountain
  - Bailey Road Phase II Expansion, Chilliwack
  - Hope Landfill Leachate Collection System Detailed Design

- **Stability Assessments**
  - Fort Fraser Landfill Stability Assessment
  - Hope Landfill Stability Assessment

- **Environmental Monitoring**
  Annual Monitoring, Hartland Landfill, Victoria (1990-1994)
  Hope Landfill Annual Monitoring, (1995-1997)
  Thornhill Landfill Annual Monitoring (1996-1997)
  Transition Plan and Environmental Monitoring
  Landfill Gas Assessment, Campbell Mountain Landfill, Penticton

Geotechnical Engineering: Dr. Sperling has participated in a number of geotechnical investigations throughout western Canada and the Arctic. His experience includes geotechnical investigation of dam foundations, concrete aggregate resources and stream diversions on B.C. Hydro's Liard, Iskut and Stikine and Hat Creek projects, construction supervision of a rock fill tailings dam for Equity Silver Mines and slope stability studies for Equity Silver, Brenda Mines, Township of Langley, and Town of Hope. He was the geotechnical engineer responsible for an innovative project that involved excavation and drying of 150,000 m^3 of very wet lake bottom peat deposits in Heal Basin. He has also completed a number of stability assessments at landfill sites at Fort St. James, Hope and Chilliwack.

Environmental: Dr. Sperling has managed Phase II contaminated site investigations for B.C. Hydro, Fletcher Challenge and MacMillan-Bloedel. Typically, the work involves a field program consisting of drilling and sampling, laboratory testing, data interpretation and report preparation.

EDUCATION: Ph.D., Geological Engineering - Ground Water Hydrogeology, The University of British Columbia, 1990. Thesis Topic: A Risk-Cost-Benefit Framework for the Design of Dewatering Systems in Open Pit Mines.

Post Graduate Course Work, The University of Arizona, 1989. Courses in hydrogeology and risk based engineering design.

M.A.Sc., Mining Engineering, The University of British Columbia, 1985. Thesis topic: Slope Stability and Dewatering in Main Zone Pit at Equity Silver Mine.
B.A.Sc., Geological Engineering, Geotechnical Option, The University of British Columbia, 1983. Thesis Topic: Avalanche Control in Allison Pass.

Scholarships:
Placer Development Ltd. Scholarship, 1981
Victor A. Olacke Memorial Bursary, 1981
British Columbia Hydro Scholarship, 1982
Cy Keyes Memorial Scholarship, 1983, 1984
National Research Council Scholarship, 1985, 1986
University Graduate Research Fellowship, 1987

COMPUTER: Dr. Sperling routinely uses the latest computer software to carry out state-of-the-art technical analyses and enhance the quality of technical reports and presentations. Software that he routinely uses include the Microsoft Office Suite of applications, AutoCad 13, AutoCad Lite, Surfer, BOSS Groundwater Modeling System, TimeLine, ModView, ModFlow, and HELP.

As well, he is a proficient computer programmer in Quick Basic and Fortran languages. He specializes in the development of user-friendly, graphic intensive software that helps him carry out complex technical analyses efficiently. He has developed a comprehensive library of software for geotechnical, hydrogeological and mining applications as well as several custom software products for a number of corporate clients. These include:

COAST:	Pre and post-processor to Modflow ground water flow model.
SG-Slope:	Slope stability analysis via Sarma's method.
SG-Pump:	Software for analysis for pumping tests.
SG-Volmod:	Landfill Volume Terrain Modeling System
SG-Settle:	Landfill Settlement Model

SG-Veneer: Landfill Cover Stability Model

AFFILIATIONS:

Solid Waste Association of North America (SWANA) - Director of B.C. Chapter
COAST Waste Management Association
Northern Waste Management Association (NWMA) - Founding Member
Association of Professional Engineers and Geoscientists of British Columbia
Canadian Geotechnical Society
North American Geosynthetics Society (NAGS)
International Geosynthetics Society (IGS)

PUBLICATIONS AND PRESENTATIONS:

A Risk-Cost-Benefit Framework for the Design of Dewatering Systems in Open Pit Mines. 28th U.S. Symposium on Rock Mechanics, Tucson, Arizona, pp. 999-1007. T. Sperling and R.A. Freeze, 1987.

Ground Water Control at Highland Valley Copper. International Journal of Surface Mining. Vol. 3, No. 3, T. Sperling, W.K. Munro and R.A. Freeze, 1989.

Dewatering the Overburden at Highland Valley Copper. 41st Canadian Geotechnical Conference, Kitchener, Ontario, 1988, T. Sperling, W.K. Munro, R.A. Freeze, 1989.

Hydrogeological Decision Analysis: 1. A Framework. Ground Water, Vol. 28, No. 5, R.A. Freeze, J. Massmann, L. Smith, T. Sperling and B. James, Sept. 1990.

Using Risk-Cost-Benefit Analysis to Design a Dewatering System at Highland Valley Copper. 43rd Canadian Geotechnical Conference, Quebec City, Quebec, T. Sperling, 1990.

Hydrogeological Decision Analysis: 2. Applications to Ground-Water Contamination. Ground Water, Volume 29, Number 4, J. Massmann, R. A. Freeze, L. Smith, T. Sperling and B. James, 1991.

Hydrogeological Decision Analysis: 3. Application to Design of A Ground-Water Control System at an Open Pit Mine. Ground Water Volume 30, Number 3, T. Sperling, R. A. Freeze, J. Massmann, L. Smith and B. James, 1992.

Site Preparation at Hartland's Phase II Landfill, B.C. Water and Waste Annual Conference, Vernon, B.C., T. Sperling, A de Meulles, S. Pitt, 1993.

Controlling Leachate at Landfills without Costly Liners, GLOBE 94 Conference, Vancouver, B.C., T. Sperling, 1994

Design and Operations Plans for Municipal Landfills, B.C. Water and Waste Annual Conference, Victoria, B.C., T. Sperling and M. Budzik, 1994

The Application of Geosynthetics at Hartland Landfill, Geosynthetics 95, Nashville Tennessee, T. Sperling and A. Jones, 1995

New Trends in Landfill Design, 1995 Canadian Waste Management Conference, Quebec City, M. Sungalia and T. Sperling, 1995.

Leachate Management at Victoria's Hartland Landfill, Public Works and the Human Environment Conference, Seattle, Washington, M. Budzik and T. Sperling, 1995

Geosynthetics Pass the Test, Waste, Washington, D.C., T. Sperling and A. Jones, August, 1995.

Hydrogeological Assessment of the City of Vancouver Landfill, 12th Annual Northwest Regional Symposium, T. Sperling, R. Dickin and P. Henderson, April, 1996.

Landfill Closure in British Columbia, Solid Waste Association of North America, British Columbia Pacific Chapter Meeting, T. Sperling, October, 1996.

Landfill Siting, Operation and Closure, Southern Interior Waste Managers Association Meeting, T. Sperling, March 1997.

Final Closure at Hartland Landfill, 1997 Solid Waste Association of North America, Solid Waste Symposium, T. Sperling and B. Hansen, April 1997.

Land Reclamation at Municipal Landfill Sites, 21st Annual Mine Reclamation Symposium, Cranbrook, B.C. B. Hansen and T. Sperling, September, 1997.

From Dumps to Sanitary Landfills – Upgrading Solid Waste Management Systems in British Columbia. 1999 SWANA Northwest Regional Symposium, Portland, Oregon, April, 1999.

Extinguishing the Delta Shake and Shingle Landfill Fire. Waste Age Magazine, Atlanta, Ga. November, 2000.

Vancouver Landfill Demolition Fire. MSW Management Magazine Vol. 11, No. 4, Santa Barbara, California, July/August, 2001

Understanding and Controlling Landfill Fires. SWANA 6th Annual Landfill Symposium, San Diego, California, T. Sperling, June, 2001.

Issues to Remember when Dealing with Landfill Fires – Canadian Corner: MSW Solutions, SWANA, Silver Spring, Maryland, March, 2002.

When a Fire Occurs at your Facility will you be ready? SWANA Training Center, Palm Springs, CA, Dr. Tony Sperling, P.Eng., April, 2008.

Extinguishing the Vancouver Landfill Fire. SWANA Landfill Symposium and Planning & Management Conference, Reno, Nevada. | Dr. T. Sperling and S. McCracken, April 12-13, 2010.

Controlling the Cerro Patacon Landfill Inferno, Panama: SWANA's 19th Annual Landfill Symposium, New Orleans, LA, Dr. T. Sperling, 2015

FIRE FIGHTING STRATEGY AND MANAGEMENT

PROJECT DESCRIPTION	CONTACT NAME	PHONE NUMBER	LOCATION
Campbell Mountain Landfill	Dave Duckworth	250-492-4121	Penticton, B.C.
Delta Shake and Shingle	Randall Wolsey	708-496-3801	Delta, B.C.
Hespiria Landfill	Eric Jackson	250-545-1361	Vernon, B.C.
Israel Carmon Landfill	Nimrod Halamish		Ber Shiva, Israel
Vancouver DLC Fire	Paul Henderson	604-946-8049	Delta, B.C.
Queen Charlotte Islands	Shelley Higman	250-755-3421	McMillan Bloedel
Confidential Client	na	na	Burnsville, Minnesota
Atlantic Waste Systems	Peter Grootendorst	604-467-7397	Maple Ridge, B.C.
Gitwangak Sawmill 2003	Lisa Webster	604-666-5299	Kitwanga, B.C.
Cathcart Landfill	Karl Hufnagel	206-695-4509	Snohomish County, Wa.
Brother's Pit Fire	Jim Dias	250-746-3112	District of North Cowichan, B.C.
Metro Waste Gas Well Fire	Jeff Dworek	515-967-2076 Ext 102	Des Moines, Iowa
Monroe County Landfill Fire 2004	Tobias Schroeder	812-349-2865	Bloomington, Indiana
Bahamas Landfill Fire 2004	Judson Wilmott	242-356-0218	Nassau, Bahamas
McKelvey Creek Fire 2004	Raymond Gaudart	250-368-0232	Trail, B.C.
Highland Valley Mine Fire 2005	Bob Hamaguchi	250-523-3237	Logan Lake, B.C.
Hazelbrook DLC Landfill Fire 2006	Garth Simons	902-569-7746	Hazelbrook, P.E.I.
Pine Tree Landfill Fire, 2006	Jim Chabot	603 229-1919	Casella, Maine
Confidential Client 2006	na	na	Dalles, Oregon
Vancouver Landfill 2006 Fire	Lynn Belanger	604-940-3201	Vancouver, B.C.
Dawson Creek Fire 2007 Fire	George Kunz	250-784-2303	Dawson Creek, B.C.
Yellowknife Landfill 2007 Fire	Bruce Underhay		Yellowknife, NWT
Kona Hawaii Landfill Fire	Gary Siu		Kona, Hawaii
Vancouver Landfill Fire 2009	Lynn Belanger	604-940-3201	Vancouver, B.C.
Ciudad Del Carmen Landfill Fire 2010	Ricardo Lopez Loredo	52-81-1366-4600 Ext 1139	Monterey, Nuevo Leon, Mexico
Brady Landfill Fire Investigation	Trevor Sims	204-986-8043	Winnipeg, Manitoba
Calgary Metals Landfill Fire 2012	Chief Bruce Burrell	403-268 2489	Calagary, Alberta
Vernon Landfill Fire Investigation - 2013	Nicole Kohnert	250-550-3741	Vernon, B.C.
Pasco Landfill Fire - 2014	William Goodhue, Jr.	206-780-7714	Pasco, Washington
Lakes County Landfill Fire - 2014	Mark Nelson	406-883-7323	Polson, Montana
Cerro Patacon Landfill Fire - 2013	Enrique Ho		City of Panama, Panama
Iqaluit Landfill Fire - 2014	Luc Grandmaison	1 867 979-5650	City of Iqaluit, Nunavut
Sk'way Landfill - 2015	Scott Postma	604 775-0423	Tervita, Chilliwack, B.C.
Winnipeg Brady Landfill Fire - 2015	Irvin Slike	1 204 986-4103	City of Winnipeg, Manitoba
Bovoni Landfill, St. Thomas - 2015	Steven Aubin	1 340 715 9100	Virgin Islands Waste Authority
Aguilla Landfill, St. Croix - 2015	Steven Aubin	1 340 715 9100	Virgin Islands Waste Authority
Harvest Power Spontaneous Combustion 2016			Richmond, B.C.
Bailey Landfill Fire, 2017	Tara Friessen	1 604 793-2701	City of Chilliwack
Calgary DLC Train ROW 2017	Marie Pierre Carrigan	403 268-8269	City of Calgary
Watson Island DLC Fire Response	Bill Horne		City of Prince Rupert
Vancouver Landfill Fire - 2018	Lynn Belanger	1 604 606-2730	City of Vancouver Transfer and Landfill Ops.
Whitehorse Landfill Fire - 2018	Geoff Quinsey	1 867 668-8351	City of Whitehorse
Roatan Landfill Fire - 2018	Karen Ludlow	9458 1486	Alcaldia Municipal, Roatan
Edson Landfill Fire, 2019			Edson, Alberta
Glenmore Landfill Fire	Scott Hoekstra		City of Kelowna, B.C.
Larry's Scrap Yard Fire - 2021	Henry Dean	1 242 557-2547	Nassau, Bahamas

FIRE PREVENTION PLANNING AND AUDITS

PROJECT DESCRIPTION	CONTACT NAME	PHONE NUMBER	LOCATION
China Creek Landfill	Shelley Higman	250-755-3421	Weyerhaeuser , B.C.
City of Calgary	Dave Griffiths	403-230-6612	Calgary, Alberta
Hartland Landfill	Chris Riddell	604-727-3331	Victoria, B.C.
Brookhaven Landfill	Paul Roth	631-451-6222	Brookhaven, N.Y.
County of Colchester	Carl Shaw	902-897-3182	Truro, Nova Scotia
Metro Waste Authority	Jeff Dworek	515-967-2076	Metro Waste, Iowa
Ecowaste Industries 2010	Tom Land	604-249-1977	Richmond,B.C.
Columbia Shuswap Regional District	Darcy Mooney	1-888-248-2773	Salmon Arm, B.C.
Yellowknife Landfill	Bruce Underhay	na	Yellowknife, N.W.T.
Revelstoke Timber Fire Assessment	Chief Rob Girard	250-837-2884	Revelstoke, B.C.
Downie Mill Fire Assessmen	Chief Rob Girard	250-837-2884	Revelstoke, B.C

FIRE RESPONSE TRAINING

PROJECT DESCRIPTION	CONTACT NAME	PHONE NUMBER	LOCATION
China Creek Landfill 2003	Shelley Higman	250-755-3421	Weyerhaueser, B.C.
Metro Waste Authority 2004	Jeff Dworek	515-967-2076	Des Moines, Iowa
City of Calgary	Dave Griffiths	403-230-6612	Calgary, Alberta

PROJECT DESCRIPTION	CONTACT NAME	PHONE NUMBER	LOCATION
Hartland Landfill	Chris Riddell	604-727-3331	Victoria, B.C.
Vancouver Landfill	Paul Henderson	604-946-8049	Delta, B.C.
SWANA California Chapter			Sacramento, California
SWANA South Dakota			
Victoria Fire Chiefs Conference			Victoria, B.C.
North Carolina SWANA	Mark Pointdexter		
Ecowaste Industries	Stuart Sommerville	604-276-9511	Richmond, B.C.
Nanaimo Cedar Road	Dave Leitch	250-390-6546	Nanaimo, B.C.
County of Colchester	Carl Shaw	902-897-3182	Truro, Nova Scotia
Brookhaven	Paul Roth	631-451-6222	Brookhaven, N.Y.
Edmonton, Alberta	Sheri Praski	306-227-8183	Northern Lights Chapter
Saskatoon, Saskatchewan	Sheri Praski	306-227-8183	Northern Lights Chapter
Winnipeg, Manitoba	Sheri Praski	306-227-8183	Northern Lights Chapter
Solid Waste Association of N. Dakota	Carolyn Trautman	605-216-3256	Aberdeen, South Dakota
SWANA Palm Springs, California	Chris Hurwitz	518-593-0529	Palm Springs, California
Forester University	Ryan Graff	805 679-7625	Forester University.net
City of Moncton Fire Training, 2015			Moncton, New Brunswick
City of Halifax Fire Training, 2015			Halifax, Nova Scotia
City of Whitehorse Fire Training			City of Whitehorse
City of St. John's Newfoundland			St. John's Newfoundland
New Providence Ecology Park	Geoff Starin	1 206 719-6809	Nassau, Bahamas
Cayman Islands Fire Dept. Training	Paul Walker	345 949-2499	George Town, Grand Cayman Island
Whitehorse, Yukon	Jim McLeod	1-867-668-8351	Whitehorse, Yk.
SWANA Silver Spring	Bob Wolfe Jr.	240-494-2256	Silver Spring, Md.
PASA - Mexico	Ricardo Lopez Loredo	+52 (81) 1366-4600 EXT. 1139	Monterey, Nuevo Leon, Mexico
Tijuana Fire Department - Mexico	Carlos Gopar Uribe		Tijuana, Mexico
Comox Strathcona Regional District	Thomas Boatman, P.E.	250-334-6025	Comox, B.C.
Northern Lights SWANA Edmonton	Sheri Praski	306-227-8183	Edmonton, Alberta
Northern Lights SWANA Saskatoon	Sheri Praski	306-227-8183	Saskatoon, Saskatchewan
Northern Lights SWANA Winnipeg	Sheri Praski	306-227-8183	Winnipeg, Manitoba
Northern Lights SWANA Grande Prairie	Sheila Reithmayer	780-496-5614	Grande Prairie, Alberta
SWANA Ontario Chapter Barrie	John Lackie	705-835-3560	Barrie, Ontario
SWANA Ontario Chapter Peterborough	John Lackie	705-835-3560	Peterborough, Ontario
SWANA St. Johns Newfoundland	Nicole Haverkort	902-232-2563	St. Johns Newfoundland
SWANA Atlantic Canada Chapter	Nicole Haverkort	902-232-2563	Moncton, New Brunswick
Municipality of East Hants	Andrea Trask	902-883-7098	Halifax, Nova Scotia
Capital Regional District, Victoria, B.C.	Chris Robbins	250 360 3219	Victoria, B.C.
City of Winnipeg Fire Response Training	Trevor Sims	204-986-8043	Winnipeg, Manitoba
Regional District of Kitimat Stikine 2017	Roger Tooms	1 250 615-8370	Terrace, British Columbia
Vancouver Landfill Fire Training 2018	Lynn Belanger	1 604 606-2730	City of Vancouver Transfer and Landfill Ops.
Newfounland Eastern Reg. Service Boar	Christie Dean	1 709 579-7960	St. Johns, Newfoundlanc

CONSULTATIONS / EXPERT WITNESS

PROJECT DESCRIPTION	CONTACT NAME	PHONE NUMBER	LOCATION
Byram Industries	Ken Byram	780-542-4733	Drayton Valley, Alberta
Demolition Landfill Fire	David Harvey	na	Malta
Hunters Point Shipyards Fire	Confidential	na	San Francisco, Ca.
Fresno Industrial Landfill	Dave Griffiths	403-230-6612	Fresno, California
Calgary Metals Landfill Fire	Dennis Yassui	403-232-8300	Calgary, Alberta
Helotes Landfil Fire 2011	Thomas Edwards	512-475-4003	Helotes, Texas
Bridgeton Landfill SSSER 2014	Peggy Whipple	573-751-8864	St. Louis, Missouri
Bella Vista Stump Dump 2021	Robert Honea	479-651-9600	Bella Vista, Arkansas
Congress Landfill 2021	Jeffery D. Jeep	708-404-9092	Hinsdale, Illinois

TRAINING INTEREST - ACTIVE FILE

PROJECT DESCRIPTION	CONTACT NAME	PHONE NUMBER	LOCATION
Southbridge DLC Fire	Mark Paulino		South Bridge, Massachusets
Malta C&D Landfill Fire	Sarah Andrews		Malta
Woodlake Landfill Fire	Chris Bratsch		Minneapolis, Minnesota
Temporary C&D Landfill	Michael Dostillio		Philadelphia, Pa.
Stark County C&D Landfill	William Franks		Stark County, Ohio
Frederick County Landfill	Ron Kimble		Winchester Virginia
Cumberland County	Darrell Jones		Cumberland County, N.S.
Barrie, Ontaric			

Benton County Exhibit 5 (BC5)

- Kellar Engineering – firm bio and resume

KELLAR ENGINEERING



Sean Kellar, PE, PTOE

Principal Engineer

Education
B.S., Civil Engineering, Arizona State University – Tempe, AZ

Registration
Colorado, Professional Engineer (PE)
Wyoming, Professional Engineer (PE)
Idaho, Professional Engineer (PE)
Arizona, Professional Engineer (PE)
Kansas, Professional Engineer (PE)
Missouri, Professional Engineer (PE)
Professional Traffic Operations Engineer (PTOE)

Professional Memberships
Institute of Transportation Engineers (ITE)

Industry Tenure
Over 25 Years

Sean's wide range of expertise includes: transportation planning, traffic modeling roadway design, bike and pedestrian facilities, traffic impact studies, traffic signal warrant analysis, parking studies, corridor planning and access management. Sean's experience in both the private and public sectors; passion for safety and excellence; and strong communication and collaboration skills can bring great value to any project. Prior to starting Kellar Engineering, Sean was employed at the Missouri Department of Transportation (MoDOT) as the District Traffic Engineer for the Kansas City District. Sean also worked for the City of Loveland, CO for over 10 years as a Senior Civil Engineer supervising a division of transportation/traffic engineers. While at the City of Loveland, Sean managed several capital improvement projects, presented several projects to the City Council and Planning Commission in public hearings, and managed the revisions to the City's Street Standards. Sean is also proficient in Highway Capacity Software, Synchro, PT Vissim, Rodel, GIS, and AutoCAD.

WORK EXPERIENCE:

Kellar Engineering, Principal Engineer/President – January 2016 – Present

Missouri Department of Transportation, District Traffic Engineer, Kansas City District – June 2015 – January 2016

City of Loveland, Colorado, Senior Civil Engineer, Public Works Department – February 2005 – June 2015

Kirkham Michael Consulting Engineers, Project Manager - February 2004 – February 2005

Dibble and Associates Consulting Engineers, Project Engineer – August 1999 – February 2004

General Information:

Kellar Engineering LLC
Attn: Sean Kellar, PE, PTOE
PO Box 8198, Prairie Village, KS 66208
Phone: 970.219.1602
skellar@kellarengineering.com

Kellar Engineering Firm History and Services:

Kellar Engineering LLC is a Transportation/Traffic Engineering consulting firm founded by Sean Kellar, PE, PTOE in January 2016. Prior to starting Kellar Engineering LLC, Sean had over sixteen years of work experience in transportation/traffic engineering in both the private and public sectors working for: Missouri Department of Transportation (MoDOT) as District Traffic Engineer; City of Loveland, Colorado; Kirkham Michael Consulting Engineers; and Dibble and Associates Consulting Engineers. Sean Kellar has worked in the industry for a total of over 25 years. Kellar Engineering LLC (KE) serves as a traffic and transportation engineering consultant for various municipal bodies. KE has completed over 500 traffic impact studies for multiple jurisdictions and states. Additionally, KE has worked with three Northern Colorado jurisdictions (City of Loveland, City of Fort Collins, and Larimer County) to write and codify the revisions to the Larimer County Urban Area Street Standards (LCUASS). Kellar Engineering LLC is dedicated to offering quality transportation and traffic engineering consulting services through great customer service to its clients. Each project presents a new opportunity to add value and for strengthening relationships with clients.

Sustainability:

Kellar Engineering LLC seeks to work toward providing a more sustainable transportation system in every project. This can be achieved through intersection and roadway improvements. However, it can also be achieved through Transportation System Management and Operations (TSMO) philosophies by improving the flow of traffic without adding pavement. Below are some of Kellar Engineering's TSMO philosophies that we look to implement on every project no matter the size or budget:

- Getting results without adding lanes
- Utilizing ITS technology to improve traffic flow and reduce vehicle emissions
- Regional traffic signal coordination
- Traffic incident management
- Multi-modal transportation infrastructure

LU-24-027 Supplemental Staff Report to Benton County Planning Commission

Benton County Exhibit 6 (BC6)
Property Zoning Map

Benton County
COMMUNITY DEVELOPMENT DEPARTMENT

April 18, 2025

Taxlots

Areas of Interest
- Development Area
- Properties with Landfill Operations
- Adjacent Properties

Rural Residential
- 2-Acre Minimum
- 5-Acre Minimum
- 10-Acre Minimum

Rural Lands
- Rural Industrial

Non-Resource Lands
- Landfill Site
- Open Space

Resource Zones
- Exclusive Farm Use
- Forest Conservation

Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri Community Maps Contributors, County of Benton, Oregon State Parks, State of Oregon GEO, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, USFWS

0 0.17 0.35 0.7 Miles

ROBISON RD
RIFLE RANGE RD
GILES RD
HWY 99
COFFIN BUTTE RD
CAMP ADAIR RD
SOAP CREEK RD

LU-24-027 Supplemental Staff Report to Benton County Planning Commission

Benton County Exhibit 7 (BC7)
Compiled Testimony from Adjacent Property Owners/Residents

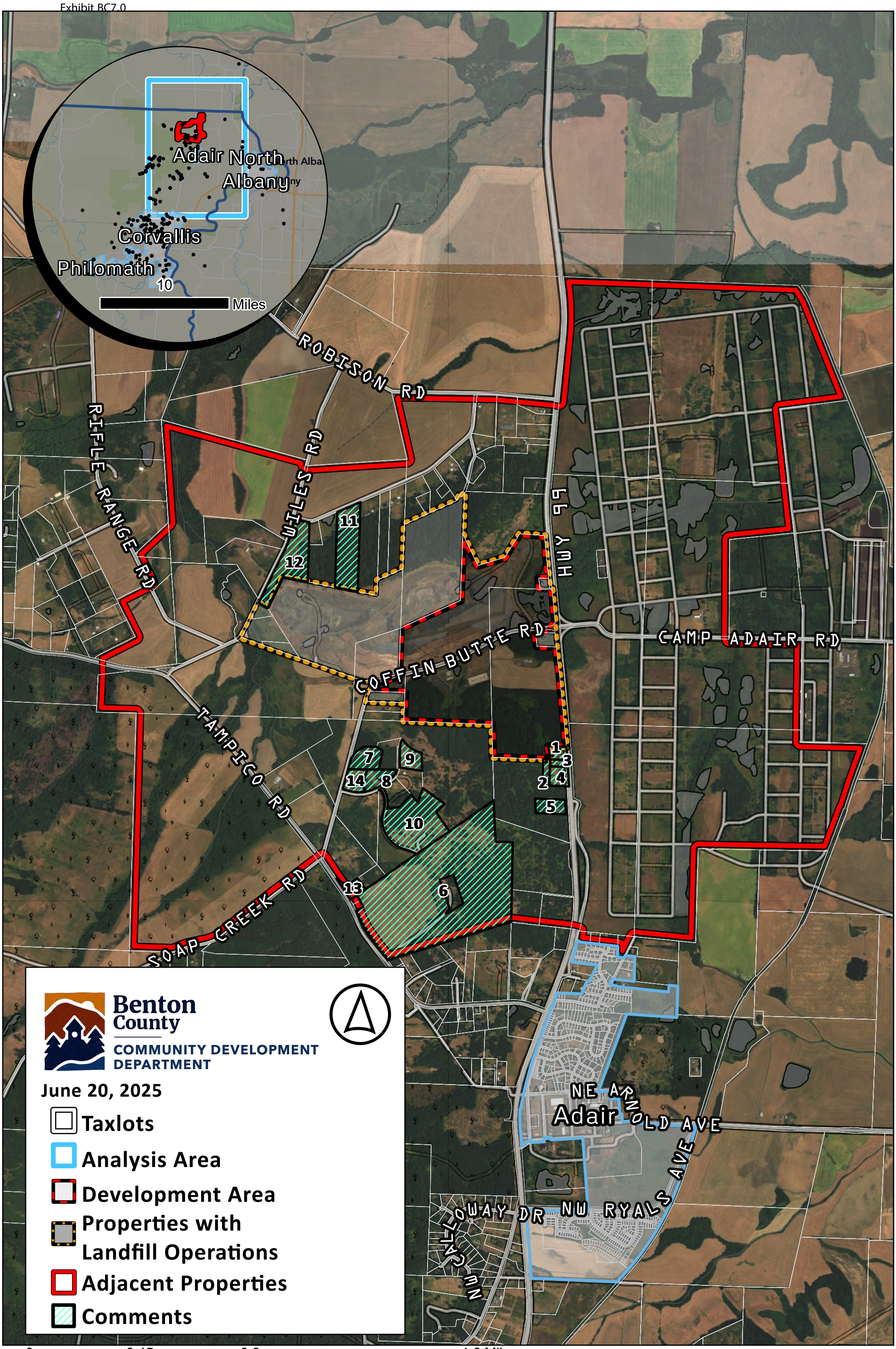
Contents:

BC7.0	Map of Testimony from Adjacent Properties
BC7.1	E. and L. Bradley
BC7.2	J. Searls
BC7.3	J. Geier
BC7.4	C. and P. Merrill
BC7.5	J. and P. Morrell
BC7.6	R. Wilson
BC7.7	G. Carlin
BC7.8	L. A. Davis
BC7.9	I. Finn
BC7.10	A., C., R. Holdorf
BC7.11	D. Hackleman
BC7.12	B. Briskey
BC7.13	D. and N. Johnson
BC7.14	G. Lind Flak

Benton County Exhibit 7 (BC7)

BC7.0	Map of Testimony from Adjacent Properties

Exhibit BC7.0



County of Benton, Oregon State Parks, State of Oregon GEO, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, USFWS, County of Benton, Oregon State Parks, State of Oregon GEO, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USFWS, Maxar

Benton County Exhibit 7 (BC7)

BC7.1	E. and L. Bradley

From: Erin Bradley
To: Benton Public Comment
Subject: Oppose LU-24-027
Date: Tuesday, April 22, 2025 7:25:43 AM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Erin and Lowell Bradley
38578 Hwy 99W
Oppose Lu-24-027

Benton County Planning Commissioners,

I respectfully request the Benton County Planning Commissioners to deny LU-24-027. This proposed expansion would move the landfill even closer to our property line. We are one of the closest southern neighbors. The buffer land is no longer sufficient due to the growing pile of debris. This proposal seriously interferes with the use of our property. Republic Services is currently in violation of County code 53.12. The last few years we have suffered through noise outside business hours, plastic bags blowing from the landfill, over the trees, onto our property, along with strange plumes of dust like material. Some days the odor is unbearable. The proposed expansion does nothing to align with Benton County's 2040 Thriving Communities Act.

Sincerely,
Erin and Lowell Bradley
38578 Hwy 99W Corvallis, Oregon 97330

From: Erin Bradley
To: Benton Public Comment
Subject: Oppose LU-24-027
Date: Tuesday, April 22, 2025 7:30:02 AM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Benton County Planning Commissioners,

July 24th, 2024, at approximately 7:30 pm Republic Services had a fire directly behind their building with the burn off stack. After hearing the Adair Village siren, I turned on the public scanner. To my horror I leaned not only of the fire, but that the fireman could not get in the gate or reach anyone to unlock it. In addition, the fire was right next to the propane storage. I am so grateful for our public responders who extinguished the 1/4-acre fire quickly. If they had not, the unmaintained Republic Services forest that boarders our land would have caught fire. I can throw a stone from my property line onto their forest land. At the time I had 18 head of livestock. I do have 2 livestock trailers but that is not sufficient for an emergency evacuation with NO warning.

May 18th, 2024, two hydraulic lifts caught fire on equipment. Two people driving by called it in. With the amount of methane in the trash pile you would think you would think Republic Services would have staff monitoring 24 hours a day?

There have been many fire alarms due to the burn off stack in the last two years. This made dispatchers question if calls were valid. Our counties resources have been wasted by false alarms. We have lived on edge due to the lack of diligence on Republic Services part. Our property is one of the closest to the proposed expansion. We respectfully request that the Benton County Planning Commissioners Deny LU-24-027

Erin and Lowell Bradley
38578 Hwy 99W Corvallis

From: Erin Bradley
To: Benton Public Comment
Subject: Deny LU-24-027
Date: Wednesday, April 23, 2025 8:45:50 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Benton County Planning Commissioners,

Our property is just south of the proposed expansion, and we share two land boarders. We have a barn with 13 head of livestock. On an average temperature day, the animals consume or use approximately 200 gallons of water. On hot days it is significantly higher, close to double. This estimate does not include our family of four daily usage. I am very concerned that drainage to these huge excavations could affect our well. This would be in violation of Benton County Code 53.215 (1) as it would place an undue burden on us being an adjacent property owner. I respectfully request you Deny LU-24-027.

Erin and Lowell Bradley
38578 Hwy 99W
Corvallis Oregon 97330

From: Erin Bradley
To: Benton Public Comment
Subject: Deny LU-24-027
Date: Tuesday, May 6, 2025 9:59:49 AM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Good Morning County Planning Commissioners,

My name is Erin Bradley. I live at 38578 OR-99W, Corvallis OR 97330.

I would like to mention a possible error in the map at the presentation last week and in the conditional land use application. The property north of us is listed as a 10 acres parcel and is shaded purple. The property is Republics Forrest Land owned by Valley Landfills and should be shaded green. I believe the map paints an inaccurate picture. It appears there is a 10 acre buffer between my property and the forest land.

Please see the attached photos of the maps presented, a current photo of the forrest looking north in my property, and Benton County's information.

I would also like to add photos to the record of the July 24th 2024 fire next to this forrest.This demonstrates the almost need to evacuate on our part. This fire could have spread to the forrest, or to the landfill.

Please deny LU-24-027 as it is affecting the enjoyment and use of our land.

Erin Bradley

Erin Bradley
Bit By Bit
541-908-3293
bitbybitadaptiveriding.org


BIT
BY BIT
ADAPTIVE RIDING

9:17 5Gw

English

005888 - Property Detail

FOR ASSESSMENT AND TAX PURPOSES ONLY

Account Information

Account Information

Account #:	005888
Map Taxlot:	10418000 1200
Acreage:	82.7
Property Class:	400
Tax Code Area:	0916
Situs Address:	29160 COFFIN BUTTE RD CORVALLIS, OR 97330

Last Certified Values

Market Land:	$526,080.0
	0

Print Close

essment.bentoncountyor.gov

12:58
11 of 76
library/functions.azurewebsites.us



Exhibit BC7.1











Benton County Exhibit 7 (BC7)

BC7.2	J. Searls

From: James Searls
To: Benton Public Comment
Subject: Oppose/Deny LU-24-027
Date: Thursday, April 24, 2025 10:08:52 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

My name is James Searls.

I own Smile Farm LLC (www.smilefarm.us) which is located at 38538 Hwy 99W, Corvallis, OR, 97330. My land is south and adjacent to the proposed Coffin Butte Landfill expansion. Ground zero.

I strongly oppose the expansion of the dump. Please do not approve the application LU-24-027 to expand the Coffin Butte Landfill. I have concerns about how this will negatively impact my property and farm.

It is our goal to provide perennial and annual crops for our community each year from our land- as well as provide farm services throughout the valley. Our motto is- "We grow smiles one plant at a time." It makes us feel good to grow specialty crops, give eggs, donate fruits and veggies and regenerate healthy soil and ecosystems. An expansion of the landfill could harm our soil and air quality making it harder to produce crops.

It is hard to smile at our farm sometimes when noxious odors from the Coffin Butte Landfill infiltrate our property. These odors/gases already cause problems and they are out of control. An expansion of the landfill will bring the piles of garbage (future dump cells) physically closer to my farm which will create a bigger odor problem.

Decline the proposal to expand the dump. Help save Smile Farm.

Thank you for your time and consideration.

Best,

James Searls

319 331 9885

james@smilefarm.us

From: James Searls
To: Benton Public Comment
Subject: Oppose/Deny LU-24-027
Date: Thursday, April 24, 2025 10:12:28 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Benton County Planning Commissioners,

My name is James Searls.
I live at 38538 Hwy 99W, Corvallis, OR, 97330. This is directly south of the Coffin Butte Landfill. I live here with my son, Burton.

We have a giant farm dog, Leroy, who helps protect our chickens. The chickens and Leroy roam the grounds of our property regularly drinking water from puddles, seasonal streams and water from our well. My son and I drink from the well too.

I am concerned about the hydrological impacts related to the proposed expansion of the Coffin Butte Landfill. How will this affect the quality of our future water? How will this impact our soil? We need reliable, safe water and soil to sustain our home, our farm, our animals and loved ones.

An expansion of the landfill- moving closer to and upstream from my property will threaten my water resources and could contaminate our soil.

Please decline the application LU-24-027 to expand the landfill. I strongly object to this proposal as it threatens our livelihood for the future.

Thank you for your time and consideration.

Sincerely,
James Searls

From: James Searls
To: Benton Public Comment
Subject: Oppose/deny application LU-24-027
Date: Thursday, April 24, 2025 10:25:19 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Benton County Planning Commissioners,

My name is James Searls and my son's name is Burton. We live next door to the Coffin Butte Landfill at 38538 Hwy 99W, Corvallis, OR, 97330. We are located to the south of the proposed expansion site.

I am writing because I strongly oppose Republic Services' Conditional Use Permit application LU-24-027 to expand the Coffin Butte landfill. I urge the Planning Commission to deny this application.

The proposed expansion would seriously interfere with the character of the surrounding area and impose an undue burden on public resources, in violation of Benton County Code 53.215 (1) and (2). Specifically, this expansion raises major concerns about:

- Air and water pollution threaten our local ecosystems and community health
- Traffic increases that pose safety risks on nearby roads and pathways
- Odor and noise issues that degrade quality of life for residents and visitors
- Negative impacts on wildlife, recreation, and property values
- Long-term climate and environmental consequences for future generations

The proposed expansion does nothing to align with *Benton County's 2040 Thriving Communities Initiative*. This expansion undermines our shared goals for responsible environmental stewardship, prioritizing public health, and sustainable waste management.

I believe Benton County should invest in waste reduction, recycling, and circular economy solutions, not expanding landfills that perpetuate pollution and place a long-term burden on local communities!

Please reject LU-24-027. Thank you for your consideration and for protecting the health and future of Benton County.

Sincerely,

James Searls

3193319885

From: James Searls
To: Benton Public Comment
Subject: Oppose/deny LU-24-027
Date: Thursday, April 24, 2025 10:38:37 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Benton County Commissioners

My name is James Searls. I own one of the south neighboring properties of the Coffin Butte Landfill. 38538 Hwy 99W, Corvallis, Oregon, 97330 is the address.

I strongly oppose the expansion of the landfill. Application LU-24-027 should be declined.

I believe an expansion will negatively impact the value of my property, farm and home. An expansion will bring more traffic and machinery closer to my home and family. The dump is already a nuisance for us. We can already smell the horrible odors that bleed out Coffin Butte Landfill. We already hear big machinery and trucks operating during quiet hours of the night/morning. We already have daily litter along Highway 99. I am concerned that an expansion will exacerbate these problems.

I also worry that our wonderful (million dollar) views of Mt Hood, Mt Jefferson, Three-fingered Jack will be tainted by the mountain of trash. Currently, we cannot see the landfill from our home. Sometimes I go out on our deck to enjoy the views and our land only to be hit with a noxious odor caused by the landfill. It is disgusting and worrisome and ruins the moment. The odors cause me to go back inside. IT ISN'T FAIR.

Growing the landfill will allow Republic Services to operate for more years which will prolong our struggles. It will trash the value of our property for more years to come.

Again, I oppose the proposal to expand the landfill. Please deny application LU-24-027.

Thanks for your time and consideration.

Sincerely,

James Searls

3193319885

james@smilefarm.us

Corvallis, OR, 97330

From: James Searls
To: Benton Public Comment
Subject: Deny/oppose LU-24-027
Date: Thursday, April 24, 2025 10:50:58 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Benton County Planning Commissioners,

My name is James Searls. My son and I live at 38538 Hwy 99W, Corvallis, Oregon, 97330.

I am concerned about the proposal to expand the landfill. Specifically, how it will change habitat for Oregon's creatures and wildlife. The fauna that grazes upon our property are wonderful. Natures food chain is fully present here ranging from insects and birds, to elk and mountain lions. This is one of the main reasons I bought this property. I love watching and living among the wildlife here. Expanding the landfill will threaten our property and the surrounding wildlife.

Please do not approve the application LU-24-027 to expand the Coffin Butte Landfill. Help preserve the habitat for our wildlife. I oppose the proposal.

Thank you for your time and attention.

Sincerely,

James Searls

3193319885

james@smilefarm.us

Corvallis, OR, 97330

Benton County Exhibit 7 (BC7)

BC7.3	J. Geier

From: Joel Geier
To: Benton Public Comment
Subject: Deny LU-24-027: First set of comments (pertaining to heron nesting colony disturbance)
Date: Monday, April 21, 2025 4:33:40 PM
Attachments: LU-24-027 comments - heron rookery.pdf
Coffin Butte-Camp Adair Herons 2000-2025-04-20.pdf

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Development Department Staff:

Please provide my attached letter (first attachment), together with a report giving supporting details (second attachment) to the Planning Commission for their consideration.

You may note, this is just the first of several sets of comments that I intend to send. For some of the other comments, I'm still awaiting responses from Oregon DEQ.

Thank you for your efforts, and please let me know if you have any questions about this part of my testimony.

Yours sincerely,

Joel Geier
North Benton County resident

From: Joel Geier
To: Benton Public Comment
Subject: Re: Deny LU-24-027: Second set of comments (pertaining to rubbish in farm fields)
Date: Monday, April 21, 2025 4:59:39 PM
Attachments: LU-24-027 comments - rubbish in fields.pdf

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Development Department Staff:

Please provide my attached letter to the Planning Commission for their consideration.

Thank you for your efforts, and please let me know if you have any questions about this part of my testimony.

Yours sincerely,

Joel Geier
North Benton County resident

Joel Geier
38566 Hwy 99W
Corvallis, Oregon 97330-9320
(541) 745-5821
joel.geier@peak.org

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

April 21, 2025

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

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

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

I'll be submitting a series of comments on different problems raised by this application, each of which give grounds for denial. This is my first set of comments in the series, focusing on the status of a Great Blue Heron nesting colony (or "rookery") which has been continuously active at this site since the spring of 2000.

The key points are these:

1. Applicant has not provided you with full information regarding the status of the heron nesting colony, which still persists at the site although the locus of nesting activity has shifted approximately 250 yards to the east since an apparent disturbance event in 2022.

2. The currently active nesting area is less than 1/4 mile from where applicant proposes major excavation work to build new leachate ponds on Forest Conservation land (Lot 1200), in place of the existing ponds which are within the footprint of the proposed new landfill.

3. Satellite images of the proposed development show that the applicant has failed to avoid disturbance to the previously documented heron rookery areas, during 2022, 2023, and 2024, and this pattern of disturbance continues into the current year.

Taken as a whole, these points indicate that approval of this CUP application would lead to further disturbance of this heron nesting colony, in contradiction to **Benton County Goal 5.9 Wildlife Habitat: To conserve and protect wildlife habitats and to promote habitat management that maintains wildlife diversity.** The applicant's record of recent and ongoing adverse activity, on the same lots where they propose to develop a new landfill and leachate ponds, makes it clear that the most likely outcome will be exactly the opposite of what Goal 5.9 espouses.

I elaborate on each of these points below (Further documentation is given in the attached report, which is an updated version of a report that I provided to ODFW and ODF on March 15, 2025).

1. Applicant has not provided you with full information regarding the status of the heron nesting colony, which still persists at the site although the locus of nesting activity has shifted approximately 250 yards to the east since an apparent disturbance event in 2022.

From reading the information provided by the applicant and their wildlife consultant (Turnstone), in their Burden of Proof statement and supporting exhibits, you might easily get the idea that herons simply gave up on the area, after an apparent mass failure of the nesting colony sometime between April and June of 2022. This is far from the truth.

In fact, community observations, as summarized in a report that I'm submitting together with this comment, establish that the herons have continued to nest in ash trees within 220 yards of Turnstone's observation point OP2, beginning in March 2023 and continuing in both subsequent years, up to the date of this comment. Several of the nests are in a direct line of sight from OP2. Adult herons flying to and from nests in the ash trees should have been visible from that point.

This is not to say that the information provided by the applicant or their consultant is false, just that it doesn't provide a full account of heron nesting activity in the immediate vicinity.

One possibility is that the applicant's consultant simply failed to notice heron activity a short distance east of the old nests that they were focused on. This is possible but seems improbable, for skilled field biologists.

A second possibility could be that the consultants may have seen this heron activity nearby, but they adhered to a very narrow interpretation of the protocol which required them only to report if they saw herons in or around the nests in the older nesting area, and not necessarily to report herons nearby.

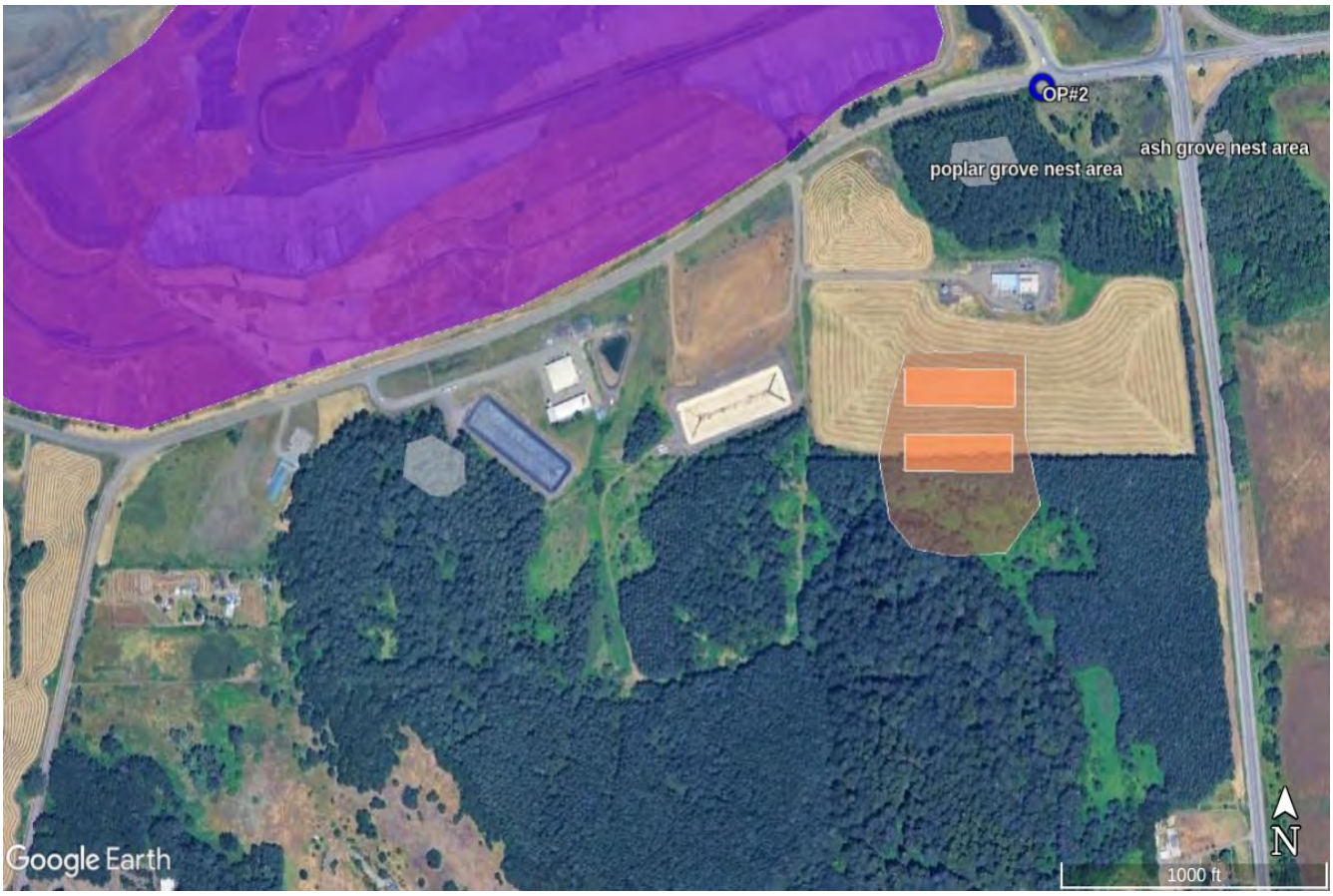
Regardless of whether the omission is due to careful parsing of observations or simply failure to notice, it's clear from independent observations that herons do continue to nest immediately proximal to the area of the proposed development, which has consequences for the proposed development.

2. The currently active nesting area is less than 1/4 mile from where applicant proposes major excavation work to build new leachate ponds on Forest Conservation land (Lot 1200), in place of the existing ponds which are within the footprint of the proposed new landfill.

The image below shows the proximity of the currently active heron nest area ("ash grove nest area") to the area proposed for development of new leachate ponds on Forest Conservation land. I've sketched in the proposed location of the new ponds (solid orange), and the approximate footprint of the required excavations (tinted orange).

From length scale included in the image, you can see that this construction activity would be within roughly 1000 ft (330 yards). Under the Oregon Forest Practices Act heron rookeries are protected, and Oregon Department of Forestry rules require avoidance of forest land operations (including truck traffic) between February 15th and July 31st, within a 1/4-mile (440 yard) radius.

The applicant has not provided any plan for protecting the ash-grove nesting area, within their current site development plans which acknowledge only a need to protect the older nesting areas, and those only if their consultants happened to notice heron nesting activity during 2023 through 2025.



3. Satellite images of the proposed development show that the applicant has failed to avoid disturbance to the previously documented heron rookery areas, during 2022, 2023, and 2024, and this pattern of disturbance continues into the current year.

Ever since the applicant learned in late 2021 that the herons nesting in the poplars could be an impediment to their development plans, in each successive nesting season (2022, 2023, 2024 and 2025) they have operated heavy equipment (excavators and gravel trucks) in an area that had previously been left undisturbed from 2017 to 2021 (during which period the herons established their nesting area in the poplar grove).

A timeline of this activity, based on evidence provided by historical satellite images, is given in the report included with this set of comments.

Whether this activity was inadvertent or otherwise, it could well have caused the apparent abandonment of nests during 2022, and the reluctance of herons to return to the area in subsequent years.

At the very least, conducting this activity so close to the known nesting areas, during nesting season, demonstrates insufficient diligence regarding the disturbance issue.

Given the applicant's poor track record on this issue, better outcomes cannot be expected in the event that they gain approval for the proposed development.

Thank you for considering these comments. I reserve the right to provide further written and oral testimony according to the time frame allowed by statute.

Yours sincerely,



Joel E. Geier, Ph.D.

Great Blue Heron Monitoring

Community observations of heron nests
Coffin Butte and vicinity, north Benton County, Oregon
2000 through present

March 15, 2025
Amended to include observations through April 20, 2025
Joel Geier

Executive Summary

A heron nesting colony is known to have been present in the area just south of Coffin Butte for more than 25 years, starting in 2000 and continuing into the current year, 2025. Although initially the colony seemed to be stable, making use of a stand of mature conifers from the early 2000s through at least 2018, within the past 6 years it has shifted nesting locations twice.

A mass incident of nest abandonment and colony failure occurred in the poplar grove ("eastern rookery") sometime during in mid- to late May 2022. The cause is not known with certainty, but excavation equipment and trucks were documented as operating as close as 600 ft to the nesting area around the time of the abandonment, much closer than the 1/4 mile buffer zone that was recommended to the operators to avoid disturbance. Bald eagles were seen scavenging the nests, but not until at least a week after the adults had abandoned the nests.

In subsequent years, herons have continued to visit the poplars during nesting season, but have not been documented as re-occupying nests in that area. Continuing disturbance by equipment operating within the recommended buffer zone during 2023, 2024, and again in 2025 may be a factor in discouraging them from reoccupying nests in that area. Instead the main locus of nesting activity since 2022 has been in an ash grove just east of the poplars. Nesting there was successful in 2023 and probably also in 2024.

That nesting area is occupied again in 2025, with herons incubating on nests as of the date of the report. This new nesting area is very close to a busy highway intersection, which poses a potential risk for the long-term success of the colony. Although the herons appear to be acclimated to the normal flow of vehicular traffic, nesting could be disturbed by pedestrians walking along the highway and/or vehicle operators who exit their vehicles during roadside stops. Such an incident was observed on April 19, 2025 when a sheriff's inmate crew picking up roadside litter near the landfill entrance came within 30 yards of the nests.

Introduction

Great Blue Heron (*Ardea herodias*) is one of Oregon's most well-known bird species, frequently noticed, recognized, and beloved by many members of the public.

This is also one of very few bird species to be specifically protected under Oregon state law (OAR 629-665-0120), which is focused on protecting and preventing disturbance to colonial nesting sites known as "heronries" or "heron rookeries."

Although perceived as a "common" bird species due to its high visibility, the status of Great Blue Heron as a nesting species in the Willamette Valley is poorly understood, both in terms of numbers of breeding birds, and the stability of existing colonies.[1]

This report summarizes community observations of herons nesting in the vicinity of the Coffin Butte landfill from the year 2000 through early 2025.

Data sources

Observations of herons nesting were not systematic over most of the 25-year period from 2000 to 2025. For years prior to 2022, a record of incidental observations has been gleaned from resources including *The Chat* (newsletter published monthly by the Mid-Willamette Bird Alliance[2]) and the electronic archives of two e-mail lists:

- Oregon Birders Online (OBOL), https://www.freelists.org/archive/obol/
- Mid-Valley Nature https://groups.google.com/g/mid-valley-nature

From 2022 onward, observations have been maintained systematically in Excel spreadsheets which are reproduced here in tabular form.

1 (Ann Eissinger, personal communication, 2021)

2 The Mid-Willamette Bird Alliance is the current name of the organization formerly known as Audubon Society of Corvallis. Newsletters prior to 2024 were published under the former name of the organization.

Locations referenced

The following locations (Figure 1) are referred to frequently in this report:

Coffin Butte is a natural landform in the shape of a ridge elongated in ENE-WSW direction, about one mile long with a peak elevation of 737 ft, which is the last in a series of ridges and hills extending northward from Vineyard Mountain near Lewisburg.

Tampico Ridge is the first main ridge to the south of Coffin Butte, elongated in the S-N direction, also about one mile long. Tampico Ridge has multiple four main summits. The highest summit, toward the south, rises to 613 ft. The next summit to the north, sometimes labeled as Poison Oak Hill, is just slightly lower at 612 ft. At its north end, Tampico Ridge splits into two ridges, with summits locally known as Schulmerich Hill (532 ft) at the north end of the main ridge line, and Beals Hill (512 ft) on the ridge line branching toward the NW.

Tampico Ridge is separated from Coffin Butte by a topographic saddle which is traversed by Coffin Butte Road, with its highest point just north of Beals Hill.



Figure 1. Satellite view of the landscape around Coffin Butte showing locations referenced by name in this report including Toketie Marsh, conifer grove nesting area ("western rookery"), poplar grove nesting area (eastern rookery"), and ash grove nesting area.

Coffin Butte Landfill is located on the south face of Coffin Butte, north of Coffin Butte Road, and is operated by Valley Landfills Inc. (VLI), a wholly owned subsidiary of Republic Services Inc.

Toketie Marsh is the name given by VLI to a remedial wetland that was constructed in early 1994[3], on the NW side of the junction of Coffin Butte Road with State Highway 99W, as partial mitigation to compensate for the destruction of two ponds higher up on the SE flank of Coffin Butte.

A **conifer grove** (mainly Douglas-firs, covering about 16 acres) on the north end of Beals Hill, between the landfill office and a facility for handling landfill leachate, has been one of the locations where herons have nested during the past 25 years. The heron nesting area in this conifer grove is referred to as "the western rookery" in some VLI documents.

A **poplar grove** (hybrid poplars covering about 9 acres) due south of Toketie Marsh and the landfill entrance (scale house road) has developed from hybrid poplars that were planted around 1994, as part of the same mitigation project. On site development maps this area is referred to as the "south cloverleaf mitigation area." The heron nesting area in this poplar grove is referred to as "the eastern rookery" in some VLI documents.

An **ash grove** (predominantly Oregon-ash, covering about 7 acres) is located on state land just east of the poplar grove, on the east side of Highway 99W. This ash grove together with the poplar grove form a nearly continuous arc of closed-canopy forest, separated only by the highway right-of-way (about 30 m wide). Herons have been observed nesting in the ash grove since 2023 after an apparent mass failure in the poplar grove in 2022.

Rays prairie is an informal name[4] for a 70-acre prairie restoration area on state land (part of E.E. Wilson Wildlife Area), adjacent to the ash grove on its east side and extending south for about 3/4 mile. Herons can frequently be seen hunting both upland areas and around the edges of two constructed wetlands during nesting season.

A **stockpile** area for fill dirt periodically used as cover material on the landfill is located to the west of the poplar grove. The east edge of this stockpile area is 0.12 mile from the heron nesting area in the poplar grove. Satellite images show that this area was managed as an

3 Per historical images on Google Earth, and confirmed by former manager Brian May, personal communication November 27, 2023.

4 Named for a former manager of E.E. Wilson Wildlife Area who initiated the restoration effort in the early 2000s. The lower of two constructed wetlands in the prairie area is known as Laguna del Ray (https://ebird.org/hotspot/L14643022). The upper wetland is informally known as Playa del Ray. Baseline point counts for this area during the early stages of prairie restoration are on file with ODFW.

agricultural field through 2006, then left fallow until 2016 when it was farmed again. In 2017 fill dirt was stockpiled on this area to form a small hill which was left undisturbed for the next several years, and was noticeably vegetated by 2020 (Figure 2).



Figure 3. Satellite view of the fill-dirt stockpile from August 13, 2020, showing the fill-dirt stockpile in an undisturbed, vegetated state at that time, with no excavating equipment present. Note that the track leading out from the east side of the stockpile is faint and does not connect to the access road for the generating plant, with a closed gate at that point, indicating that it was in a state of disuse.

Historical observations 2000 through 2020

Great Blue Herons were first documented nesting near Coffin Butte in 2000, with the following description as recorded in the summer field notes column in the *The Chat*:

> *An improbable choice of nesting site by Great Blue Herons at Toketie Marsh, at the entrance to Coffin Butte Landfill along Highway 99W north of Corvallis, gave area birders a unique chance to observe these birds through the summer. On 7-1, Carolyn Paynter watched an adult feeding 3 young in a very crowded nest. By 7-16 the juveniles could be seen hunting inexpertly around the edges of the marsh.*

As this new colony increased, the herons began to nest in the conifer grove south of the growing landfill, in the area between VLI's office building and a leachate storage facility. The field notes from the April 2018 issue of *The Chat* gave this update, noting the impact of rising Bald Eagle numbers on heronries:

> *On 10 Mar more than 20 Great Blue Herons flew in to perch in conifers where they've nested in recent years on the south side of Coffin Butte Regional Landfill. As Bald Eagle numbers continue to recover, herons seem to have abandoned some relatively exposed nesting locations along the main rivers, in favor of conifer groves that offer more protection from avian predators.*

The heron nesting area in the conifer grove, now referred to by VLI's consultants as the "western rookery" for this site, was documented by the Oregon Department of Forestry in a Notification of Operations (NOAP) under NOAP ID: 2019-551-05885. This documentation reportedly occurred when VLI sought clearance from ODF to log in that area, and were informed that this work could not proceed while that rookery remained active.

By the next year, 2020, herons were noticed to be nesting in the hybrid poplar plantation (now referred to as the "eastern rookery"). Whether this shift was due to disturbance in the former location, or due to the improved suitability of the poplars as they had grown taller with a closed canopy, or due to some other factor, is unknown.

Heron nesting activity in 2021

Community nesting observations during the 2021 nesting season are summarized in Table 1. At least 12 pairs nested in the poplar grove (east rookery) and possibly upward of 15.[5] By June local observers began to notice young birds foraging alongside adults in the local fields and pastures of Soap Creek Valley, indicating that at least some of these nests were successful.

Table 1. Heron observations during 2021.

Date	Number of herons	Location	Observer	Notes
1/28/21	0	poplar grove, conifer grove, and vicinity	Joel Geier [Mid-Valley Nature]	"I haven't seen much activity so far in the heron nesting colony at Coffin Butte Landfill. Still many hundreds of gulls around ..."
2/23/21	18	Toketie Marsh	Joel Geier [Mid-Valley Nature]	Two Bald Eagles (one adult, one immature) were keeping the gull flock stirred up above the Coffin Butte Regional Landfill, and also briefly put 18 Great Blue Herons to flight off of the remedial wetland ("Toketie Marsh").
4/07/21	12+ active nests	poplar grove	Joel Geier [Mid-Valley Nature]	"Now is still a good time to watch Great Blue Herons nesting in the poplar plantation just south of Coffin Butte Regional Landfill. At least 12 nests were active as of yesterday, and they're easy to see from the road as the poplars have just started to leaf out.
7/07/21	several	poplar grove	Joel Geier [Mid-Valley Nature]	"Great Blue Heron chicks in the poplars outside Coffin Butte Regional Landfill are now in "Stage 1" [beg from the tree as adults flt back and forth] from recently harvested fields full of voles both dead and alive. Some of the heron chicks may have already left the nest, but some were in good view when I stopped by there this morning. .... The chicks that remain are mainly standing up in the nests now, mostly motionless and pretending to be invisible until mom or dad returns with a cropful of fresh carrion."

An October 25, 2021 report by Stephanie James of Turnstone Environmental Consultants, submitted by the landfill operators in support of a proposed expansion of the Coffin Butte

5 Per comments by wildlife biologist Dave Vesely.

Landfill, based on a single site visit on October 8, 2021, stated the following regarding the conifer grove nesting area ("western rookery"):

> *James was able to observe the rookery from the access road but was not able to investigate under the trees up close due to fencing and high coverage of poison oak. James observed 12 stick nests in 8 active nest trees in the western rookery. The nests were approximately 18 to 36 inches in width, 70 to 100 feet in height, and did not appear active this year (2021) with no visible whitewash. The nests appeared to be intact and were likely were built upon in the last 2 to 3 years.*

Regarding the poplar grove nesting area ("eastern rookery"), the same report stated:

> *The eastern rookery is in a forested stand with 12- to 20-inch hybrid poplar trees approximately 90 to 110 feet in height. This forest lost many branches in recent wind and ice events, as noted by downed limbs and broken branches. The eastern rookery was likely active this year as evidenced by copious whitewash under the nests (Figure 1). This rookery contained six nests approximately 12 to 30 inches in width, 60 to 80 feet in height, in four poplar trees.*

Independent photos from Nov 7, 2021 documented that 13 heron nests were still present in the poplars as of that date, even after fall wind and ice events. Note that this was more than twice as many nests as reported by the landfill's consultant.

After local conservationists expressed concerns about impacts on herons, ODFW commented, recommending three years of professional surveys, as well as restriction of landfill activities within 1/4 mile of the active nesting areas during the critical breeding period from February through June.

Heron nesting activity and nesting failure in 2022

Community nesting observations during the 2022 nesting season are summarized in Table 2. All observations of nesting activity in this year were from the poplar grove. Although this nesting area was occupied with as many as 14 active nests, these all appear to have failed sometime between May 14 and May 25.

At least 10 nests were occupied by March 5. Incubation started sometime between March 22 and April 12, by which date herons were incubating at least 12 nests. Based on a 28-day incubation period, the earliest expected hatch date (if incubation began on March 23) would have been April 20. The latest expected hatch date (if incubation began on April 12) would have been May 10.

In a brief visit on April 20, the adult herons were observed to be perched near the nests, but not incubating. The nesting area continued to be active with adult herons present through May 14, but by May 25 it was abandoned.

Juvenile Bald Eagles were observed visiting the abandoned nests on June 1, but this was a full week after the heronry was already noted to be abandoned by community observers. The most likely explanation of the observed eagle activity on that date is that they were scavenging already-dead heron chicks from the nests.

A carcass draped over a utility wire, noted on May 25 and still hanging there for some weeks afterward, suggests the possibility of a disturbance resulting in a panic flight in conditions of dim light or darkness (i.e., when herons might not be able to see and avoid such a wire) sometime between May 14 and May 25.

Several hypotheses for this nesting colony mass failure during May of 2022 can be considered.

Hypothesis 1: Failure caused by adverse weather

Weather during April 2022, and into the first weeks of May, was notably cool and rainy for the season. These conditions could have been adverse for survival of heron chicks, particularly if they had hatched and reached the stage of growth where both parents would be away from the nest for extended periods, leaving them exposed to the weather. However the observational bounds on incubation period, together with behavioral observations from the period after hatchlings would have been expected, do not support this hypothesis.

Table 2. Heron observations during 2022. Community observations are in black font. Additional observations by Turnstone Environmental Consultants (on behalf of VLI) that help to inform the timeline up to and shortly after the time of mass nesting failure are included in blue font.

Date	Number of herons	Location	Observer	Notes
2/17/22	1	poplar grove	Stephanie James	Adults observed standing in one nest.
3/05/22	10+	poplar grove	Priya Thakkar	"Saturday evening I saw a heron standing up in each of the nests! There were at least 10 that I could see, and only one of the nests off to the side didn't have a heron in it."
3/22/22	17	poplar grove	Stephanie James	Adults observed standing in or near 11 active nests.
4/12/22	12+	poplar grove	Joel Geier	At least 12 nests were occupied with adults incubating or brooding on the nest.
4/20/22	18+	poplar grove	Joel Geier	Adult herons were perched near the nests, but not on them, in brief visit.
4/28/22	17	poplar grove	Stephanie James	Adults observed standing in or near 14 nests, all active. One observed possibly turning an egg in the nest.
5/14/22	several	poplar grove	Joy Shreyer	Several adult herons perched around the nests.
5/25/22	0	poplar grove	Joel Geier	Heronry abandoned. Decomposed / desiccated carcass, apparently of a heron, hanging from utility wire along the south side of Coffin Butte Road, due north of the west end of the poplar grove nesting area.
5/26/22	0	poplar grove	Joel Geier	Posted inquiry to OBOL and Mid-Valley Nature list, noting abandonment of heronry, and requesting any observations not already reported.
6/01/22	0	poplar grove	Stephanie James	No herons present. Juvenile bald eagles moving from nest to nest in groups of 2 to 4.

Hypothesis 2: Predation by eagles

The nearby landfill is well known to host large numbers of bald eagles, both adult and juvenile, which scavenge from the waste. With such concentrations of eagles nearby, predation on heronries is a plausible risk, as has been observed in the Puget Sound region (Eissinger, 2007).

The observations by VLI's consultant on June 1, 2022 document that eagles visited the heronry on that date. However this was a full week after failure of the heronry was noticed by community observers.

If the failure of the heronry was due to eagle predation, we should expect that most predation would have occurred on or within days after the date that adults abandoned the heronry. The fact that eagles were observed going from nest to nest at least a full week post-failure is counter-indicative of this hypothesis, suggesting instead that the eagles had just recently discovered this source of carrion.

Hypothesis 3: Disturbance by landfill operations

Heavy equipment operations in a fill-dirt stockpile just west of the poplar grove was a possible source of disturbance, during the period in which nesting failure occurred.

Satellite images from June 2022 (Figure 3) show excavation equipment operating within 0.16 mile of the heron nesting area. In comparison with satellite images of the same area from August 2020 (Figure 2), the 2022 images show indications of recent truck traffic along the access road leading out from the east side of the stockpile even closer to the nest sites.



Figure 3. Satellite view of the fill-dirt stockpile from June 24, 2022, showing excavating equipment working in a recently excavated area southwest of the poplar grove nesting area. Note that the road leading out from the east side of the stockpile shows signs of recent use. The area of recent excavations, as measured from this image, was approximately 2.6 acres.

Concerns about this issue as a possible cause of the nesting colony failure were raised during a Benton County Disposal Site Advisory Committee on July 27, 2024. Notes on the minutes for that meeting provided to Benton County staff state[6]:

> *Last year ODFW's biologists recommended that there should be no major construction within 1/4 mile of the rookery, from February 15 through July 31, apart from the usual traffic on Coffin Butte Road and Hwy 99W.*[7]
>
> *During March of 2022, local observers noted that heavy equipment was being used to mine away the stockpile of fill dirt adjacent to the Forest Conservation zone. Initially this activity was on the far side of the stockpile, where it seemed unlikely to impact the herons. However that activity seems to have shifted much closer to the rookery during May, around the time that the herons disappeared.*
>
> *Two questions for Republic staff:*
>
> *1) Did Republic Services carry out any monitoring of this nesting colony this year? And if so, have those observations been reported to ODFW?*
>
> *2) Also, is there any log of activities that were carried out within or near the Forest Conservation zone? Of particular concern would be if and when trucks hauling fill dirt started to use the gate onto Coffin Butte to the east of the stockpile, or if there were any personnel entries into the rookery area itself.*
>
> *Ian [Macnab] (Republic Services) responded that these are normal operations and there has been no other change in that area for quite some time. A biologist has been monitoring the eastern and western rookeries starting this year. Results will not be reported by the biologist until the end of a three-year period, and no data is available at this time.*

No further information has been provided by VLI or Republic Services regarding the timing of these operations.

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6 Comments transmitted by e-mail to Community Development Department staff Linda Ray and Daniel Redick on September 3, 2022.

7 A Condition of Approval proposed by CDD staff for LU-21-047, based on input from ODFW, was stated as follows: "During the critical nesting period for the Great blue heron, which is from February 15 through July 31, neither construction to prepare the ground or build the leachate ponds, employee building, road bed, or landfill cell shall occur within a quarter mile of the boundary of the rookery."

However the company has asserted a right to conduct landfill-related operations outside of the posted operating hours:[8]

> *"..internal operations, which include the arrival of field personnel on-site, begins at 4:30 a.m., Monday through Friday, and at 7:30 a.m. on Saturday. Additional operations not governed by the conditional use permit include work by third party contractors on landfill infrastructure, and commercial customers, who have 24-hour access to the Landfill.*

Such activities have been observed to occur pre-dawn, making use of bright artificial lights. During a landfill tour, the landfill environmental manager confirmed that portable lights to support operations on the landfill typically come on at 4:45 a.m.[9] During the period from May 14 to May 25 in which nesting failure apparently occurred, local sunrise ranges from 5:45 a.m. to 5:35 a.m.

The satellite evidence shows that operations in the stockpile area were in fact unusual, so this remains as a plausible cause for nesting colony disturbance and abandonment. If heavy equipment and/or artificial lights powered up in the stockpile area before sunrise, this would have been an unaccustomed disturbance and could conceivably caused a panic flight.

8 Benton County Talks Trash Solid Waste Process Workgroup Report, 2023, p. 830.
9 Benton County Talks Trash Solid Waste Process Workgroup Report, 2023, p. 935.

Heron nesting activity in 2023

Community nesting observations during the 2023 nesting season are summarized in Table 3.

There were two observations during March in which herons either perched in the poplar grove or flew toward it with a stick. Satellite images (Figure 4) show that excavation activity occurred in the stockpile area, during the early part of the nesting season. This recurring disturbance might have inhibited herons from occupying utilizing the nests in the poplars, despite some indications of interest.

Table 3. Heron observations during 2023.

Date	Time of day	Number of herons	Location	Observer	Notes
1/12/23	afternoon	0	poplar grove	Joel Geier	At least 15 stick nests
3/17/23	17:35	1	poplar grove	Joel Geier	roosting in the hybrid poplars, not in one of the trees with one of the nests that were occupied last spring
3/24/23		0	poplar grove	Jim Fairchild	Quick look at the hybrid poplar heron nests (~16, no visible occupants)
3/26/23	12:00	2	Ray's Prairie (Laguna del Ray)	Joel Geier	Flew up from ground south of pond.
3/26/23	14:30	5	Ray's Prairie	Rebecca Geier	South of ash grove
3/26/23	14:45	1	Soap Creek Ranch pasture north of entrance road	Joel Geier	hunting in pasture
3/26/23		2	ash grove / poplar grove	Jim & Karan Fairchild	2 herons just east of 99W in the ash grove next to the highway. One repeatedly circled over 99W towards the [poplars], carrying a stick. Last we saw it had stopped in the top of the ash grove.
3/27/23	15:30	6	ash grove	Joel Geier	6 herons perched in the ash grove ... including two pairs and two "single" birds, each on partly-constructed nests (several of them just a few sticks laid cross-wise). We saw one heron drop down into the understory and come back up with a stick, which its mate then added to the growing nest.
3/29/23	10:00	2	Soap Creek Ranch pasture north of entrance road	Joel Geier	hunting in pasture
5/15/23	10:30	1+	ash grove	Joel Geier	adult standing in nest, hard to see due to foliage
6/18/23	10:45	6+	ash grove	Joel Geier	multiple nests with noisy nestlings, 3 in one nest, total of at least 6 nestlings. Look nearly ready to fledge.

All other observations of nesting activity were from the ash grove. Numbers of herons were decreased from the previous year, with a maximum of 6 adults recorded early in the nesting season. Six nestlings, nearly ready to fledge, were observed in nests in the ash grove on June 18.

Based on these observations, the nests in the ash grove appeared to be successful, but no nesting was observed in the poplar grove. eBird records from nearby E.E. Wilson Wildlife Area confirm that herons were regularly present throughout the nesting season, including in June and July.



Figure 4. Satellite view of the fill-dirt stockpile from April 29, 2023, showing continuation of excavation activity southwest of the poplar grove nesting area, during the early part of the heron nesting season. Note that the road leading out from the east side of the stockpile continues to show signs of recent use. The excavated area has grown to 3.0 acres.

Heron nesting activity in 2024

Community nesting observations during the 2024 nesting season are summarized in Table 4.

Early in the nesting season, around February 12, one heron was observed standing in one of the old nests in the poplar grove. All other observations of nesting activity were from the ash grove.

Satellite images (Figure 5) show that excavation activity occurred in the stockpile area, and agricultural equipment activity (presumably field spraying) even closer to the nesting area occurred during the early part of the nesting season. This recurring disturbance might again have inhibited herons from occupying utilizing the nests in the poplars.

Nests in the ash grove began to be occupied by mid-February. Incubating birds on at least 6 active nests were noted by March 31. Subsequent observations were limited due to dense foliage and other time commitments by volunteer observers. However eBird records from nearby E.E. Wilson Wildlife Area indicate that herons were regularly present throughout the nesting season, including in June and July.

Table 4. Heron observations during 2024.

Date	Time of day	Number of herons	Location	Observer	Notes
2/12/24 (approx)		1	poplar grove	Dave Vesely	1 standing on old nest in poplars (noted in e-mail Feb 14, 2024 as “a couple days ago”)
2/13/24	13:30	1	ash grove	Joel Geier	Standing on one of last year’s nests
2/14/24	13:30	6	ash grove / Ray's prairie	Joel Geier	3 in trees around last year’s nests, 3 hunting out in Ray’s Prairie
3/10/24		6	ash grove	Joel Geier	6 in ash trees around last year’s nests, all toward north end
3/17/24	10:00	6	ash grove	Joel Geier	About 6 standing on nests (brief drive-by)
3/31/24	09:35	6	ash grove	Joel Geier	At least 6 incubating on nests. 3 additional nests seen but could not tell if occupied.



Figure 5. Satellite view of the fill-dirt stockpile from April 19, 2024, showing continuation of excavation activity southwest of the poplar grove nesting area, during the early part of the heron nesting season. Note that the road leading out from the east side of the stockpile continues to show signs of recent use. Tracks in the adjacent grass field, approaching within 250 ft of the heron nests, are presumably from operation of spray buggies during early spring.

Heron nesting activity in 2025 (to date)

Community nesting observations during the 2025 nesting season through the date of this report (March 14, 2025) are summarized in Table 5.

Thus far there have been two observations during March in which herons flew into and/or perched in the poplar grove. However the main locus of nesting activity continues to be in the ash grove.

Disturbance within the recommended 1/4 mile buffer zone is again ongoing and has intensified as of the date of this report (Figure 6).

Table 5. Heron observations during 2025.

Date	Time of day	Number of herons	Location	Observer	Effective transect width (m)
2/09/25	10:00	5	ash grove	Joel Geier	Standing in and near nests, flew off to north
2/21/25	13:30	10	ash grove	Joel Geier	Standing in and near nests
2/28/25	10:00	8	ash grove	Joel Geier	Standing in and near nests
3/06/25		1	poplar grove	Karan & Jim Fairchild	we did see a heron fly low into the hybrid poplar stand, but lost where it went.
3/06/25		1	ash grove	Karan Fairchild	one heron standing on a nest in the thick ash tops immediately east of 99W. I could count at least 12 nest accumulations in the hybrid poplar stand, but saw no herons on nests.
3/11/25	11:55	1	poplar grove	Joel Geier	Heron called while flying north from area of ash grove, looped back over Toketie Marsh and landed to perch in edge of poplars, south of Coffin Butte Road near OP2 (2nd utility pole west of highway). Viewed from north of archery range.
3/11/25	12:05	2	prairie restoration just e. of trailhead.	Joel Geier	Two adult herons hunting in prairie.
3/14/25	13:30	8+	ash grove	Joel Geier	Two herons incubating on nests, others standing in or near nests. Very brief stop. Excavation activity noted adjacent to poplar grove.
3/38/25	12:00	10+	ash grove	Joel Geier	7+ incubating on nests, 2 standing in nests, 1 building new nest.
4/08/25	09:35	10	ash grove	Joel Geier	9 incubating, 1 standing in nest. Small nests up high now occupied with incubating birds.
4/19/25	11:00	3+	ash grove	Joel Geier	Litter crew walking/working on both sides of highway. Herons standing up in nests.
4/20/25	15:30	3+	ash grove	Joel Geier	Brief check following disturbance. 3 herons standing in nests. Heard "cluck" calls indicating birds still in agitated state.



Figure 6. Photograph from March 14, 2025 of excavation activity underway on, below the previous natural grade of the stockpile. Dump trucks observed entering and leaving site via the road to the east, passing within 600 feet of the nesting area in the poplars.

References

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

April 21, 2025

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

Dear Nicholas Fowler, Chair, 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 corporation proposes to construct a new landfill on the north end of Tampico Ridge, south of Coffin Butte Road.

This is my second in a series of comments, and it will be brief.

Today while returning from bird surveys near Airlie, I noticed windblown plastic trash far out in this agricultural field. This is another consequence of the landfill operation. The impacts extends far into Polk County, at least as far as Rickreall.

I'm sharing a few snapshots on the following. This particular land belongs to Green Spring Farms, which specializes in regenerative agriculture. Their office is located in Suver, about 2 miles from the landfill.

A suggested question for you to ask of Staff:

Did Green Springs Farms receive a notice of opportunity to comment on LU-24-027? What about other farms in the landfill-impacted area, which for this issue extends at least as far north as Rickreall?

Thank you for considering these comments. I reserve the right to provide further written and oral testimony according to the time frame allowed by statute.

Yours sincerely,



Joel E. Geier, Ph.D.





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

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

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).

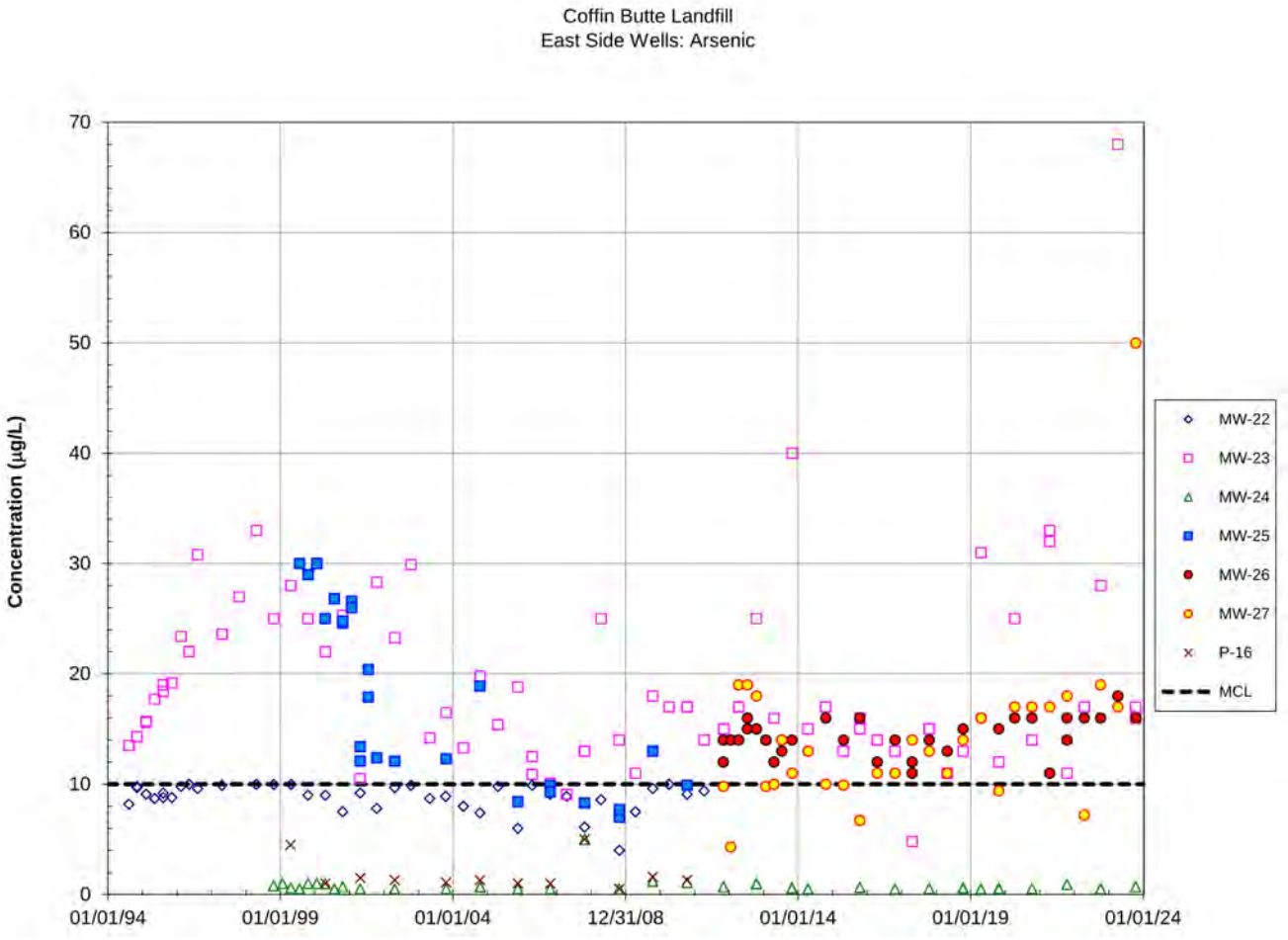


Figure 1. Arsenic concentrations in wells on the east side of Coffin Butte Landfill (from p. 245 of the 2023 Annual Environmental Monitoring Report submitted to Oregon DEQ).

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.

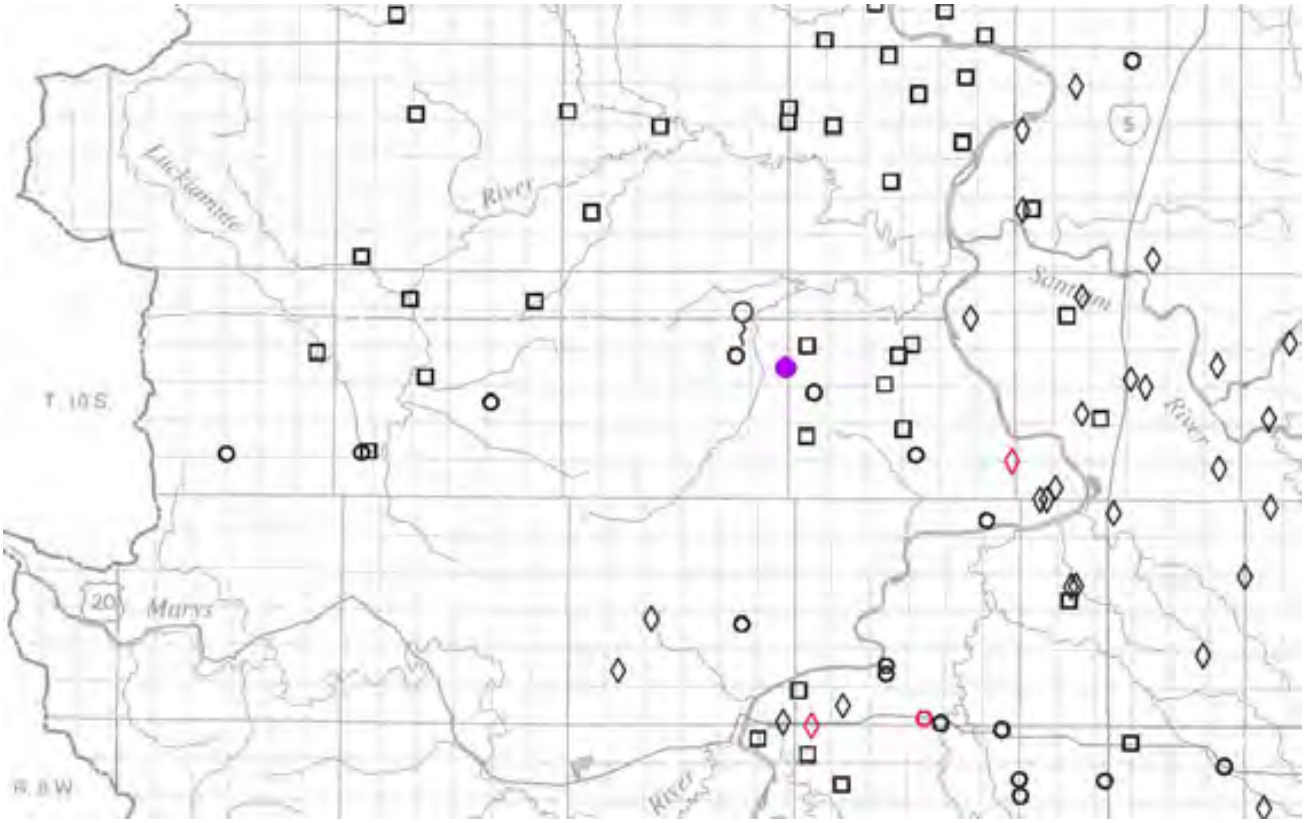


Figure 2. Detail of Plate 1 from Hinkle and Pollette (1999) showing arsenic concentrations in wells in the western mid-Willamette Valley region. The purple dot has been added for reference to show the location of Coffin Butte Landfill (not sampled by Hinkle and Pollette). Black symbols are wells and 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.

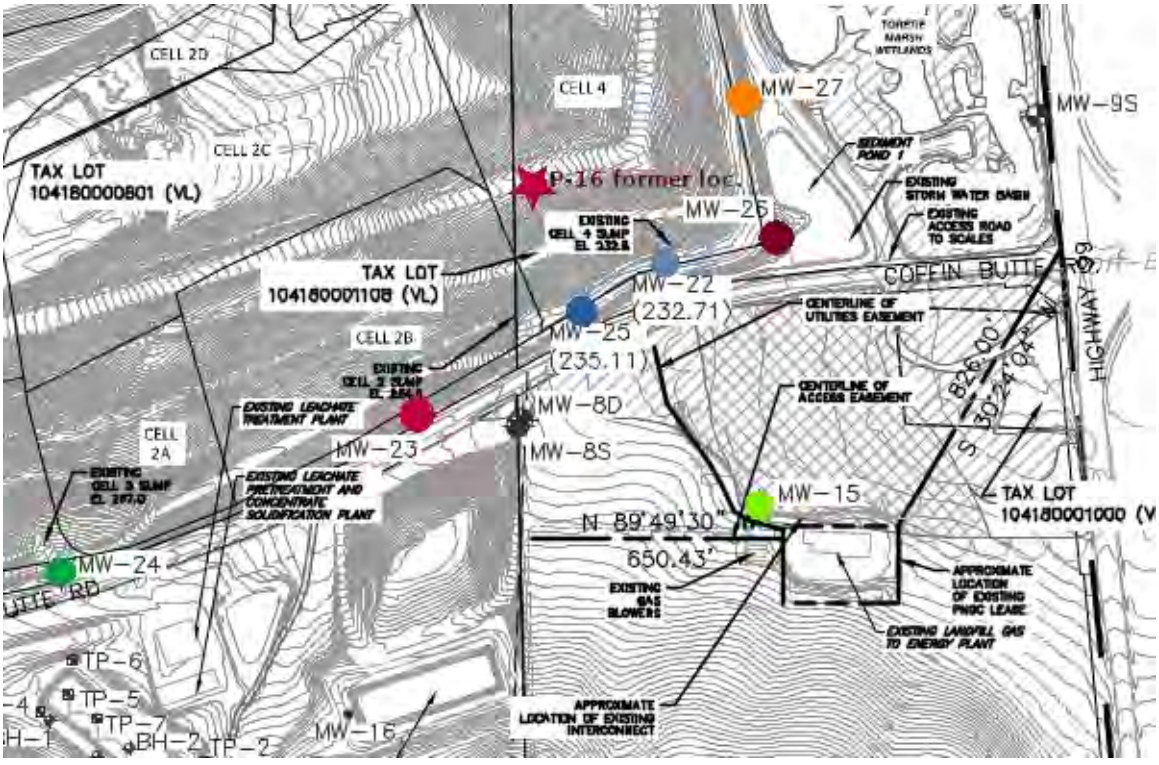


Figure 3. Location of monitoring wells in the area of concern.

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.

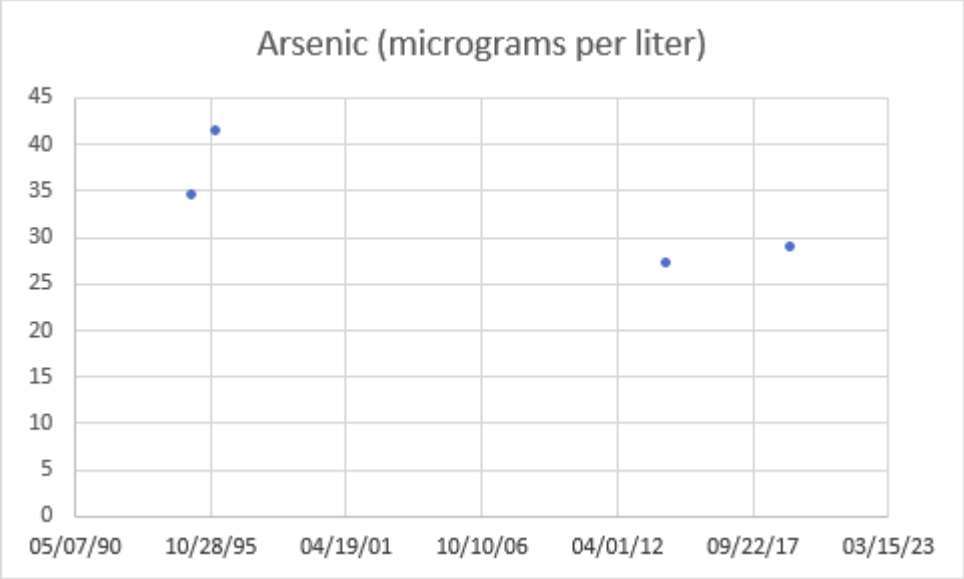


Figure 4. Arsenic concentrations measured in MW-9S from 1990 to 2023. Note that, although the applicant states that "this well has been subject to a quintennial sampling schedule (every five years) since 1991," the earliest reported are from 1995, and there appears to have been an 18-year gap in arsenic 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.

From: Joel Geier
To: Benton Public Comment
Subject: LU-24-027: Information to add to the record regarding groundwater
Date: Saturday, May 3, 2025 6:48:59 PM

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Dear members of the Planning Commission and Community Development Department staff:

Please enter the attached document:

> 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.
> *Geosciences* **2022**, *12*, 109. https://doi.org/10.3390/geosciences12030109

into the record for LU-24-027. This is a peer-reviewed, open-access article distributed under the terms and conditions of the Creative Commons Attribution license (https://creativecommons.org/licenses/by/4.0/).

The article contains scientific information that is highly relevant to understanding the flaws in the Applicant's claims that construction of the proposed new landfill will not impact groundwater access and groundwater quality on adjacent properties.

The article describes findings from a scientific investigation of groundwater and its relationship to surface water flow in the Oak Creek watershed, on the west side of Corvallis and also in Benton County.

The Oak Creek watershed is less than 10 miles south of the proposed new landfill, bordering on the Soap Creek watershed in its upper reaches. It is similar to the proposed development in terms of:

- bedrock geology,
- climate including seasonal precipitation,
- topographic relief,
- proximity to the Corvallis Fault.

I've cited this article in my own previously submitted testimony on groundwater issues. The second author, Dr. William (Todd) Jarvis, an Engineering Geologist registered in Oregon, kindly reviewed my testimony on that topic before I sent it to you, and confirmed that my representations of the technical findings in this article were accurate.

In particular, I cited this document as an example of how:

- Groundwater divides do not necessarily coincide with topographic divides

(contrary to the applicant's claims).
- Groundwater directions in fractured bedrock (similar to that under Tampico Ridge) cannot be fully predicted from topography and shallow investigations.
- Bedrock structures such as the Corvallis Fault (which also angles down under the proposed development site) can influence groundwater flow directions.

This study also serves as an example of what the Applicant could have done, if they were genuinely interested to develop an understanding of groundwater in the area around the proposed new landfill. Such an investigation could provide a well-founded analysis of the risks for groundwater resources on adjacent properties.

But the Applicant has not undertaken such an investigation. Instead they're expecting you to accept arguments based almost entirely on the very limited data that they've collected on their own site. They know that this leaves major gaps, which they've tried to fill by conjecture and "arm-waving."

I hope that you will see that **arm-waving in the absence of relevant data is not an acceptable way to dismiss the legitimate concerns of nearby residents**, for whom loss of access of to safe and reliable well water would **seriously interfere with use of their property (Benton County Code 53.215)**.

Thank you for taking this information into consideration for your deliberations.

Yours sincerely,
Joel Geier, Ph.D.
38566 Hwy 99W
Corvallis, OR 97330-9320

From: Joel Geier
To: Benton Public Comment
Subject: LU-24-027: Information to add to the record regarding arsenic
Date: Saturday, May 3, 2025 6:11:57 AM

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Dear Community Development Department staff and members of the Planning Commission:

Please enter the attached document:

> Arsenic in Ground Water of the Willamette Basin, Oregon
> by Stephen R. Hinkle and Danial J. Polette
> Water-Resources Investigations Report 98–4205

into the record for LU-24-027.

This is a publicly available document produced by the United States Geological Survey.

It contains scientific information that is highly relevant to the Applicant's claims that the high levels of arsenic discovered in groundwater at the landfill site are "typical" for this part of the Willamette Valley.

I've cited this document in my own previously submitted testimony on the arsenic issue (in which, I notice now, I misspelled the name of the second author as "Pollette").

This document is technical in nature, so some details may require a scientific background to understand. But here's one simple thing to note:

If you run text search on this document, you'll find that the names of the two counties closest to Coffin Butte Landfill, Benton and Polk, occur just four times in total. Two of those instances are as labels on maps. The other two are for a single document in the list of references. Nowhere in this document is there any mention of arsenic as being a naturally occurring problem in either Benton or Polk County.

In contrast, Linn and Lane counties are mentioned frequently (a total of about 75 time). Linn and Lane are the counties in the southern Willamette Valley where arsenic in groundwater is recognized to be a common problem, not Benton or Polk.

In other words, the "character of the area," in areas of Benton and Polk counties all around the landfill, has been an area where rural residents haven't had to worry about arsenic in their wells, at least up until now.

Thank you for taking this information into consideration for your deliberations.

Yours sincerely,
Joel Geier, Ph.D.
38566 Hwy 99W
Corvallis, OR 97330-9320

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Article

A Hydrogeologic Framework for Understanding Surface Water and Groundwater Interactions in a Watershed System in the Willamette Basin in Western Oregon, USA

Carlos G. Ochoa [1,*], William Todd Jarvis [2] and Jesse Hall [3]

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[2] Institute for Water and Watersheds, Oregon State University, Corvallis, OR 97331, USA; todd.jarvis@oregonstate.edu
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Abstract: A broad understanding of local geology and hydrologic processes is important for effective water resources management. The objectives of this project were to characterize the hydrogeologic framework of the Oak Creek Watershed (OCW) geographical area and examine the connections between surface water and groundwater at selected locations along the main stem of Oak Creek. The OCW area comprises the Siletz River Volcanic (SRV) Formation in the upper portion of the watershed and sedimentary rock formations in the valley. Past hydrologic and geologic studies and our field measurement data were synthesized to create a hydrogeologic framework of the watershed, including a geologic interpretation and a conceptual model of shallow, deep, and lateral groundwater flow throughout the OCW. The highly permeable geology of the SRV formation juxtaposed against the Willamette Basin's sedimentary geology creates areas of opposing groundwater flow characteristics (e.g., hydraulic conductivity) in the watershed. The Corvallis Fault is the primary interface between these two zones and generally acts as a hydraulic barrier, deflecting groundwater flow just upstream of the fault interface. The extreme angle of the Corvallis Fault and adjacent less permeable sedimentary geology might facilitate subsurface bulk water storage in selected locations. The stream-aquifer relationships investigated showed gaining conditions are prominent in the upper watershed's northern volcanic region and transition into neutral and losing conditions in the downstream southern sedimentary region in the valley. Agriculture irrigation seepage in the valley appeared to contribute to streamflow gaining conditions. Results from this case study contribute critical information toward enhancing understanding of local hydrogeologic features and potential for improved SW-GW resources management in areas near coastal ranges such as those found in the Pacific Northwest, USA.

Keywords: hydrology; geology; surface water-groundwater interactions; fault permeability; gaining stream; losing stream

Citation: 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

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1. Introduction

Understanding the interactions between surface water and groundwater (SW-GW) is critical for improved water resources management [1,2]. Surface water and groundwater cannot be seen as isolated components [3] and the role of geology in their spatial and temporal variability throughout the landscape needs to be better understood. The replenishment of groundwater from surface water sources such as irrigation and precipitation can be influenced by geologic characteristics, such as the presence of fractured bedrock or basalt [4], and the timing and quantity of precipitation [5,6] or irrigation [7,8]. A common expression of SW-GW relationships occurs at the stream and aquifer intersection. Geology has long been considered a primary driver of watershed hydraulic characteristics [9–11]

such as streambed permeability and the rate of surface water infiltration into the aquifer [12]. A variable SW-GW flow exchange can influence the streamflow volume between any two points along the stream and can create gaining conditions where groundwater inputs contribute to streamflow, or losing conditions where streamflow is lost through the permeable substrate [13–15]. Groundwater inputs can constitute a significant portion of the overall streamflow volume of a gaining reach or stream, especially during low-flow conditions [16]. The SW-GW connections are highly dependent on the geological features responsible for water transport and distribution throughout the landscape [4,17–19].

Geologic faults are another feature that significantly influences SW-GW relationships, particularly the dynamics of groundwater flow. Faulting impacts groundwater hydrology by altering flow vectors near the fault core zone [20]. Fault gouge, coupled with separation, creates a broad spectrum of hydraulic barriers, conduits, or a combination of these [4,17,20,21]. Impermeable areas within fault zones can sever the hydraulic continuity of aquifers, producing incongruent groundwater tables and isolated groundwater compartments. Active faults can have irregular fault core thickness and a degree of damage to surrounding rock along their profile length [21]. Varying degrees of damage and fault gouge create significant contrasts in permeability along with the fault profile, and as a result, a single fault can be both a barrier and a conduit for groundwater flow [21,22].

A common resource management integration of SW-GW relationships is by using groundwater replenishment tools such as managed aquifer recharge (MAR). In a 60-year retrospective of global MAR, Dillon et al. [23] indicated that "*MAR is a management tool to consider with and complement new efficiency measures in irrigation, switching to low water use crops, conjunctive use of surface water and groundwater resources including substituting use of recycled water for groundwater, and foregoing extraction*". The drivers for considering MAR in various forms include limited surface reservoir sites, increased costs associated with surface water treatment for harmful algal blooms, decreasing barriers to fish passage, and increased costs to purchase water from regional water suppliers. Over the past 50 years, the storage of managed aquifer recharge in the US has increased nearly 10-fold from approximately 300 Mm^3 $year^{-1}$ in 1965 to 2570 Mm^3 $year^{-1}$ in 2015 [23].

According to the Oregon Water Resources Department (OWRD), managed recharge and related aquifer storage and recovery (ASR) projects have been operating in Oregon since 1996, with more than 7.5 Mm^3 per year stored annually. Potential aquifer storage identified by Woody [24] approaches Oregon's annual public water supply in the year 2000, or 500 Mm^3. Oregon currently has approximately 15 state-authorized and planned ASR test sites servicing municipalities and agriculture. Most of these sites store water in volcanic rock aquifers, including the Siletz River Volcanics [24]. The use of small-scale managed recharge utilizing rainwater or spring water for domestic well storage is increasingly considered in mountainous areas underlain by low permeability volcanic rocks and siltstone [25,26]. Likewise, a market for aquifer storage space is gaining momentum as the concept of Aquifer Recharge Units (ARU) is being developed [27].

Characterizing hydrogeology's role in SW-GW interactions is critical for understanding the potential for integrated water resources management, including stream-aquifer interactions and groundwater recharge. This project examined hydrogeological features influencing SW-GW interactions in the southern portion of the Willamette Basin region in western Oregon, USA. The objectives of this case study were to: (1) characterize the hydrogeological framework of the watershed geographical area, and (2) examine stream-aquifer relationships along the main stem of the creek.

2. Materials and Methods

2.1. Study Site

The study was conducted in the Oak Creek Watershed (OCW) within the Willamette Basin region. The OCW (44.57° latitude; −123.30° longitude) encompasses 3360 hectares, and it is adjacent (west) to the City of Corvallis, Oregon, USA. The main stem of Oak Creek

flows 11 km from its source and highest point (650 m above sea level, MASL) in the McDonald-Dunn Forest to its lowest point (64 MASL) at the confluence with Marys River. The climate in the region is a Mediterranean type, with a warm and dry season in the summer and a mild and wet winter season. Most precipitation occurs as rainfall between November and April. Mean annual precipitation within the basin ranges from 2500 mm at higher elevations to 1000 mm at lower elevations [28]. The monthly-averaged lowest temperature occurs in January (0.67 °C), while the highest occurs in August (27.4 °C). The lowest and highest total monthly precipitation occurring in July (9.1 mm) and December (181.4 mm), respectively [29]. Oak Creek is a fourth-order headwater stream with discharge volumes generally ranging between 0.01 $m^3 s^{-1}$ and 0.25 $m^3 s^{-1}$, and peak discharge reaching up to 6 $m^3 s^{-1}$ in the winter. Upland overstory vegetation at the OCW is dominated by Douglas-Fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and western red cedar (*Thuja plicata*). At lower elevation sites, White oak (*Quercus alba*), red alder (*Alnus rubra*), Oregon ash (*Fraxinus latifolia*), and bigleaf maple (*Acer macrophyllum*) dominate the landscape.

Land cover in OCW encompasses forest (70%), agriculture (12%), urban (12%), and undeveloped (6%). Land use categories at OCW include forestry in the uplands, agriculture in mid to lower elevation sites, and urban including Oregon State University (OSU)'s main campus at the bottom of the watershed. Much of the area of the OCW is a mixture of publicly and privately-owned forest maintained for uses such as timber harvest, protected water drinking water-supply source areas, recreation, and forestry and agricultural research stations associated with the Colleges of Agricultural Sciences and College of Forestry at OSU. Approximately 20 hectares of OSU's pasture fields in the lower valley are irrigated with water diverted from Oak Creek during the summer. Water pumped from the creek is run through underground pipes that feed individual irrigation lines with multiple sprinkler pods at different fields. The rest of the agricultural activity in OCW depends mostly on the soil moisture accumulated during the wet precipitation season in the winter. No deep groundwater extraction for agriculture irrigation currently exists at the OCW. The Siletz River Volcanic (SRV) rock formation underlying much of OCW has become increasingly important for municipal and domestic water supplies in the last 30 years [30]. Over the past 20 years, significant residential growth near the cities of Corvallis and Philomath, Oregon, USA has been occurring [30,31].

The generalized hydrostratigraphy of the rocks underlying OCW has been summarized by [20,30,32,33] based on water well logs available from the OWRD, oil exploration wells available from the Oregon Department of Geology and Mineral Industries (ODGMI), field examination of rock quarries, outcrop examination, and hydrogeologic mapping (Table 1).

Table 1. Lithology, permeability, and hydrologic features of the various geologic formations at OCW.

Formation Name	Generalized Lithology	Permeability Architecture	Hydrologic Properties
Alluvium	Sand, gravel, cobbles thin, 10 m thick	Porous media.	Prolific yield for irrigation near Willamette River.
Spencer/Tyee/Yamhill, undifferentiated	Shale, siltstone, interbedded sandstone, up to 3000 m thick	Microfractures in siltstones and shale, porous media in sandstones.	Low yield for domestic wells. Some saline water and artesian flow in deep sandstones.
Siletz River Volcanics	Basalts with interbedded claystone and sandstone, up to 1000 m thick	Fractures, conduit flow in interflows. Stratigraphic and structural groundwater compartments common.	Moderate yield for domestic and municipal wells.

2.2. Hydrogeologic Framework

2.2.1. Site Geologic Conditions Map and Hydrogeologic Cross-Sections

Information from several sources including previous geophysical research conducted in the OCW [20], oil and gas exploration well logs maintained by the ODGMI, United Stated Geologic Survey (USGS) geological maps, OWRD water well logs, and our field-based data were used to create a Site Geologic Conditions Map along with cross-sections of site geologic and hydrogeologic conditions (Figure 1).

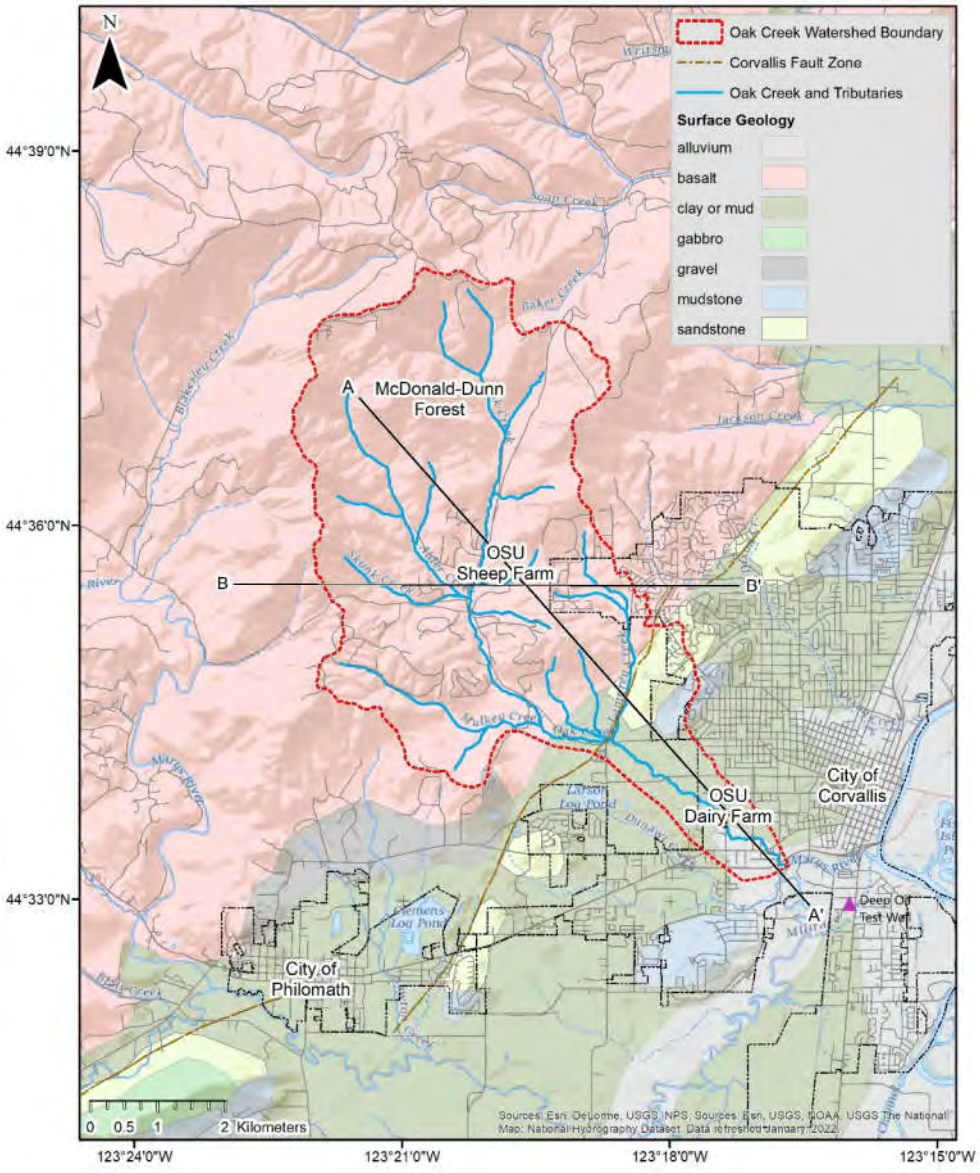


Figure 1. Surface geology map showing geologic cross-section locations and the main geologic features in the Oak Creek Watershed (OCW) and the surrounding region including Corvallis, Philomath, and Oregon State University (OSU).

Well logs of particular interest included those of a 655 m deep well completed in 1934 by the Willamette Petroleum Syndicate (WPS) located in south Corvallis near the outlet of the watershed (see Figure 1), and a 2581 m deep well completed in 1964 by the Gulf Oil Corporation of California (GOC) located approximately 18 km to the southeast near

Halsey, Oregon, USA (location not shown on Figure 1). The GOC well penetrates surficial alluvial deposits of soil, clay, sand, and gravel before encountering the Eugene Formation, the Spencer Formation, the Yamhill Formation, the Tyee Formation, and finally, the SRV Formation at 2160 m below ground surface. The WPS well records are relatively complete to a depth of 655 m, other than a missing section between 412 and 475 m depth, which was likely omitted due to a high-pressure water flow event occurring when the borehole was deepened with a cable tool. The well log annotation substantiated that the drillers required a water shut-off valve when they reached approximately 450 m. This interval is likely a confined aquifer and is stratigraphically located in a volcano-clastic conglomerate mentioned in the GOC well log. If the missing zone and the volcano-clastic zone are stratigraphically equivalent, this zone's apparent thickness likely decreases from nearly 450 to 60 m thick from east to west.

Seismic reflection data and deep exploratory well logs throughout the Willamette Valley reveal the bottom SRV unit extends from beneath the continental shelf in the west [34,35] to as far east as the Cascade Range [20]. Geophysical evidence shows the thickness of the SRV formation to be approximately 8 to 18 km [36–38], with about 4.5 km exposed west of the Corvallis Fault [20].

The Corvallis Fault, which bisects the watershed, is a low-angle reverse-thrust fault [20] uplifting the watershed's northern volcanic region over the southern sedimentary region and pushing it to the southwest. The position of the fault creates two distinct geologic areas with opposing hydrogeologic conditions. Portions of the study site north of the Corvallis Fault overlie the SRV Formation, which consists of a mélange of permeable Paleocene to Eocene submarine basaltic pillow lavas interbedded with less permeable tuffaceous marine sediments which dip approximately 20 degrees to the west. The fault-cutting alignment perpendicular across the watershed creates an abrupt interface between the northern high conductivity volcanic geology and the southern low conductivity sedimentary geology. Additionally, numerous dikes of gabbro, diorite, and aplite rock cut through the fault zone and act as hydraulic barriers, completely severing the hydraulic connection at the fault interface and redirecting groundwater in these areas [20]. The low angle of the Corvallis Fault creates a wedge of Siletz Formation volcanic rocks overlying Spencer and Tyee formation sedimentary rocks [20] which compartmentalizes vertical groundwater movement and promotes horizontal groundwater movement parallel to the fault line.

South of the Corvallis Fault, geology abruptly transitions into thick repetitious sequences of bedded units of graded sandstones, siltstones, and shales [39]. Fractured marine basalt found north of the Corvallis Fault interface is highly permeable due to large conduits (fractures) cutting through the formation; however, the rock itself is nearly nonporous. Conversely, the sedimentary formations found south of the fault are more porous but less permeable.

These two regions' opposing hydrological characteristics influence where and how groundwater flows and how late into the dry summer season water remains in these formations to supply surface water streams (baseflow). The Tyee and Spencer formations, sandstones and siltstones with high porosity (14% to 49%) but low permeability (1×10^{-11} to 6×10^{-6} m s^{-1}), can sustain baseflow into surface water streams later into the dry season when compared to the less porous (3% to 35%) and more permeable (4×10^{-7} to 2×10^{-2} m s^{-1}) basalts of the SRV Formation [40,41].

To better understand the geologic structure of the OCW, we constructed two hydrogeologic cross-sections (A-A' and B-B'), the locations of which are shown on the surface geology map (see Figure 1). Cross-section A-A' runs from the McDonald-Dunn Forest in the northern region of the watershed in a southeast direction through Oak Creek and the Corvallis Fault. Cross-section B-B' runs from west to east, approximately perpendicular to Oak Creek at the OSU Sheep Center.

Subsurface geology and static water level information represented on the geologic cross-sections were obtained through the analysis of over 600 OWRD well logs, two deep

exploration drill logs (WPS and GOC), geology maps, previous research reports [20,30,32,42], and our stream and shallow groundwater well level information. Geologic and hydrologic data of wells within 250 m of each side of the cross-section line were projected onto the cross-section transect to create a vertical hydrogeologic profile (n = 620). Additionally, well log stratigraphy from the nearby WPS and GOC deep exploration wells were projected to the cross-section profile (n = 2). Together, the cross-sections provide a three-dimensional representation of the hydrogeologic framework of the OCW site and an indication of how the Corvallis Fault affects OCW groundwater dynamics.

2.2.2. Stream-Aquifer Interactions

We used shallow groundwater and stream levels data to assess stream-aquifer interactions at one site (OSU Sheep Center; 118 MASL) in the northern volcanic portion of the watershed and one site (OSU Dairy Center; 80 MASL) in the southern basin-sediment infills. Data from previously installed monitoring wells (<6 m depth; 50 mm diameter) were used to characterize water table fluctuations at these two sites [33]. Two wells (sw-1 and sw-2) were in the riparian area at the OSU Sheep Center, and three wells (dw-1 to dw-3) were located in the riparian zone at the OSU Dairy Center. A laser level was used to measure onsite soil surface, stream, and water table elevation to develop cross-section profiles at each location. Data from two other wells in a 2-ha irrigated pasture grass field and one well in its adjacent riparian area, near the stream gauge, were used to characterize irrigation percolation contributions to the shallow aquifer and potential return flow to the stream. All wells were equipped with water level loggers (Model HOBO U20-001-01, Onset Computer, Corp., Bourne, MA, USA) and programmed to record data every hour. A water level meter (Model 101, Solinist Canada Ltd., Georgetown, ON, Canada) was used to collect depth to water table during selected dates. These data were used for verification or calibration of the water level loggers. A water level logger (Model HOBO MX2001, Onset Computer, Corp., Bourne, MA, USA) was installed in each location (OSU Sheep Center and OSU Dairy Center) to measure stream water level fluctuations.

In addition to the monitoring of stream and groundwater levels to assess stream-aquifer interactions, we also monitored hydrostatic pressure differential at selected locations in the streambed during summer groundwater baseflow conditions. We built a hydraulic potentiometric manometer (potentiomanometer) [33] to collect hydrostatic pressure data from 20 different locations along the creek, from its headwaters to its mid and lower reaches. Three measurements at each location were taken at 1 m depth in areas where streambed conditions permitted an adequate seal between the potentiomanometer and surrounding sediment. Locations with large rocks, highly compacted sediments, or sand and gravel bottoms did not provide adequate conditions for manometer readings. A 'vertical gradient' (positive or negative) was obtained for each location based on the potentiomanometer readings. Hydrostatic pressure values of zero or between −1 and 1 mm were considered to be neutral [33].

2.2.3. Potentiometric Surface Map

We developed a potentiometric surface map based on a previous study on springs and losing reaches of the upper watershed [30], static water level data obtained from OWRD well logs, surface water levels of surrounding rivers and streams, and data obtained from our observation wells. Potentiometric contour lines were created by first generating an Excel® spreadsheet detailing the position of wells, surface water observation locations, and the respective static water level of our observation wells at each location. Static water level (meters below ground surface) was then subtracted from the ground surface elevation to obtain hydrostatic head in meters at each location. The OWRD water level measurements span approximately 65 years and at different times of the year, as summarized in their well-log database. We acknowledge there could be much uncertainty; consequently, all the wells' data are referenced as a generalized summary of water level measurements. Long-term data from observation wells at or near OCW are scarce.

Data from a well near the OCW showed seasonal static water level variations of about 4 to 25 m during the period or record 1994 to 2014 (Figure A1). This is within the contour interval of 25 m we used in generating the potentiometric surface map.

Given static water levels in individual wells represent a snapshot in time, synoptic contour lines were generated using the spatial analyst extension of ArcMap® (Version: 10.4.1, ESRI, Redland, CA, USA) to create a digital elevation model (DEM) of the water table surrounding the OCW. Spatial analyst does not consider the influence of the Corvallis Fault when using water elevation data to generate the DEM. Thus, specific contour lines were manually edited to show the elevation of groundwater more accurately as it crosses the geologic interface at the Corvallis Fault. These maps were compared to and shown to be consistent with past hydrologic research in the area (see for example [32]).

Potential lines were edited where there were conflicting or limited data. For example, the potential lines were not shown in areas with a limited potentiometric low associated with pumping from clusters of domestic wells. Likewise, the potential lines were adjusted where our field observations of the potentiomanometer readings suggested gaining or losing reaches that conflicted with direct field observations such as a spring occurrence or detailed water level measurements in dedicated observation wells.

3. Results

3.1. Hydrogeologic Framework

3.1.1. Hydrogeologic Cross-Sections

Figure 2a,b shows the cross-sectional representation of the three distinct geologic formations found at the OCW study site: the fractured and highly permeable SRV Formation to the north of the Corvallis Fault, the low permeability Tyee and Spencer Formations to the south of the fault, and the fault zone itself. The water table in the sedimentary basin region is laterally continuous compared to stratigraphically compartmentalized water-bearing zones found in the Siletz Formation [30]. Depths to water in the OCW site ranged from nearly ground-surface (<1 to 3 m) in the upper region of the watershed near the McDonald-Dunn Forest to nearly 100 m below ground surface in the central portion of the watershed near the OSU Sheep Center (see Figure 1).

Figure 2a (cross-section A-A') shows the multilayered aquifer system of the SRV formation, as well as the shallow and deep aquifer zones of the basin region east of the fault. Data from the WPS and GOC deep exploration wells showed that the water table in the basin east of the fault was generally within 3 to 5 m below the ground surface, with slight fluctuation throughout the year. The GOC drill logs showed a 400+ m thick layer of a water-bearing zone of volcano-clastic conglomerate extending as far west as the Corvallis Fault. Dip estimations suggest the volcano-clastic layer shallows to the west from the GOC well and could be located 10 to 60 m below the OSU Horse Center (Figure 2a). Previous field observations by Goldfinger [20] near the City of Philomath, OR, noted this volcano-clastic layer outcropping in a gravel pit within Spencer Formation siltstones on the Corvallis Fault interface. The volcano-clastic layer at the Philomath Gravel Pit supports the notion that this layer is contiguous east to the GOC exploration well location, dipping between 1 and 3 degrees to the north striking to the southwest.

Figure 2b (cross-section B-B') illustrates the Siletz River Volcanics region of the watershed. Data from nearby well logs showed unconfined, confined, perched, and compartmentalized aquifer systems within the SRV formation near the OSU Sheep Farm. Depth to water table data was more erratic as the distance from Oak Creek increased, with static water levels adjacent to the creek found near the ground surface. Static water levels decreased in elevation as the distance from the creek increased. Additionally, artesian wells near the west end of the profile (data not shown) indicated confined aquifers within the SRVs near the OSU Sheep Center and McDonald-Dunn Forest. During the dry season, the central water-bearing unit in this region appeared to be individual isolated pockets of sandstone within the SRVs.

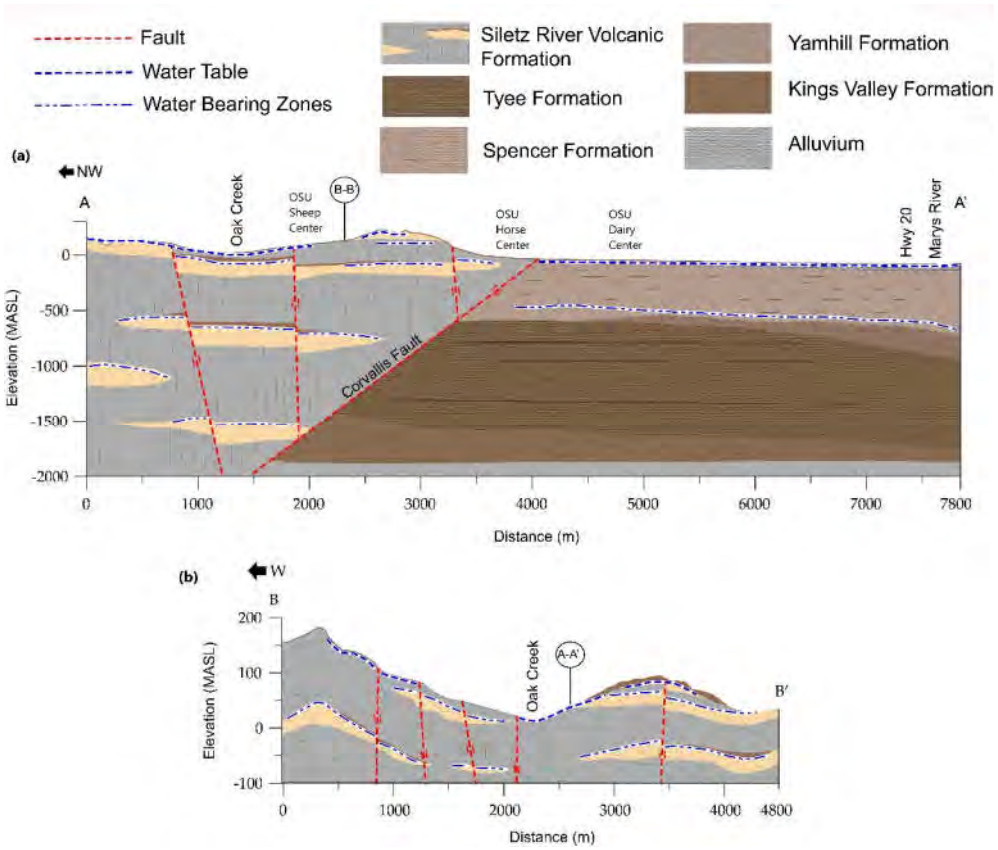


Figure 2. Geologic cross-sections of the Oak Creek Watershed. (**a**) Cross-section A-A′ (drawn to scale) runs from the headwaters of Oak Creek in McDonald-Dunn Forest, southeast to the confluence with Marys River. (**b**) Cross-section B-B′ (drawn 5× vertical exaggeration) runs from the headwaters of Oak Creek in the McDonald-Dunn Forest southeast to its confluence with Marys River.

3.1.2. Stream-Aquifer Relationships

Figure 3 shows three years (2019–2021) of seasonal water level fluctuations in the stream, the monitoring well in the riparian zone, and a well in a non-irrigated crop field at the OSU Dairy Center, in the sedimentary rock formations (see Figure 1). The well in the riparian area is 6 m north of the stream, the well in the irrigated field is 160 m north of the stream, and the well in the non-irrigated agricultural field is 90 m south of the stream. Relatively rapid rises and declines in stream level in response to rainfall events during winter and spring were observed. Groundwater levels in all wells began rising with the onset of winter precipitation, which reached its peak in January. Following the end of the rain season in the spring, groundwater levels started a steady decline, which in the non-irrigated field continued until baseflow conditions were reached in the fall. In the irrigated field, groundwater levels started rising soon after the onset of the irrigation season (July to September) and remained relatively high during the summer and fall. A slight groundwater level rise during the irrigation season was also observed in the riparian area well, located 6 m north of Oak Creek and 40 m south of the irrigated field's edge. Marginal to no summer precipitation was observed during the three years evaluated; therefore, the groundwater level rises observed in the wells in the irrigated field and riparian area were attributed to irrigation seepage and return flow to the stream, respectively. All irrigation applications were from water diverted from Oak Creek. Total water applied (irrigation depth) for the pasture field depicted in Figure 3 was 510 mm in 2020 and 670 mm in 2021. No records are available for 2019. Annual total precipitation was 871, 1004, and 1043 mm in 2019, 2020, and 2021, respectively.

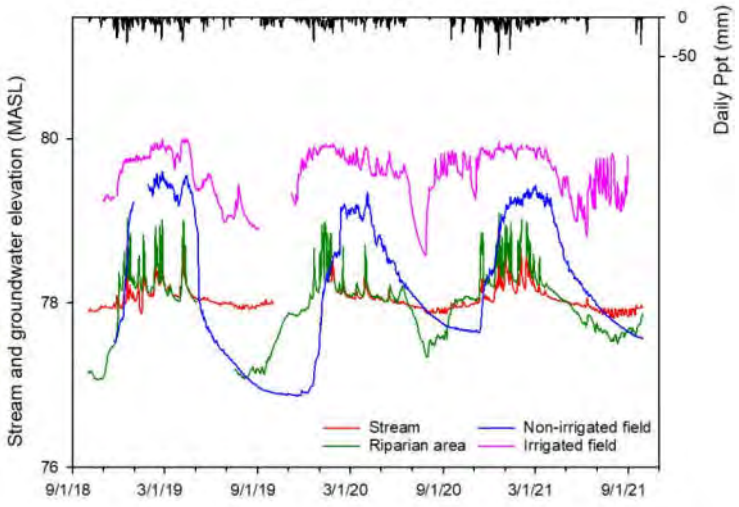


Figure 3. Seasonal surface water and shallow groundwater response to precipitation (Ppt) in three water years (2019 to 2021) at in-stream and various monitoring well locations at variable distance from Oak Creek's mainstem near the OSU Dairy Center: a well in the riparian area 6 m north of the stream, a well in an irrigated field 160 m north of the stream, and a well in a non-irrigated agricultural field 90 m south of the stream. Irrigation season is typically July to September every year. Daily Ppt records obtained from https://agsci.oregonstate.edu/hyslop-weather-station (accessed on 30 January 2022).

A closer look at stream and groundwater levels variability in the wells in irrigated, non-irrigated, and riparian areas during the 2020 irrigation season (27 July to 12 September) is shown in Figure 4. A downward groundwater level trend, typical of the transition to baseflow conditions in the summer, can be observed in all wells before the start of irrigation. While a steady decline in groundwater level occurred in the non-irrigated field during the rest of the season, the well in the irrigated field first, followed by the well in the riparian area, showed a rise in groundwater level of up to 1.18 m a few days after irrigation started. Several peak and slow decline events observed in the irrigated field well corresponded to irrigation applications. Groundwater levels for both the riparian and irrigated field wells continued higher than the non-irrigated field during the remainder of the irrigation season.

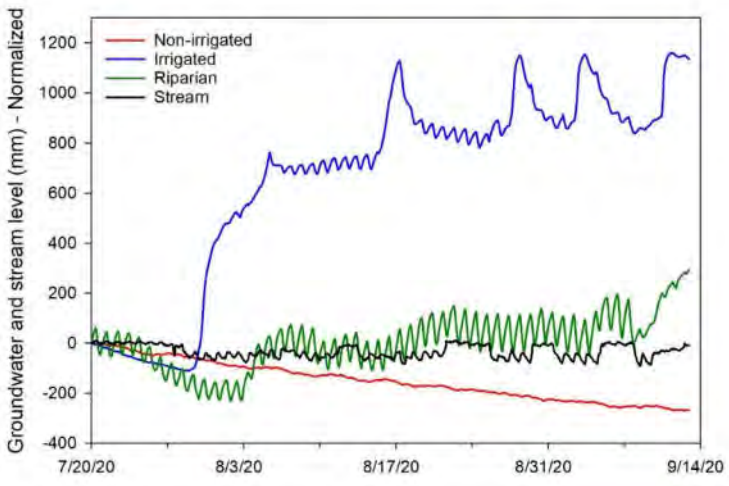


Figure 4. Stream and shallow groundwater level variability in wells at riparian, irrigated, and non-irrigated field locations during the 2020 irrigation season (27 July to 12 September).

Variable seasonal stream-aquifer interactions along non-irrigated fields in both the SRV and Sediments formations were observed. Figure 5a shows groundwater and Oak Creek levels at an upstream cross-section at the OSU Sheep Center, in the SRV rocks-dominated area of the OCW in 2021 (See Figure 1). The steep gradient between groundwater and stream levels for peak flow in the winter and baseflow in the summer indicated 'gaining' streamflow conditions. Figure 5b shows groundwater and Oak Creek levels at a downstream cross-section at the OSU Dairy Center, in the Sediments portion of the OCW. At this reach, groundwater and stream levels showed 'losing' streamflow conditions during the summer (baseflow) and 'gaining conditions' during the winter precipitation season.

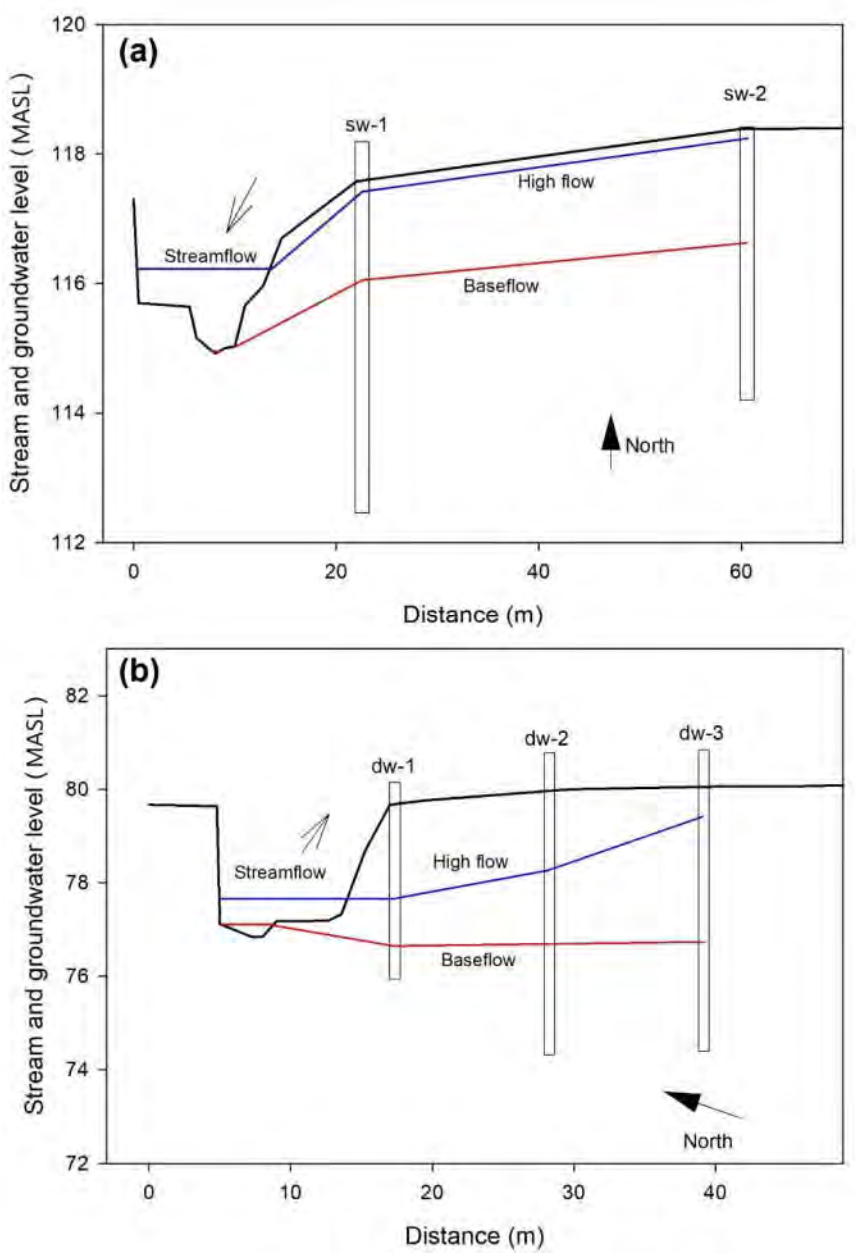


Figure 5. Surface water and groundwater levels (MASL) at baseflow (summer) and high streamflow (winter) conditions in (**a**) the Siletz River Volcanics formation at the OSU Sheep Center and (**b**) the alluvium in the Spencer formation at the OSU Dairy Center.

Data from the potentiomanometer test conducted under baseflow conditions in the summer showed that the Oak Creek streambed is losing water to the aquifer at locations upstream from the confluence with Alder Creek (see Figure 1), in the permeable fractured volcanic geology, as indicated by the negative pressure values obtained. The negative vertical hydraulic gradient gradually decreased until it reversed at approximately 3 km upstream of the Corvallis Fault, where multiple readings showed a positive slope immediately upstream of the fault. Once Oak Creek crossed the Corvallis Fault, hydraulic gradients became much less variable and maintained neutral or positive pressure conditions, as reported in [33].

3.1.3. Potentiometric Surface Map

The potentiometric surface map (Figure 6) generated from shallow static water level and surface water level data showed that the region's water table generally followed surface topography across the study area. Most of the groundwater within the OCW originated in higher elevations in the McDonald-Dunn Forest and flowed down-gradient to the south towards Oak Creek and Marys River's confluence. Water table elevation levels are 1 to 3 m higher on the northern side of the fault line and then drop significantly immediately past the fault. Once past the fault plane, water table elevations and gradients had much less variance than those of the volcanic region. In the southern region, surface topography affected water table elevations in places, but groundwater generally flows at a consistent gradient toward either the Marys River or the Willamette River.

The watershed's northern volcanic portion was characterized by downward vertical gradients that flowed from several aquicludes and aquitards, resulting in a multilayered aquifer system (see Figure 2a: Cross-Section A-A'). Water table levels in the southern sedimentary region of the watershed generally remained much more consistent, only fluctuating between 1 to 5 m throughout the year.

The Corvallis Fault lies at the boundary between the Siletz Formation and the Tyee and Spencer Formations and acts as the interface between these two opposing hydrologic zones. Potentiometric contour lines generated from OWRD well log data indicated that the fault zone acts as both a barrier and a conduit for groundwater flow through the fault interface. Impermeable zones within the fault deflect groundwater, while large fractures and truncations allow groundwater to pass. Additionally, the abrupt change in permeability between the two formations impacts groundwater paths and velocities, as fluid transfer through geologic material is much more efficient in the watershed's northern volcanic region.

Hydraulic gradients within the OCW generally mimic the topography, with groundwater circulating from higher elevations towards lower elevations in the creek channel or to the south in the basin. This is generally true down to the Corvallis Fault, where the fault's impermeable nature causes groundwater to flow parallel to the fault plane until it either finds a conduit or flows through the terminus of the fault damage zone.

Potentiometric contour lines adjacent to the fault have been altered by the change in permeability architectures and the less-permeable fault zone, which has caused them to become fragmented in places. Additionally, water table elevations in the Oak Creek basin within 1 to 2 km northwest of the fault-line have been elevated, as indicated by the area's diminutive groundwater flow gradient.

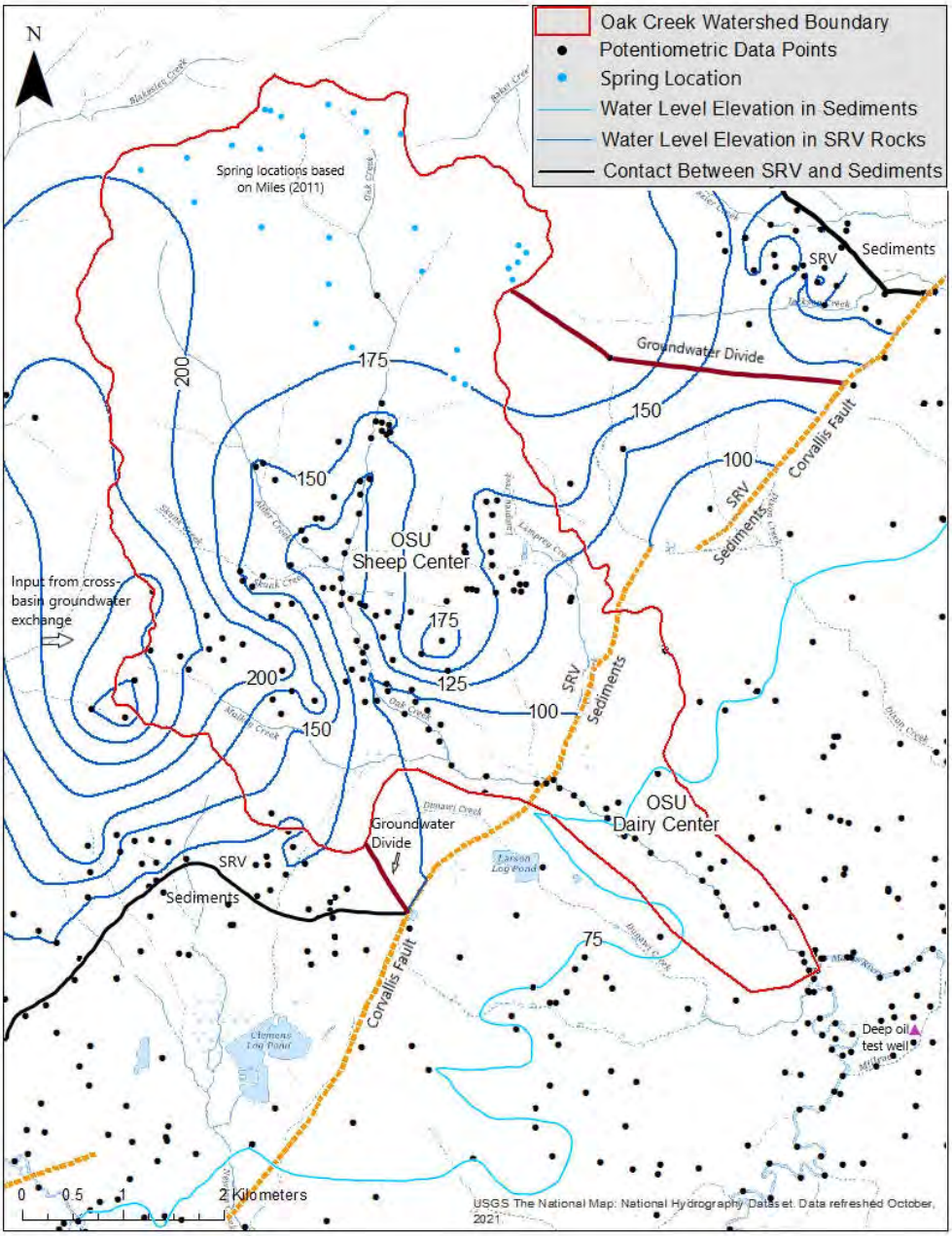


Figure 6. Potentiometric surface map of the Oak Creek Watershed and the surrounding region.

3.1.4. Conceptual Model

A conceptual (block) model, including the neighboring hydrogeologic conditions, was created to gain a three-dimensional representation of the OCW and surrounding region's hydrogeologic framework. The model developed is a synthesis of available topographic, geologic, and hydrologic data. Location, depth, and representation of geologic formations and structures were based on geologic descriptions from well logs and maps described by Goldfinger [20]. The nearby WPS and GOC deep exploration wells drilled southeast of the OCW provided data on subsurface geology structure, including lithology, potential water-bearing zones, dip and strike of geological layers, and water quality. The dip angle and distance from the exploration wells to the study area were considered when interpreting hydrogeological structure and conditions.

The Oak Creek Watershed conceptual model (Figure 7) shows that watershed hydrologic characteristics are dominated by surface topography and geology. The highly contrasting permeability architecture of the opposing geologic formations and the fault between the northern volcanic and the southern sedimentary regions influence groundwater flow through the fault interface. This groundwater compartmentalization model is consistent with other studies completed in fractured volcanic aquifers in Oregon [4,43]. Past drilling and other research data [20,30] in the OCW have indicated numerous intrusions of very low permeability volcanics throughout the region, especially along faults. The contrasting permeabilities of the northern and southern regions paired with impermeable intrusives along the fault interface have produced a zone of decreased permeability along the fault plane. As groundwater circulates hydraulically down-gradient and encounters this zone, velocities decrease, and flow is deflected along the fault strike. Groundwater gradients within the two regions of the study site are highly contrasting, with higher grades in the northern volcanic region compared to a lower grade in the southern sedimentary region. The fracture permeability, coupled with the higher surface slope in the Siletz Formation, results in a discontinuous water table with numerous perched and confined systems. In contrast, low permeability, and low gradients in the Tyee and Spencer formations of the southern region create a shallow water table circulating towards the Willamette River, which serves as a regional hydraulic sink (Figure 7).

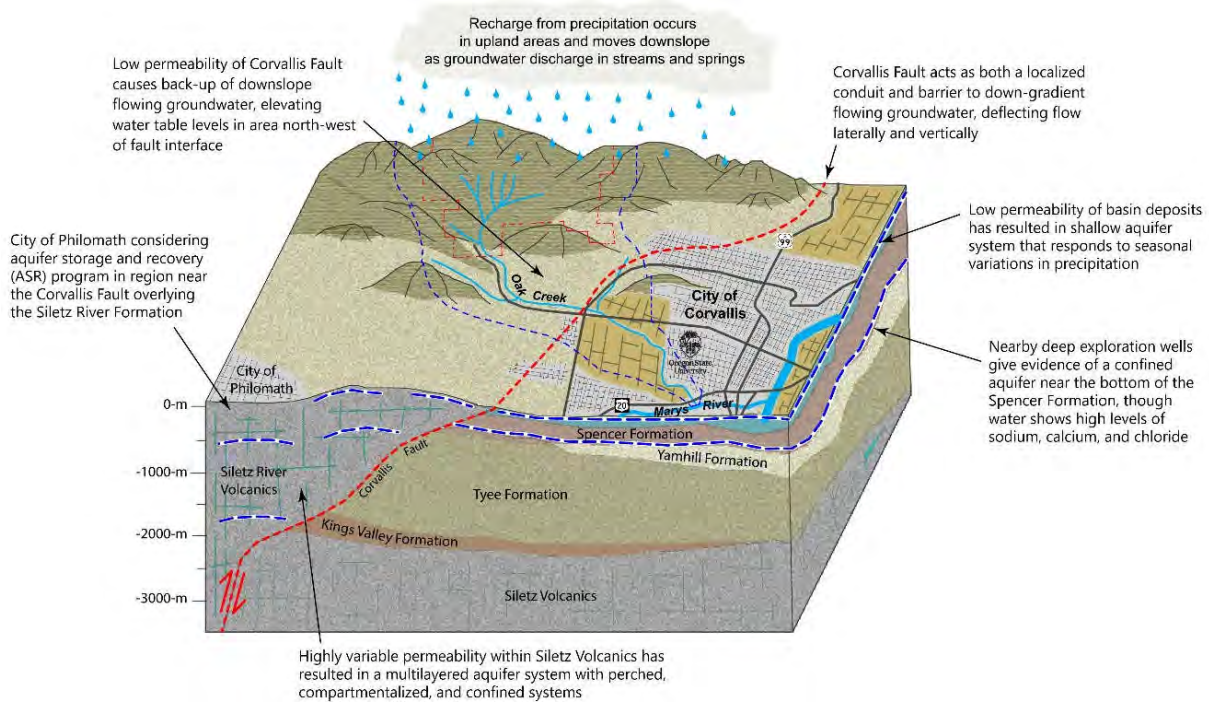


Figure 7. Conceptual model of the groundwater system of the Oak Creek Watershed and surrounding region based on a synthesis of topographic features and data from hydrologic and geologic investigations.

4. Discussion

4.1. Interaction of Geology and Hydrology

Previous sections discussed the geology and hydrology using a synthesis approach building upon rather than duplicating previous studies. Most of the physical hydrology studies summarized in this study focused on low flow conditions, given this is a time of year with competition for water use between agricultural facilities, fisheries, and rural residential land use rather than exploring the interaction of geology, direct runoff, and

baseflow. Seasonal SW-GW connections are variable and can be contrasting within short distances. Gaining conditions are prominent in the watershed's northern volcanic region and transition into neutral and losing conditions in the southern sedimentary region. As depicted in Figure 8, the upper part of the watershed is a springs basin where the SRV is composed of low permeability rock mixed with higher permeability breccia and interflow zones, similar to conditions commonly found in rock quarries. Based on areal analysis, the rocks and interflow zones dip westward due to uplift along the Corvallis Fault. Losing reaches of the incised streams are more common where the topography becomes less steep. Whether the noted stream losses can be directly attributed to a function of changes in permeability architecture is uncertain and its study goes beyond the purpose of this synthesis paper.

The middle section of the watershed constitutes a generally gaining reach of the mainstem of Oak Creek. Drainage from the overlying perched aquifer to springs discharging along the stream bank can be observed downgradient of the OSU animal research facilities. Ground-truthing through observations of water levels in shallow wells confirmed the hydraulic separation of the perched aquifer from the deeper volcanic rock aquifer. Stable isotope analyses of stream water, coupled with general water chemistry analyses, indicate mixing of surface water and groundwater in the OCW exists [44]. Reconnaissance-level stream gauging using a potentiomanometer identified isolated losing reaches [33]. Whether the losing reaches are a function of an apparent increase in intercalated low permeability sedimentary rocks or volcanic rock permeability architecture or stream capture of clusters of permit-exempt wells servicing the rural residences remains unknown without further investigations.

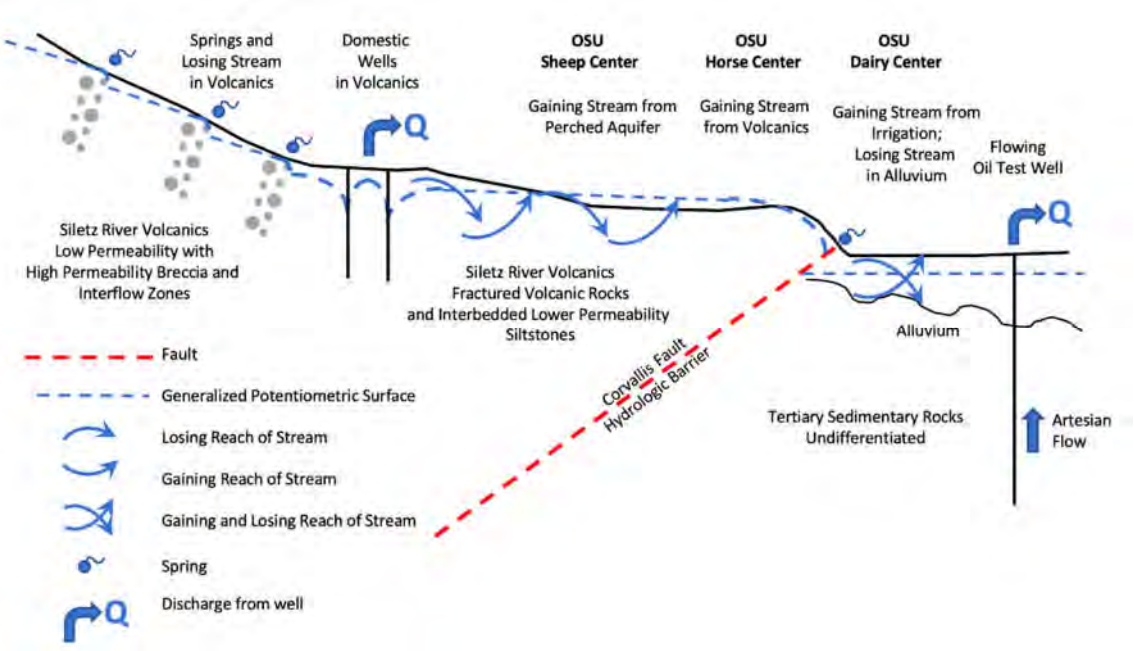


Figure 8. Summary sketch of hydrogeologic observations and interpretations. Not to scale. Generalized orientation of the section coincides with section A-A′ on Figure 1.

Study results showed that the hydrogeology of the OCW is characterized by two regions of contrasting hydrologic properties: the highly fractured and permeable Siltez Volcanic rocks in the northern region of the watershed and the low permeability sediments of the Spencer, Yamhill, and Tyee formations in the southern region. The interface between these two regions is the Corvallis Fault that serves as a hydraulic barrier to groundwater flowing downgradient from the Coastal Range to the Marys River basin to the south

and the Willamette River to the east. The Corvallis Fault severs the hydraulic continuity of the volcanic rock aquifer by juxtaposing the lower permeability sedimentary rocks to the east against the higher permeability rocks on the hanging wall of the reverse fault. The hydrologic barrier interpretation of the Corvallis Fault is corroborated by previous work that mapped the Benton County area's well function, including wells located within the OCW and SRV, Tyee, and Spencer Formations. Transmissivity, specific capacity, and total yield all increased in the Oak Creek Basin area near the Corvallis Fault [30]. These findings are consistent with the hydrogeologic framework presented in this article. As groundwater encounters the less-permeable interface of the Corvallis Fault, it backs up, increasing the amount of groundwater available for withdrawal. This results in groundwater mounding in the SRV north of the fault that contributes to the compartmentalization of the volcanic rock aquifer.

Higher variability of groundwater level exists within the Siletz Formation compared to the Tyee and Spencer formations. The potentiometric surface map developed in this study provides evidence of the northern and southern regions' opposing permeability architectures and hydraulic conductivities. Water contours in the northern region generally have a higher gradient than those in the southern region due to the volcanic rock's greater effective porosity (permeability) and hydraulic conductivity. Water moves more freely through the northern portion of the watershed, and as a result, the hydraulic gradient is steeper in the northern region compared to the southern region. The potentiometric surface map developed in this project is consistent with a groundwater map completed in the Corvallis area that stopped just east of the OCW [32]. While no wells penetrate the Corvallis Fault to confirm the hydraulic separation from west to east, the decrease in hydraulic gradient in wells tapping the sedimentary rocks to the east, coupled with the reported artesian flow from a nearby oil and gas exploration well provides first order approximations of the lack of direct hydraulic continuity across the Corvallis Fault. Irrigation of fields along the lower reach of the OCW also complicate the confident assessment of gaining and losing reaches as some of the return flows from irrigation occur along the north bank of the stream. Yet, water levels measured in shallow wells located on the south bank of the stream are unchanged during the irrigation season.

4.2. Groundwater Compartmentalization

The Corvallis Fault, coupled with complex inter-layering of sedimentary rocks and volcanic rocks and groundwater mounding, has created a groundwater compartment in the OCW. Groundwater compartments have demonstrated the suitability of Columbia River Basalts for the storage of water and gas. Mansfield [45] described a compartmentalized aquifer in northwestern Oregon for aquifer storage and recovery as an affordable alternative to above-ground storage. The Mist Gas Field, located along the Oregon coast near Astoria, Oregon, has been used since the 1980s to store natural gas in compartmentalized volcanic rocks similar to the compartment described by Mansfield, precluding the need for expensive above-ground storage facilities [46]. Harpham [43] designed an Aquifer Storage and Recovery project to repurpose a dam site in the Deschutes Basin near Tumalo, Oregon, USA where a surface water reservoir constructed on the footwall of a fault in the volcanic rocks has never held water since construction in 1915. Ringrose and Meckel [47] cite the role of fault architecture as a critical element for storage site characterization elsewhere in the world, citing a global petroleum assessment where 71% of the known hydrocarbon reserves occurred in structural (i.e., faulted) traps, as opposed to stratigraphic or other traps.

Beyond the trace of the Corvallis Fault, the outline of the OCW groundwater compartment closely coincides with watershed boundary. As depicted in Figure 6, the northern boundary is defined hydraulically by the groundwater mounding or "divide" just beyond the watershed boundary. Likewise, the aquifer compartment's southern boundary closely coincides with the watershed boundary, which is hydraulically defined by groundwater mounding or divide.

4.3. Land and Watershed Management Practices

An isotope and geochemical investigation by Johnson [44] identified a connection between agricultural land use in the middle reaches of the OCW. The preponderance of forest and agricultural use within the OCW, coupled with the related rural residences served by individual permit-exempt water wells, underscores the importance of protecting drinking water supplies, especially given that permit-exempt water wells are typically paired with onsite wastewater systems that are well known for contributing nitrates and phosphorus to groundwater [48]. While the Agricultural Improvement Act (Farm Bill) of 2018 primarily focuses on building partnerships between water utilities and agricultural producers in watersheds to limit nutrient and sediment runoff, the Conservation Partnership Programs rarely address groundwater and much less groundwater supplying drinking water derived from private wells [49].

This paradox is not unique to the Farm Bill of 2018. The Wellhead Protection and Source Water Protection Programs associated with the Safe Drinking Water Act, as amended in 1986, served as the impetus behind states to develop programs to protect groundwater supplying public water systems. However, the Wellhead Protection and Source Water Protection Programs continued to overlook protection for areas serviced by private wells. The Sole Source Aquifer program authorized by the Safe Drinking Water Act of 1974 allowed citizens to petition the Environmental Protection Agency for Sole Source Aquifer Designation when an aquifer supplies at least 50% of the drinking water for a "service area" and if there are no reasonably available alternative drinking water sources should the aquifer become contaminated. This study provides an example of the type of information needed to develop a Source Water Protection program in mixed agriculture, forestry, and rural residential land use through the Sole Source Aquifer petition process.

4.4. Framework Adds to Role of Geology and Potential Groundwater Supplies

One of the ancillary goals of the study was to evaluate the substitution for surface water supplies used by research farms that require temporary dams on Oak Creek which inhibit fish passage. The OCW study offers an unusual alignment of supplemental water needs, hydrogeologic framework that contributes to water supply options, current favorable land use for water quality protection, and aquifer compartmentalization for subsurface storage. The nearby communities of Philomath and Dallas, Oregon, USA are experiencing growth and desire to develop new groundwater supplies and underground water storage options in the same aquifers underlying the OCW. The findings of our study contribute options to supplement these and other local municipal water supplies [50] and can inform proposed aquifer storage and recovery (ASR) projects in the surrounding region. ASR is a proven technology used by many municipalities where water is injected and stored in subsurface aquifers for future extraction. Use of ASR may be possible within the volcanic rocks underlying the OSU agricultural research facilities. Comparable hydrogeologic compartmentalization of the volcanic rocks in the OCW were proven to be instrumental in ASR in the volcanic rocks underlying Warren, Oregon, USA as described by Mansfield [44].

While proximity does not guarantee viability, the OCW is located near other ASR projects utilizing the volcanic rocks for subsurface storage. Aquifer storage and recovery techniques have been shown to be successful within the volcanic rocks serving as water supplies for the City of Dallas, Oregon, USA. The Dallas ASR system is unique in Oregon because the naturally brackish groundwater found in the volcanic rocks mixes with the injected water. However, recovery of injected water has been sufficient to supplement municipal water supplies during periods of water scarcity.

The neighboring City of Philomath is also pursuing ASR for supplementing municipal drinking water supplies and has generated plans to develop two existing drinking water wells. Philomath water managers expect the ASR project to reduce water demands

on the nearby Marys River, which has experienced record low flows during the summer months. Preliminary pump tests and other performance analyses conducted on the City's wells have shown promising results.

The minimal overburden overlying the SRV in the OCW contribute to the viability of managed recharge. Likewise, constructed wetlands could be used to treat water before infiltration. The general lack of land development, except for small agricultural research facilities, research forest, and the few rural residences, make the OCW a valuable location for managed aquifer recharge.

Hydrogeological information in the OCW region is limited as deep drilling in the area has been sparse. The 650-m deep oil exploration well drilled east of the OCW encountered a sufficient water flow that well casing was installed to shut off the flow. The old well records do not report whether the water was fresh or saline, or any estimated flow rates. However, the available deep well data from nearby oil and gas exploration wells suggests that a well approaching 500 m in depth located east of the Corvallis Fault may encounter fine-grained sandstones capable of yielding sufficient water quantities to facilities located in the lower portion of the OCW, though the produced water quality remains unknown. Further investigation, including the drilling of a small diameter test hole followed by geophysical logging, would provide information on the number and thickness of the interbedded sandstones encountered in the test hole. Geophysical logging would also provide a first-order approximation of the salinity of water stored in the sandstones.

5. Conclusions

This case study contributes critical information toward enhancing understanding of local hydrogeologic features and improved groundwater resources management in areas near coastal ranges such as those found in the Pacific Northwest, USA. While this study's goal was to characterize the hydrogeologic framework within and near the Oak Creek Watershed (OCW) and enhance base knowledge of groundwater flow and aquifer fluid dynamics in the region, we were able to link this information for current and future water uses. First, the interaction of geology and hydrology are assessed with particular focus on the hydrologic role of the Corvallis Fault. The hydraulic barrier-conduit role of the fault contributes to the compartmentalization of the volcanic rock aquifer, creating two hydraulically separated groundwater compartments. The complex intrinsic and secondary permeability architecture of the volcanic rock aquifers imposed through flows and later structural geologic history link two adjacent watersheds through inter-basin groundwater flow. These findings provide an opportunity for proactive land and watershed management practices given the OCW and nearby mountainous regions are used, or are anticipated to be used, for residential and municipal drinking water supplies, either through direct capture through wells or secondary capture through managed aquifer recharge storage and recovery. Deep drilling frontiers for underutilized groundwater and aquifer storage exist, as shown by the limited hydrogeologic data reported for a smattering of past oil and gas exploration wells near the OCW.

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Appendix A

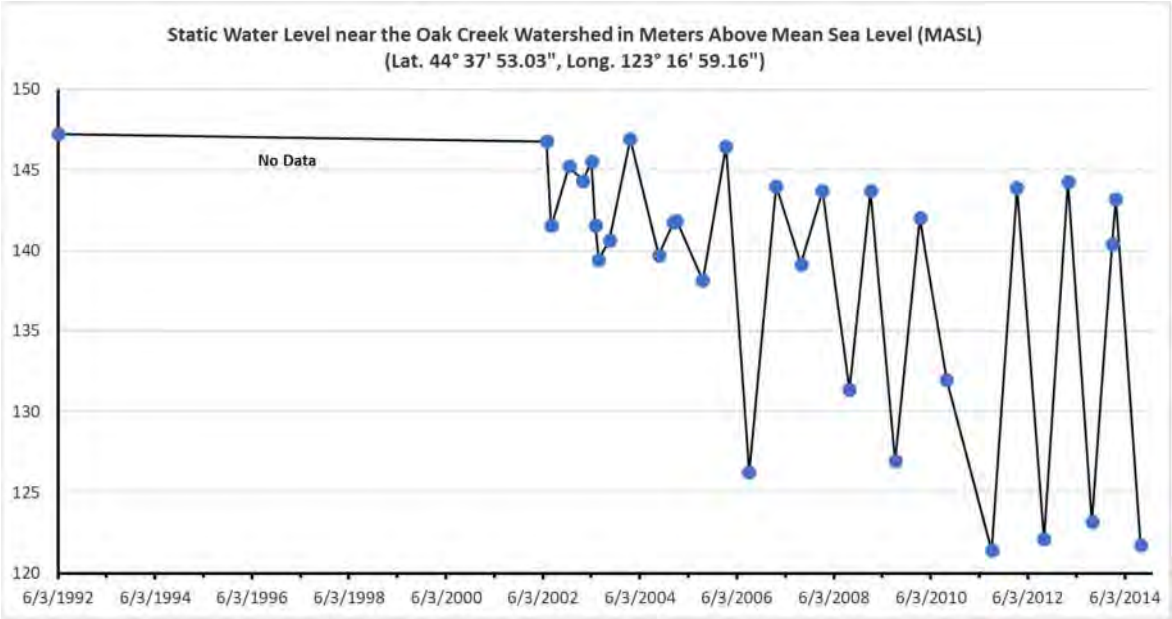


Figure A1. Example of Static Water Level Measurements at Observation Well near the Oak Creek Watershed (OCW), Corvallis, Orgon, USA. Data source (https://www.oregon.gov/owrd (accessed on 30 January 2022)).

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Arsenic in Ground Water of the Willamette Basin, Oregon

By Stephen R. Hinkle *and* Danial J. Polette

SUMMARY AND CONCLUSIONS

Arsenic concentrations exceeding the U.S. Environmental Protection Agency (USEPA) current Maximum Contaminant Level (MCL) of 50 µg/L (micrograms per liter) are widespread in ground water in the Willamette Basin. The Oregon Water Resources Department and the U.S. Geological Survey began a cooperative study in the Willamette Basin in 1996. One goal of this study is to characterize the regional distribution of naturally occurring poor-quality ground water, such as ground water with high concentrations of arsenic. Characterization of the regional distribution of arsenic concentrations in the Willamette Basin will be useful to public health officials, water-resource managers, the medical community, and those using ground water for drinking and cooking.

The spatial distribution of arsenic concentrations in ground water of the Willamette Basin was assessed by combining historical data from 597 sites with data from 131 sites collected for this study. A total of 728 spatially distinct samples thus were available. Additional data also were collected to evaluate temporal variability of arsenic concentrations on a seasonal timescale. Samples were collected quarterly from 17 sites for 1 year for this purpose. Temporal variability was addressed for two reasons: First, characterization of temporal variability allowed evaluation of the acceptability of combining arsenic-concentration data collected during different seasons for determining the spatial distribution of arsenic concentrations. Second, knowledge of temporal variability will benefit well owners and water managers who require guidance on timing for sampling.

During the course of quarterly sampling, arsenic concentrations in water from many wells remained essentially constant, but variations of up to almost a factor of three were observed in other wells. No obvious correlation with season was apparent. Analytical accuracy, as determined from 11 standard reference samples submitted during the course of project work, generally was within ±10 percent, and always ±20 percent. Thus, analytical variability can only explain some of the observed temporal variability. One possible explanation for observed temporal variability in arsenic concentrations is that differences in the amount of pumpage prior to sampling may lead to variations in the amounts of water pumped from different sources (different aquifers or parts of aquifers), and thus, differences in water chemistry.

For a regional assessment of arsenic concentrations in ground water, where arsenic concentrations may vary in space by several orders of magnitude, the relatively smaller temporal variations such as those observed in the quarterly samples are not a significant limitation, and the aggregation of data collected at different times is justified. However, this conclusion may not necessarily apply to all investigations of arsenic concentrations in ground water. For some purposes, site-specific characterization may require characterization of temporal variability. Such characterization may require evaluation over a range of well uses and seasons.

Concentrations of arsenic in the 728 spatially distributed samples ranged from less than 1 to 2,000 µg/L. Concentrations in 58 (8.0 percent) of the samples exceeded the USEPA current MCL.

Regionally, the distribution of arsenic concentrations in ground water of the Willamette Basin appears to be primarily related to aquifer geology. High arsenic concentrations (concentrations exceeding the USEPA current MCL) are widespread in bedrock areas in south-central and eastern Lane County, and Linn County. High concentrations of arsenic also are present in some ground water in the Tualatin Basin (a subbasin in the northwestern part of the Willamette Basin). High arsenic concentrations in Lane and Linn Counties appear to be associated with two regionally extensive associations of rocks, (1) the Fisher and Eugene Formations and correlative rocks, and (2) the undifferentiated tuffaceous sedimentary rocks, tuffs, and basalt. (These rock associations are defined by Walker and MacLeod, 1991. The undifferentiated tuffaceous sedimentary rocks, tuffs, and basalt are approximately equivalent to the Little Butte Volcanic Series of Peck and others, 1964.) At land surface, these two rock associations cover 24 percent of the Willamette Basin. These associations of rocks include extensive volumes of silicic (rhyolitic) volcanic rocks, which are commonly associated with high concentrations of arsenic. High concentrations in the Tualatin Basin are associated with alluvial deposits. At a regional scale, well depth does not appear to be a useful predictor of arsenic concentration in the Willamette Basin. However, depth may be an important parameter on a local scale, particularly where wells of different depth tap aquifers in different geologic units.

Ground waters in bedrock areas in south-central and eastern Lane County, bedrock areas in Linn County, and alluvial areas in the Tualatin Basin may be more likely to yield water high in arsenic than ground water elsewhere in the basin. However, it cannot be assumed that these areas are the only areas in the basin that contain ground water with high concentrations of arsenic. Little or no data exist for many parts of the basin. Even in areas that have been sampled, geohydrologic heterogeneity makes it difficult to formulate meaningful generalizations regarding the likelihood of finding high-arsenic ground water. There is no substitute for actual sampling.

Available information, in combination with an understanding of processes known to promote arsenic mobilization, is sufficient to formulate hypotheses that explain arsenic sources and mobilization in the Willamette Basin. However, available geochemical data and interpretations are sparse. Thus, these hypotheses are preliminary, serving mainly to help direct future geochemical investigation in the Willamette Basin.

Anthropogenic sources of arsenic can be significant in some settings. Arsenical pesticides such as lead arsenate have been used in the basin, and arsenic can be released into the environment from industrial sources. However, regional patterns of arsenic occurrence in Willamette Basin ground water are not consistent with either industrial or agricultural sources of arsenic.

Naturally occurring arsenic commonly is found in a variety of solid phases. Arsenic can be a component of volcanic glass in volcanic rocks of rhyolitic to intermediate composition, adsorbed to and coprecipitated with metal oxides (especially iron oxides), adsorbed to clay-mineral surfaces, and associated with sulfide minerals and organic carbon. Examination of these potential arsenic sources for arsenic availability in the Willamette Basin apparently has never been done.

Two categories of processes largely control arsenic mobility in aquifers: (1) adsorption and desorption reactions and (2) solid-phase precipitation and dissolution reactions. Arsenic adsorption and desorption reactions are influenced by changes in pH, occurrence of redox (reduction/oxidation) reactions, presence of competing anions, and solid-phase structural changes at the atomic level. Solid-phase precipitation and dissolution reactions are controlled by solution chemistry, including pH, redox state, and chemical composition.

Several species of arsenic occur in nature, but arsenate (arsenic V) and arsenite (arsenic III) are the two forms commonly found in ground water. For this study, samples from five domestic wells were analyzed for arsenic species. Two additional analyses for arsenic species in ground water from the Willamette Basin were available in the literature. Arsenite was the predominant species of arsenic in six of these seven samples. The predominance of arsenite has both geochemical and toxicological implications. From a geochemical standpoint, mobility of arsenite differs from that of arsenate. From a public-health perspective, arsenite is more toxic than arsenate, and arsenite also is more difficult to remove from drinking-water supplies than is arsenate. Seven samples do not characterize regional arsenic speciation patterns. However, if the predominance of arsenite in Willamette Basin samples is substantiated by additional speciation work, public health officials and water managers may need to evaluate the scope of the arsenic problem with regard not only to arsenic concentrations, but also to arsenic speciation.

Existing data, including the speciation data, and published interpretations were used to establish preliminary hypotheses for the evolution of high-arsenic ground water in the Willamette Basin. For ground water in bedrock areas of Lane and Linn Counties, existing information suggests that at least some of the following controlling factors likely are important in adsorption and desorption reactions that often control arsenic mobility: (1) high pH, (2) presence of competing anions, and (3) occurrence of reducing conditions. Existing information did not allow for evaluation of the potential importance of adsorption and desorption reactions related to solid-phase structural changes at the atomic level, or solid-phase precipitation and dissolution reactions.

For alluvial ground water of the Tualatin Basin, presence of competing anions and occurrence of reducing conditions may be important controlling factors in arsenic adsorption and desorption reactions. These two factors might be more important than pH controls over arsenic adsorption and desorption. Reducing conditions and high concentrations of dissolved iron also suggest that dissolution of iron oxides, with subsequent release of adsorbed and (or) coprecipitated arsenic, may play a role in arsenic mobility in the Tualatin Basin.

Although the regional distribution of arsenic concentrations in ground water of the Willamette Basin has been evaluated by this study, an understanding of how ground water in parts of the basin evolved to contain high concentrations of arsenic has not yet been developed. Limited geochemical data have allowed establishment of preliminary hypotheses to explain the evolution of high-arsenic ground water. Developing an understanding of arsenic sources and processes responsible for evolution of high concentrations of arsenic, though, will require additional geochemical investigation. In particular, thermodynamic evaluation of ground water chemistry and study of solid phases present in aquifers would facilitate development of an understanding of adsorption and desorption and precipitation and dissolution reactions controlling arsenic mobility in the Willamette Basin. A key benefit of detailed geochemical study of arsenic in ground water of the Willamette Basin would be increased predictability of areas likely to yield ground water with high arsenic concentrations. Such increased predictability would be likely to have transfer value beyond the Willamette Basin.

INTRODUCTION

In response to increasing demands on ground-water resources in the Willamette Basin, Oregon (fig. 1), the Oregon Water Resources Department (OWRD) and the U.S. Geological Survey (USGS) began a cooperative study of the basin's ground-water resources in 1996. This study was designed to increase the current understanding of the ground-water resource, and to better characterize the distribution of naturally occurring poor-

Figure 1



Figure 1. Location of the Willamette Basin, Oregon.

quality ground water in the basin. Essential components of the study of the physical ground-water resource are the development of a quantitative understanding of regional ground-water availability and flow, and of ground-water/surface-water interactions. Of paramount interest in the characterization of naturally occurring poor-quality ground water in the Willamette Basin is the distribution of arsenic in ground water, the subject of this report.

Arsenic contaminates many regional aquifer systems worldwide (Cantor, 1996; Thornton, 1996), and arsenic commonly is detected in ground water of the Willamette Basin at concentrations exceeding the U.S. Environmental Protection Agency (USEPA) current drinking water Maximum Contaminant Level (MCL) of 50 µg/L (micrograms per liter) (U.S. Environmental Protection Agency, 1996). Arsenic is associated with a number of adverse effects on human health. The USEPA considers arsenic to be a human carcinogen (U.S. Environmental Protection Agency, 1996). Examples of other adverse health effects attributed to consumption of arsenic range from weakness and abdominal pain to neurological and cardiovascular problems. A review of health effects associated with consumption of arsenic is given in a report by World Health Organization (1996).

Purpose and Scope

The primary purpose of this report is to describe the spatial distribution of arsenic concentrations in ground water of the Willamette Basin. Both historical data and data collected for this study (henceforth, "project data") were used for this purpose. Project data also were used to evaluate temporal variability of arsenic concentrations. It is useful to have an understanding of temporal variability before arsenic-concentration data, collected at different times, is used to evaluate spatial distributions. Evaluation of temporal variability may also benefit well owners and water managers, who may require guidance on timing for sampling.

A secondary purpose of this report is to briefly summarize current knowledge of the geochemistry of arsenic in the Willamette Basin. Relevant geochemical data are few, so this discussion is inherently general, serving mainly to outline future research needs. Possible sources of arsenic are evaluated, and geochemical processes that may control arsenic mobilization are briefly discussed.

Location and Description of the Willamette Basin

The Willamette Basin is an approximately 12,000-square-mile basin in northwestern Oregon. Primary drainage is by the Willamette River, but for the purposes of the study, the basin is defined to also include the region drained by the Sandy River; both rivers are tributary to the Columbia River. The Willamette Basin was home to 69 percent of the State's population in 1990 (Broad and Collins, 1996).

The crests of two north-south trending mountain ranges, the Coast and the Cascade Ranges, respectively define the western and eastern edges of the Willamette Basin. The Willamette Valley, an elongated, structural and erosional lowland, lies between these mountain ranges. The Coast Range is composed of marine sedimentary rocks and associated volcanic rocks. The Cascade Range is composed of lava flows and pyroclastic and epiclastic rocks. The Willamette Valley is filled with clastic basin-fill sediments of primarily alluvial origin; these alluvial sediments form the most important aquifers in the Willamette Basin. The geologic framework of the basin is described by Gannett and Caldwell (in press), and a regional representation of the surficial geology of the Willamette Basin is given on the geologic map of Oregon compiled by Walker and MacLeod (1991). Usage of geologic names in this report is consistent with that of Walker and MacLeod (1991).

STUDY DESIGN AND METHODS

The overall approach used to collect, assemble, and analyze data for this report is described in this section. First, a description of the sources of historical data is given, followed by a description of the sampling design for project data. Approaches used to define the quality of both historical and project data are discussed, as are collection and analytical methods used for project data. Finally, benchmarks for comparison of arsenic-concentration data, and methods for identification of well locations, are described.

Historical Data

Analysis of historical data (arsenic concentrations and site locations, and in most cases, well depths) from regional ground-water investigations was the starting point for evaluation of distribution of arsenic in the Willamette Basin. Some wells were sampled more than once; in these cases, the first-in-time sample was selected. Four sets of historical data used in this report are described below.

Historical data from the USGS National Water Information System (NWIS) database (Maddy and others, 1990) (271 wells). These data were collected between 1971 and 1997 as parts of various USGS projects. Many of these projects were regional in scope, and thus these data cover large areas in the Willamette Basin. In addition to arsenic concentrations, depth data also were retrieved. Data from both unfiltered and filtered samples were found in NWIS. Some of these NWIS data are discussed in the following reports: Frank and Collins, 1978; Gonthier, 1983; Leonard and Collins, 1983; Hinkle, 1997. Project data, although stored in NWIS, are discussed separately (see section "Sampling Design for Project Data").

Data from four USGS studies (Frank, 1973, 1974, 1976; Helm and Leonard, 1977), not entered into NWIS (89 wells). These data, also from regional-scale projects, encompass large areas in the southern part of the basin. The data were collected between 1964 and 1973 by USGS personnel. Well depths were obtained from tables in the reports. Techniques used to process these samples (in particular, filtering or a lack thereof) are not known.

Data from a USGS study in Lane County, not entered into NWIS (171 wells; 1 nonthermal spring). These data were collected during 1962–63, and summarized by Goldblatt and others (1963). Many of these wells withdraw water from the arsenic-rich Fisher Formation (Goldblatt and others, 1963). Arsenic concentrations and well depths were compiled from original project notes from USGS files. Samples were collected and analyzed as unfiltered samples (A.S. Van Denburgh, U.S. Geological Survey, oral commun., 1997).

Data from Linn County Department of Health Services, Environmental Health Program (65 wells). More than 100 wells were sampled for arsenic by the Environmental Health Program in 1987. Most of these wells were located near Sweet Home, an area that received little coverage in the three regional data sets listed above. Drillers' logs were on file with the Environmental Health Program for many of these wells. In 1996, USGS personnel were able to locate 65 homes corresponding to addresses from well drillers' logs for sampled wells. Arsenic concentrations from Environmental Health Program files and well depths from well drillers' logs were matched with the home locations to create a data coverage. Samples were probably collected and analyzed as unfiltered samples.

Sampling Design for Project Data

Project data were collected for several purposes. Ground-water samples were collected to fill gaps in the spatial distribution of the historical data and to illustrate the magnitude of temporal variability in arsenic concentrations. In addition, five ground-water samples were analyzed for arsenic species. Quality-control (QC) data were collected to evaluate the quality of project data, evaluate the quality of historical data (by resampling selected historical sites), and compare results obtained by different processing and analytical methods.

Samples from 125 wells and 6 nonthermal springs were collected during 1996 and 1997 to complement the spatial distribution of historical data. The wells and springs sampled were distributed throughout the lower elevation areas of the Willamette Basin, which are areas of greatest ground-water use. These sites had not previously been sampled for arsenic by the USGS. Some wells were sampled more than once during the course of this project; in these cases, the first-in-time samples were used to define the spatial distribution of arsenic.

To evaluate temporal variability of arsenic concentrations, samples were collected quarterly for 1 year from each of 17 sites. These samples also were collected during 1996 and 1997. A subset (5) of these 17 sites were sampled for arsenic species.

QC samples were used to evaluate the quality of techniques used to collect and analyze project samples. Twelve field equipment blanks, 6 sets of triplicate split samples, and 11 standard reference samples (SRSs) were analyzed over the course of the project. Field equipment blanks allow evaluation of the extent of any sample contamination

resulting from sample collection, processing, and analysis. Replicate samples allow evaluation of the reproducibility (precision) of analyses. SRSs facilitate evaluation of analytical accuracy. The USGS SRS program, an interlaboratory testing program, is described in a report by Long and Farrar (1995). Preparation, description, and most probable values (MPVs) of constituents of individual SRSs used in this study are described by U.S. Geological Survey (1990) and Long and Farrar (1991, 1993, 1995). An MPV for an analyte is the median of the concentrations determined by the participating laboratories. Analytical results are reported as percentages of SRS-program MPVs.

Additional quality assurance included resampling 11 historical sites. Comparison between historical arsenic concentrations and concentrations determined upon resampling offers a measure of the reliability of historical data.

Comparisons between filtered and unfiltered samples, and between USGS and USEPA analytical methods, also were made. Characterization of differences in arsenic concentrations among unfiltered and filtered samples helps quantify the effect of sample filtering, and increases the transfer value of the data and interpretations presented in this report. Data from comparison of USGS and USEPA analytical methods facilitate comparison of arsenic concentrations determined by USGS methods with USEPA water-quality criteria.

Project Sample Collection Methods

Project samples from wells and springs used for evaluation of spatial distribution of arsenic were not filtered. Unfiltered samples, in addition to being more economical to collect than samples filtered through 0.45-µm (micrometer) filters, also have the advantage of being more representative of the water being consumed by most well owners. Another justification for collection of unfiltered samples is that many of the historical data, with which project data were combined, were from analyses of unfiltered samples. Furthermore, USEPA and World Health Organization (WHO) guidelines for water quality (see section “Comparisons with Water-Quality Criteria“) apply to “finished water.” For most project wells, which were primarily domestic wells, “finished water” generally is equivalent to unfiltered water. However, because unfiltered samples may contain more colloids and (or) more sediment entrained during pumping, unfiltered samples are less representative of water actually moving through an aquifer than are 0.45-µm-filtered samples. Thus, the use of unfiltered samples in characterization of ground-water quality represents an approximation. Additional, quantitative discussion on this topic is presented in the section, “Comparison of Processing and Analytical Methods.”

Of the 125 project wells used for evaluation of spatial distribution of arsenic, 116 were actively used domestic wells. The remaining 9 wells included 3 public-water-supply wells, 3 industrial wells, 2 irrigation wells, and 1 livestock well. Of these nine wells, those that were not actively used were purged a minimum of three casing volumes prior to sampling to remove standing water from the well. Samples from actively used wells were collected following a minimum purge time of 1 minute. Longer purge times, characteristic of most USGS ground-water-quality work, were deemed unnecessary for actively used wells in this project because these wells experienced a degree of regular purging from the frequent use of the wells. A resulting limitation, however, is that samples from these wells may lose arsenic by way of adsorption to iron casing or precipitation as ground water undergoes geochemical changes while residing in a well bore or casing. Thus, arsenic concentrations in samples from these wells may be biased toward low arsenic concentrations relative to water actually moving through the aquifer. The extent of this possible bias has not been quantified, but because these wells were actively used, this potential bias is likely to be small.

Project samples collected from springs were collected from flowing springs. Fine sediment was present along with the water in several of the springs, so spring samples were filtered through 0.45-µm nominal-pore-size filters.

Project wells sampled for evaluation of temporal variability in arsenic concentrations were actively used wells, sampled using the same methods as for project wells sampled for evaluation of spatial distribution of arsenic.

Project wells sampled for arsenic speciation also were actively used wells. Samples were collected as unfiltered samples following a minimum well purge time of 1 minute. Samples were col-

lected without headspace in brown glass vials, wrapped in aluminum foil (to prevent photooxidation), and shipped on ice to the laboratory.

Eleven wells represented in the historical data set were resampled. All were actively used wells and were sampled using the same methods as for project wells sampled for evaluation of spatial distribution of arsenic.

Samples for comparison between filtered and unfiltered samples, and comparison of USGS and USEPA methods, were collected from a subset of the wells sampled for temporal variability. Each 10-liter sample was split in the field by mechanical agitation into four subsamples. One subsample was filtered through a 0.10-µm nominal-pore-size 47-mm-diameter filter. One subsample was filtered through a 0.45-µm nominal-pore-size 142-mm-diameter filter. Two subsamples were collected as unfiltered samples. For each set of the four subsamples, both of the filtered samples and one of the unfiltered samples were analyzed by USGS methods (see section "Project Analytical Methods"). The other unfiltered sample was analyzed by USEPA methods (see section "Project Analytical Methods").

All arsenic samples, except samples collected for analysis of arsenic species, were field-acidified to below pH 2 with nitric acid. Samples for analysis of arsenic species were not acidified.

Project Analytical Methods

Arsenic analyses were done at the USGS National Water Quality Laboratory (NWQL) in Arvada, Colorado. Most arsenic determinations were done by hydride atomic absorption with a 3-minute sulfuric acid and potassium persulfate digestion (Fishman and Friedman, 1989). This is the standard USGS method, and it is referred to as the "USGS method" in this report. Ten analyses were done by graphite furnace atomic absorption with a 2-hour hydrochloric acid and nitric acid digestion (U.S. Environmental Protection Agency, 1994). This method is referred to as the "USEPA method" in this report. The analytical minimum reporting level (MRL) was 1 µg/L for both methods.

Samples for arsenic speciation were analyzed by the USGS Methods Research and Development Program at the USGS NWQL. Samples were analyzed for two inorganic species, arsenite (arsenic III) and arsenate (arsenic V), and two organic species, monosodium methylarsonate (CH_3AsO_3HNa) and sodium dimethylarsinate ($(CH_3)_2AsO_2Na$). Analyses were done by direct injection high-performance liquid chromatography/hydride generation/inductively coupled plasma-mass spectrometry. Method detection limits (MDLs) were 0.2 µg/L (expressed as mass of arsenic per liter). Samples were analyzed within 48 hours of collection.

Comparisons with Water-Quality Criteria

To provide benchmarks against which arsenic-concentration data can be compared, arsenic-concentration data are compared with USEPA and WHO drinking-water standards. Concentrations of arsenic are compared to the USEPA current drinking water MCL for arsenic of 50 µg/L (U.S. Environmental Protection Agency, 1996). The USEPA current MCL is the maximum concentration of a contaminant allowed in a public water system. This MCL is under review (U.S. Environmental Protection Agency, 1996). Bagla and Kaiser (1996) report that the USEPA is considering reducing the current MCL by 90 percent. However, until any such reduction in the MCL occurs, the current MCL remains a logical benchmark for comparison. As an alternative benchmark, concentrations of arsenic also are compared to the WHO provisional guideline of 10 µg/L (World Health Organization, 1996).

Water with an arsenic concentration below the USEPA current MCL or WHO provisional guideline is not necessarily free from health risks. For example, arsenic concentrations may be below the USEPA current MCL and WHO provisional guideline, but still be greater than the USEPA drinking-water Risk-Specific-Dose Health Advisory (RSDHA) of 2 µg/L (U.S. Environmental Protection Agency, 1996). (The RSDHA is defined as the concentration of a contaminant in drinking water that is expected to result in a specified increased risk of cancer. The USEPA RSDHA for arsenic is calculated at the 1-in-10,000 cancer risk level. Consumption of water containing a contaminant at the RSDHA 1-in-10,000 risk level is expected to be associated with the following risk: a 70-kg adult drinking 2 L of such water per day for 70 years faces an increased risk of cancer of

approximately 1 in 10,000.) Furthermore, effects of arsenic consumption on human health are not uniform among different people, and no single threshold can be defined as the dividing line between "safe" and "unsafe." Comparison of arsenic data to the USEPA current MCL and WHO provisional guideline are done solely for illustrative purposes; no implication of "safety" or lack thereof is implied.

Methods of Identifying Wells

All wells discussed in this report were assigned well location names corresponding to well locations. Well locations generally were determined when the wells were first visited. Well locations were identified using the Township, Range, and Section method of land subdivision. Two methods are shown on figure 2. Most wells were identified with a system that uses nested groups of the letters A, B, C, and D for section subdivision. Prior to about 1967, wells were identified with an alternative system, using letters A through R (excluding I and O) for section subdivision. To preserve linkage to historical data sources, all wells discussed in this report are referred to by the well location names originally assigned to them. It should be noted, however, that in some cases, the original well location names do not accurately describe the true locations of the wells. To provide accurate locational and identifying information for wells discussed in this report, corrected well locations, and additional identifying information (USGS site identification number and OWRD well log identification number), are listed along with original well locations in the

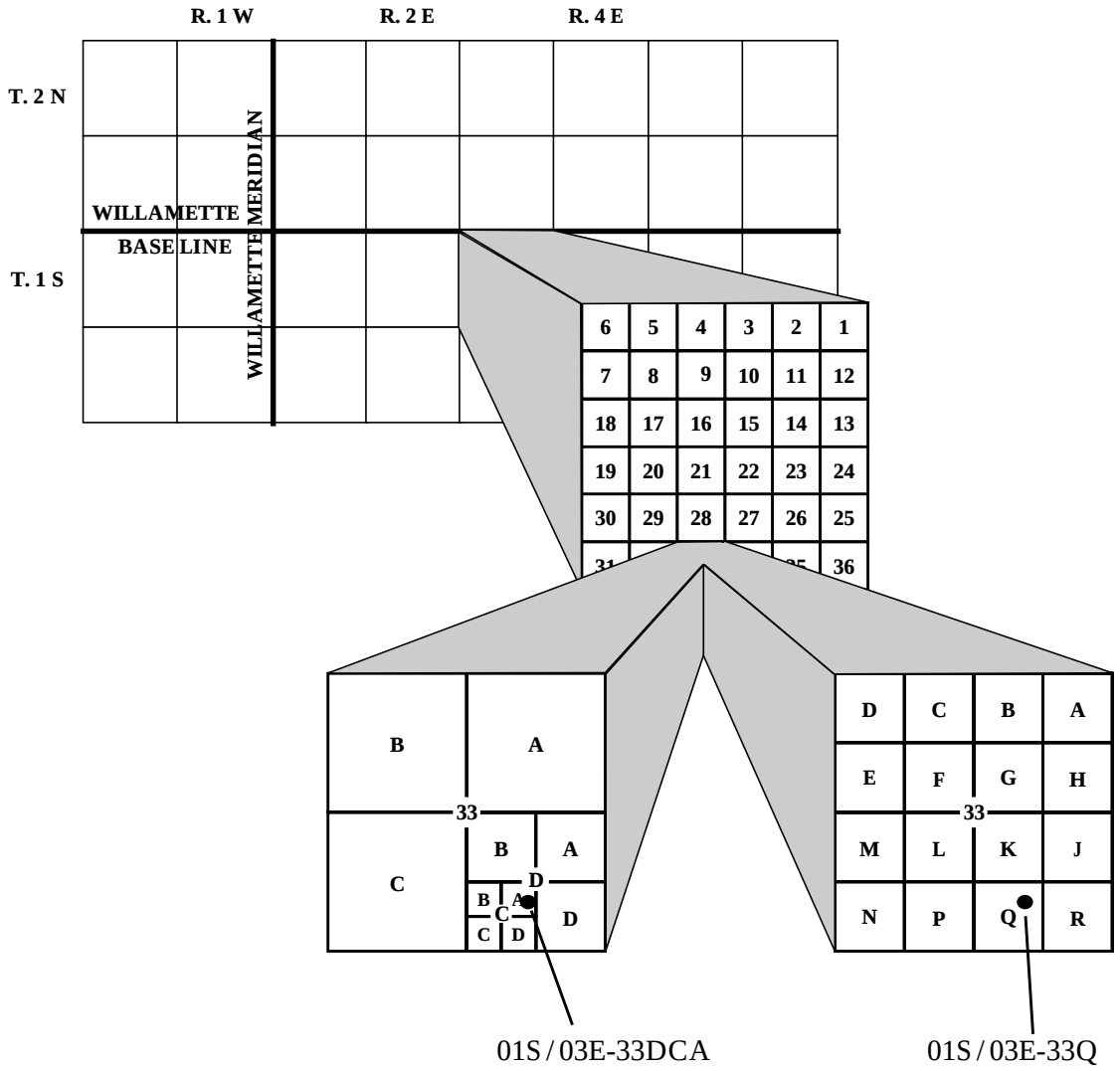


Figure 2. Well-location system.

Appendix. Note that in the project data report (Orzol and others, in press), wells are listed by corrected well location names.

DATA QUALITY: SAMPLING AND ANALYTICAL VARIABILITY VERSUS ENVIRONMENTAL VARIABILITY

In this section, project QC data are evaluated to characterize sampling and analytical variability. Sampling and analytical variability must be evaluated before environmental variability can be addressed. Three sets of QC data were collected as part of project data-collection activities. First, sampling and analytical variability of project data are evaluated. Second, the quality of historical data is discussed. Evaluation of historical data is difficult because few historical quality-control data are available. However, resampling of historically sampled sites provides insight into the quality of the historical data. Third, a comparison of sample processing and analytical methods is presented; these data illustrate the magnitude of the differences that can arise from use of various sample processing and analytical methods.

Quality of Project Data

All 12 project field equipment blanks yielded arsenic concentrations below the MRL of 1 µg/L. These results indicate that field and laboratory methods were noncontaminating.

The coefficient of variation (CV) (standard deviation divided by mean, expressed in percent) for each of the six sets of project triplicate split samples ranged from 0.0 to 14 percent. The median CV was 6.0 percent.

Analytical accuracy of project data was quantified with data from 11 SRSs. Analytical accuracy ranged from 92 to 110 percent for nine of the SRSs, but was 82 and 120 percent for the other two SRSs. In other words, reported concentrations were in error by up to about ±20 percent.

Contamination-free sampling and analysis, and reasonable analytical precision and accuracy, indicate that project data were adequate for definition of patterns of regional arsenic occurrence. However, because analytical accuracy was observed to range up to about ±20 percent, definitive characterization of temporal variability at individual sites is compromised where temporal variability also is on the order of ±20 percent or less.

Quality of Historical Data

The quality of project data is well characterized, so comparison of project and historical arsenic concentrations yields a measure of the quality of the historical data. Evaluation of the analytical accuracy of historical data is particularly desirable. However, arsenic concentrations determined in original studies and determined again during this study may differ for a variety of reasons unrelated to differences in data quality. Notably, differences between historical arsenic concentrations and arsenic concentrations determined from sampling during this project may reflect changes in the source of water being sampled at different times. Changes in the source of water being sampled can arise for a number of reasons. Ground-water flowpaths in aquifers can change over seasonal or longer time scales. Also, water often flows into wells from more than one permeable zone, and the relative contributions from different zones can change as pumping stresses change. Thus, changes in type of well use (for example, change from domestic use to lawn-watering use) or differences in the history of well use prior to sampling can result in changes in the source of water being withdrawn from wells. Finally, changes in well construction or well characteristics (for example, well cave-in over time) can result in changes in source water for wells. (Note, however, that none of the 11 wells were known to have been deepened between the time of historical sampling and the time of project resampling.) In addition to changes in source water to wells, variability in arsenic concentrations can arise from differences in sample processing prior to analysis, or, especially in the case of unfiltered samples, differences in the amount of colloid- or sediment-bound arsenic. Therefore, an absence of strong correlation between historical and project arsenic concentrations is not necessarily cause for rejection of the historical data. Because differences between historical and project data can arise from a number of factors in addition to differences in data quality, the central purpose for which the resampling data were collected was to determine if the magnitudes of the historical data are adequate

for definition of patterns of regional arsenic occurrence.

Data from the 11 sites with historical data that were resampled are presented in table 1. Differences between historical and project data are variable. For example, a difference of less than 10 percent was observed for well 19S/03W-31E1, whereas an order-of-magnitude difference was observed for well 22S/03W-17N. However, historical and project arsenic concentrations were in agreement when interpreted relative to exceedances of the USEPA current MCL. Sites at which historical arsenic concentrations exceeded the USEPA current MCL also yielded water exceeding the USEPA current MCL upon sampling during this project, and sites at which historical arsenic concentrations were less than the USEPA current MCL also yielded water below the USEPA current MCL upon sampling during this project. The historical data therefore indicate a similar pattern of spatial variability of arsenic concentrations as the project data.

Closer examination of these data indicates that data from the early 1960s generally correlate poorly with project data, whereas later data demonstrate reasonably good correlation. This pattern may reflect improvements in analytical techniques since the early 1960s.

Because two historical samples dating from the mid- to late-1960s (wells 12S/01W-29N1 and 18S/04W-14ACB) had both arsenic and chloride data, these sites were sampled for chloride as well as arsenic during project sampling (table 1). For well 12S/01W-29N1, both the arsenic and chloride concentrations were slightly lower upon project sampling: the arsenic concentration upon project sampling was 86 percent of the historical concentration, and the chloride concentration, 88 percent of the historical concentration. For well 18S/04W-14ACB, both the arsenic and the chloride concentrations were considerably lower upon project sampling: the arsenic concentration upon project sampling was 60 percent of the historical concentration, and the chloride concentration, 33 percent of the historical concentration. Historical chloride concentrations would be expected to be reliable, and would have been negligibly affected by sample processing or the presence of colloids and sediment. Thus, the changes in chloride concentrations suggest that changes in the source of water being pumped by these two wells have occurred over time. If historical chloride concentrations had been similar to project chloride concentrations, then the historical arsenic analyses might be suspect. However, differences in chloride concentrations between historical and project sampling suggest that differences in arsenic concentrations between historical and project sampling were a result, at least in part, of changes in the source of water being pumped by these wells.

Comparison of historical arsenic concentrations and arsenic concentrations determined upon project sampling indicate that historical arsenic concentrations will not necessarily reflect current arsenic concentrations. Use of historical data in process-oriented geochemical studies could be problematic. However, the comparison does

Table 1. Comparison of historical arsenic concentrations with arsenic concentrations measured during this project
[Well location as recorded in original data source; arsenic concentrations in micrograms per liter; "--", unknown]

		Historical data		Project resampling	
Source for historical data	Well location	Date	Arsenic concentration	Date	Arsenic concentration
USGS files; Goldblatt and others, 1963	18S/04W-22B	10/04/62	160	08/20/97	820
USGS files; Goldblatt and others, 1963	18S/04W-10D	10/17/62	120	08/20/97	520
USGS files; Goldblatt and others, 1963	22S/03W-17N	10/25/62	32	09/05/96	3
USGS files; Goldblatt and others, 1963	19S/03W-11E2	01/08/63	420	11/13/96	700
USGS files; Goldblatt and others, 1963	19S/03W-31E1	03/29/63	120	11/13/96	130
Frank, F.J., 1973	18S/04W-14ACB	06/12/69	500[a]	09/06/96	300[b]
Helm and Leonard, 1977	12S/01W-29N1	06/24/65	70[c]	08/29/96	60[d]
Linn County Dept. of Health Services	13S/01E-33	--/--/87	10	09/06/96	4
Linn County Dept. of Health Services	14S/01E-05	--/--/87	74	09/06/96	89
Linn County Dept. of Health Services	13S/01E-33AC	04/09/87	900	09/06/96	790
Linn County Dept. of Health Services	13S/01E-35	07/06/87	<5	09/06/96	3

[a]Chloride concentration 43 milligrams per liter.
[b]Chloride concentration 14 milligrams per liter.
[c]Chloride concentration 26 milligrams per liter.
[d]Chloride concentration 23 milligrams per liter.

suggest that the historical data are adequate for definition of patterns of regional arsenic occurrence.

Comparison of Processing and Analytical Methods

Hydrologists employ a variety of sample processing and analytical methods in geochemical and water-quality studies. Samples may be collected as unfiltered or as filtered samples. Filtering may be done using any of a variety of pore sizes, but 0.10-µm and 0.45-µm pore sizes are most commonly used. Analysis of arsenic usually is done using either hydride atomic absorption (commonly used by the USGS) or by graphite furnace atomic absorption (commonly used by the USEPA).

When combining data collected by a number of investigators using a variety of sample processing and analytical methods, questions about the comparability of data arise. Furthermore, comparison of analyses performed using non-USEPA analytical methods against USEPA water-quality criteria raises questions about comparability of analytical techniques. Information on comparability of different sample processing and analytical methods is given in this section. Data from split samples that were (1) filtered through 0.10-µm nominal-pore-size filters and analyzed by hydride atomic absorption, (2) filtered through 0.45-µm nominal-pore-size filters and analyzed by hydride atomic absorption, (3) analyzed as unfiltered samples using hydride atomic absorption, and (4) analyzed as unfiltered samples using graphite furnace atomic absorption are shown in table 2 and on figure 3.

Differences in reported arsenic concentrations between unfiltered and filtered samples generally were small. However, one set of samples (from well 21S/03E-08CBD2) demonstrated that concentrations of arsenic in unfiltered samples can be considerably greater (factor of three) than those in filtered samples. Differences between unfiltered and filtered samples may result from differences in the amount of colloid- or sediment-associated arsenic in the samples. Concentrations in both the unfiltered and the filtered samples from this site were greater than the USEPA current MCL, so interpretation was not affected significantly. However, interpretation of data from other sites could conceivably be affected by such differences between unfiltered and filtered samples and investigators will need to bear such potential differences in mind. Overall, however, combining filtered and unfiltered samples appears to be acceptable for definition of patterns of regional arsenic occurrence.

Differences in reported arsenic concentrations between the two analytical methods were small. Arsenic concentrations reported for samples analyzed by the USEPA method were slightly higher than those analyzed by the USGS method. These differences could be a result of differences in analytical methods. The longer digestion associated with the USEPA method could result in differences in reported arsenic concentrations. Different reagents used in sample digestion in the two methods also could result in differences in reported arsenic concentrations. However, the observed differences also could simply represent analytical variability.

Table 2. Comparison of arsenic concentrations for various processing and analytical methods

[USGS, U.S. Geological Survey; USEPA, U.S. Environmental Protection Agency; arsenic concentrations in micrograms per liter; processing and analytical methods described in text]

Well location	Filtered, 0.10-micrometer filter	Filtered, 0.45-micrometer filter	Unfiltered (USGS method)	Unfiltered (USEPA method)
01N/03W-04CCC	54	57	53	64
01N/03W-07CCD1	17	17	16	22
01N/03W-15ADB1	47	47	53	60
01S/03W-10BCA1	55	57	59	64
02S/02W-11CCD1	16	16	20	24
15S/01W-23CCA	18	18	18	21
17S/01W-24DCA	70	75	70	82
19S/01W-03ADB	41	43	40	46
21S/03E-08CBD2	62	64	180	180
18S/04W-14BBA	1,100	1,100	1,100	1,200

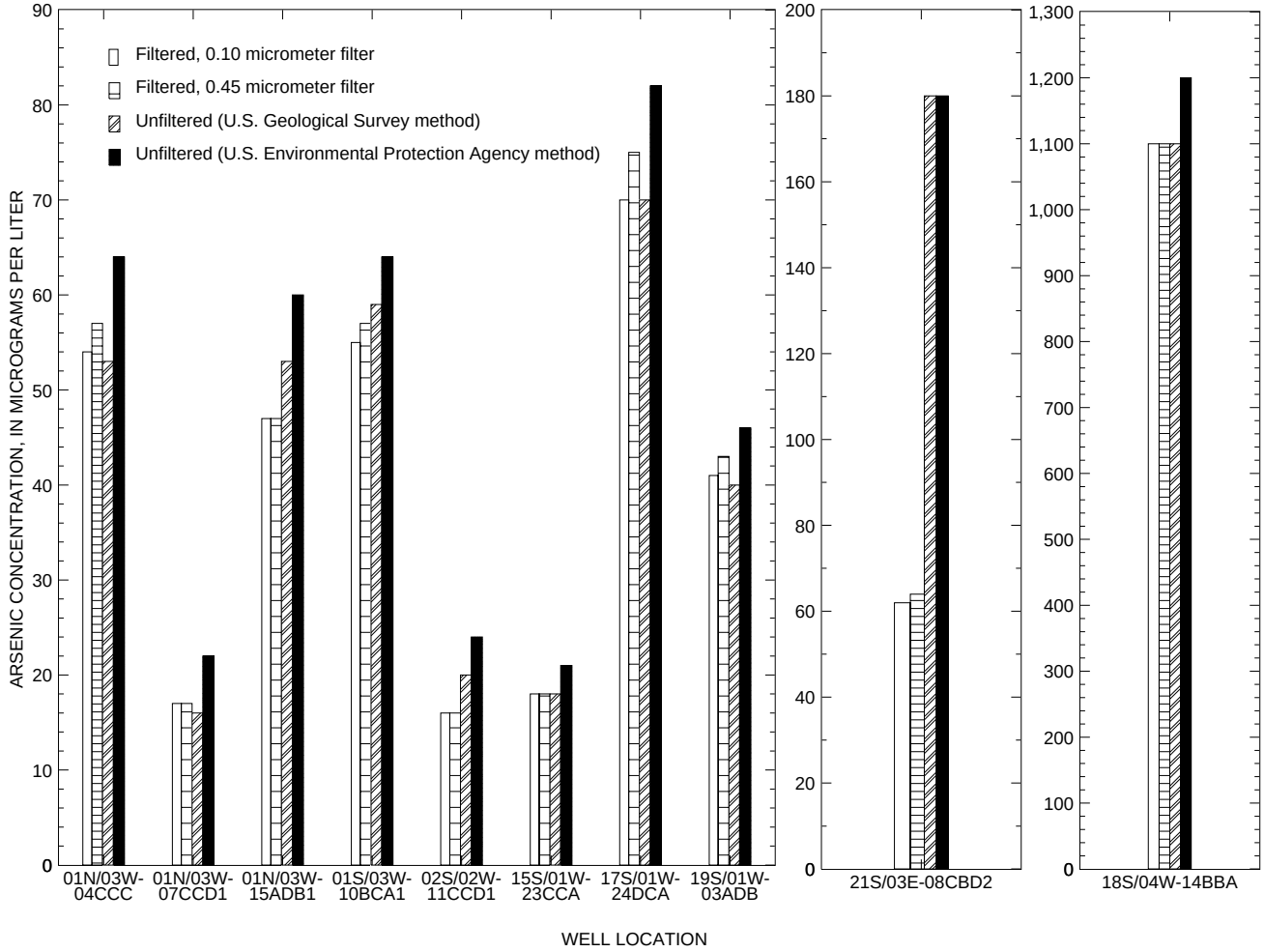


Figure 3. Comparison of arsenic concentrations determined by various processing and analytical methods.

DISTRIBUTION OF ARSENIC

The distribution of arsenic in ground water of the Willamette Basin is discussed in terms of temporal and spatial variability. First, project data are used to assess temporal variability. It is useful to assess temporal variability before arsenic-concentration data collected at different times is used to evaluate spatial distribution. Also, assessment of temporal variability should benefit well owners and water managers who desire guidance on when to sample for arsenic. Second, historical and project data are used to define spatial variability of arsenic concentrations in ground water in the Willamette Basin.

Temporal Variability

Project data were used to evaluate temporal variability of arsenic concentrations in ground water during a 1-year period. These data help characterize variability resulting from seasonal and other short- to medium-term factors. Characterization of temporal variability in arsenic concentrations over longer periods of time was not explicitly done, but long-term variability was discussed qualitatively in a previous section of this report, “Quality of Historical Data.”

Arsenic concentrations measured quarterly over a period of 1 year at 17 sites are given in table 3 and shown on figure 4. Field-measured specific conductance, a surrogate for dissolved solids, also is given in table 3. Arsenic concentrations did exhibit temporal variability. Although arsenic concentrations in water from many wells remained essentially constant over the course of sampling, concentrations at some sites varied by up to almost ±50 percent from mean concentrations, and arsenic concentrations in samples from well 19S/01W-

Table 3. Temporal variations in arsenic concentrations and specific conductance

["As", arsenic concentration in µg/L (micrograms per liter); "SC", field-measured specific conductance in µS/cm (microsiemens per centimeter) at 25 degrees Celsius; "--", not measured]

Well location	Date	As	SC	Date	As	SC	Date	As	SC	Date	As	SC	Date	As	SC
01N/03W-04CCC	11/21/96	53	587	02/20/97	52	585	05/15/97	82	496	08/19/97	97	522	12/05/97	72	616
01N/03W-07CCD1	11/19/96	16	345	02/20/97	17	357	05/15/97	19	345	08/19/97	26	314	12/05/97	18	345
01N/03W-15ADB1	11/21/96	53	1,220	02/20/97	47	1,300	05/15/97	64	1,390	08/19/97	63	1,500	12/05/97	52	1,450
01S/02W-29DBD	11/12/96	33	--	02/20/97	28	194	05/15/97	35	193	08/19/97	41	195	12/05/97	29	192
01S/02W-33BBA	11/12/96	12	--	02/20/97	10	274	05/15/97	12	272	08/19/97	13	275	12/05/97	12	274
01S/03W-10BCA1	11/19/96	59	341	02/20/97	52	340	05/15/97	62	339	08/19/97	56	339	12/05/97	56	341
02S/02W-11CCD1	11/19/96	20	335	02/20/97	16	335	05/15/97	18	334	08/19/97	19	336	12/05/97	18	336
15S/01W-23CCA	08/14/96	19	268	11/15/96	18	263	02/18/97	19	261	05/13/97	17	262	08/20/97	19	262
15S/01W-23CCC2	08/14/96	11	164	11/15/96	11	167	02/18/97	10	163	05/13/97	9	161	08/20/97	12	164
17S/01W-24DCA	09/06/96	85	194	11/15/96	70	198	02/19/97	74	195	05/13/97	84	191	08/21/97	69	193
18S/04W-14ACA	09/05/96	9	319	11/14/96	6	293	02/18/97	5	253	05/14/97	6	250	08/21/97	10	320
18S/04W-14BBA	09/04/96	830	1,040	11/15/96	1,100	1,070	02/20/97	640	797	[a]	[a]	[a]	08/20/97	1,100	1,060
19S/01W-03ADB	09/04/96	15	188	11/14/96	40	329	02/18/97	23	193	05/13/97	33	237	08/21/97	28	205
19S/03W-11E2	11/13/96	700	389	02/19/97	710	393	05/14/97	740	396	08/20/97	850	391	12/04/97	800	390
19S/03W-31E1	11/13/96	130	295	02/19/97	130	295	05/14/97	140	291	08/20/97	130	285	12/04/97	130	292
21S/03E-08CBD2	09/05/96	140	1,590	11/14/96	180	1,460	02/18/97	130	1,120	05/13/97	100	1090	09/04/97	69	1,450
22S/03W-17N	09/05/96	3	298	11/13/96	3	292	02/19/97	4	276	05/14/97	4	295	09/04/97	4	381

[a]Four samples within 37 hours:
05/13/97 at 7 p.m., As, 1100 µg/L; SC, 1090 µS/cm
05/14/97 at 10 a.m., As, 810 µg/L; SC, 952 µS/cm
05/14/97 at 8 p.m., As, 880 µg/L; SC, 809 µS/cm
05/15/97 at 8 a.m., As, 600 µg/L; SC, 877 µS/cm.

03ADB varied by a factor of 2.7 between the lowest and highest concentrations. The data as a whole demonstrate no obvious correlation with seasons. Analytical variability may be responsible for some of the observed variability, but can only explain up to about ±20-percent variation among samples. Differences in arsenic concentrations also could be due, in part, to temporally varying amounts of colloid- or sediment-bound arsenic. However, 10 of the 17 wells used for quarterly sampling also were used in the comparison of unfiltered and filtered samples. The resulting data showed little colloid- or sediment-bound arsenic present in samples from those wells at that time, except for well 21S/03E-08CBD2. Clearly, other factors are responsible for some of the observed temporal variability in arsenic concentrations.

It is likely that temporal variability in project data reflects variation in contributing sources of water to wells, and in the absence of seasonal patterns in temporal data, variation in contributing sources to wells is probably largely due to short-term (hour-to-hour or day-to-day) variations in well use prior to sampling. Relatively heavy well use can temporarily deplete water from parts of an aquifer adjacent to the well, and thus the well can yield water of different chemical quality than when sampled after a period of relatively light use. Two pieces of evidence suggest that some of the 17 wells sampled for temporal variability yield water from different sources at different times, although a relation between differences in contributing sources to wells and differences in well use remains only a hypothesis. One piece of evidence for changing water sources to wells lies in the specific conductance data. Specific conductance generally was less variable in samples where arsenic concentrations were less variable (table 3). Furthermore, specific conductance had the greatest relative temporal variability for water from well 19S/01W-03ADB; the same site also had the greatest relative temporal variability in arsenic concentrations (table 3). Because large changes in the chemistry of individual bodies of ground water generally take place over a period of years, it is difficult to explain large seasonal changes in specific conductance of well water by processes other than changing water sources to wells. A second piece of evidence suggesting changing water sources to wells is derived from examination of data from well 18S/04W-14BBA. Maximum and minimum arsenic concentrations in samples from this site varied by nearly a factor of two over the course of a year. At this site, some additional temporal sampling was conducted. Four samples were collected over one 37-hour period. The observed variability during a

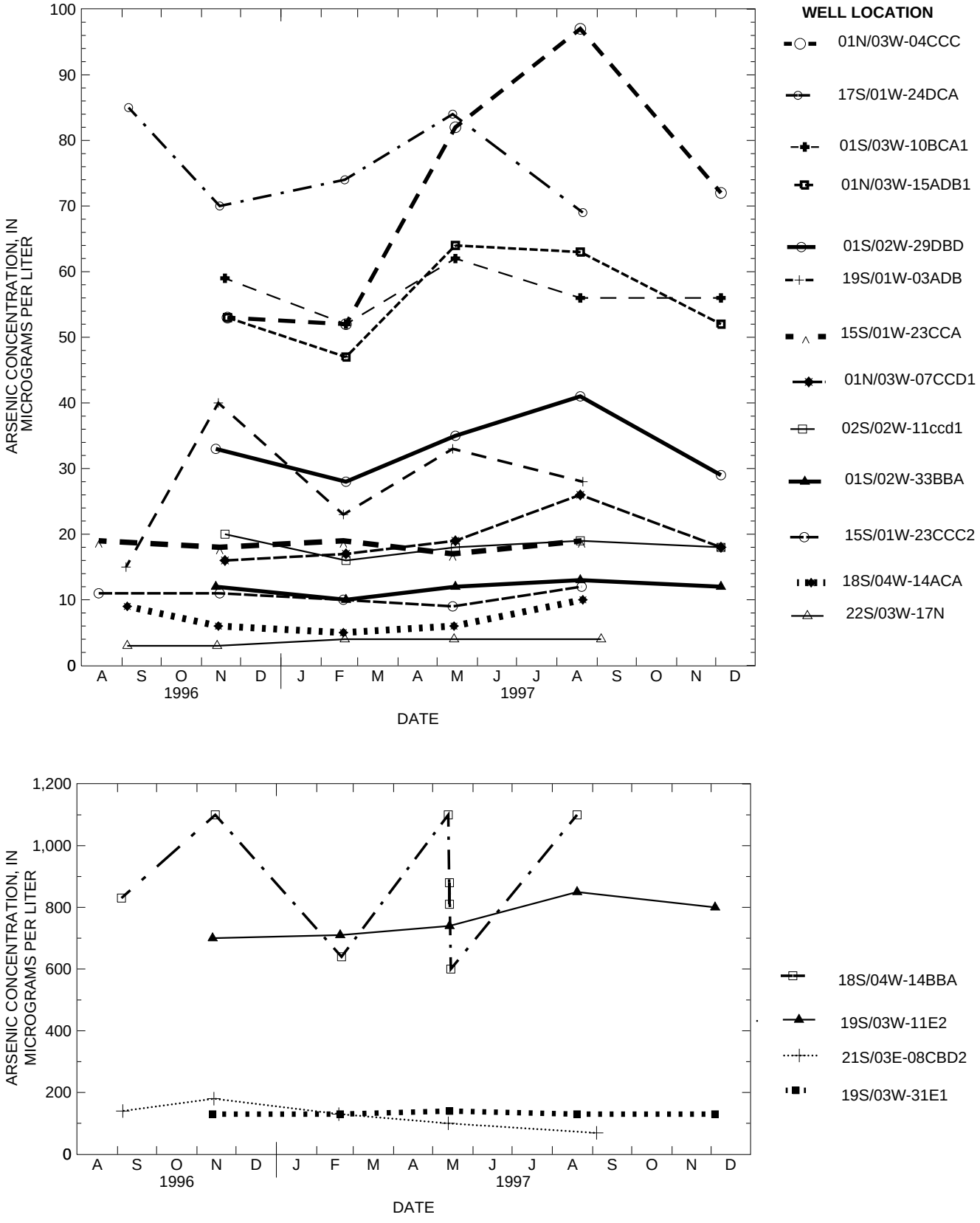


Figure 4. Temporal variations in arsenic concentrations.

37-hour period was as great as the variability observed during the course of a year (table 3, fig. 4). Such variability over the course of 37 hours cannot be ascribed to seasonal factors.

Certainly, a relationship between arsenic concentrations and well use prior to sampling remains only a hypothesis. But regardless of the processes resulting in the observed temporal variability, the data demonstrate that short-term variability in arsenic concentrations can be similar in magnitude to variability observed during the course of quarterly sampling.

The temporal variability of the project data (less than a factor of three) contrasts greatly with temporal variability in arsenic concentrations reported by Nadakavukaren and others (1984) for some wells in Lane County in the southern part of the Willamette Basin. Nadakavukaren and others (1984) reported temporal variability of up to about three orders of magnitude over the course of a year for some of the 14 wells sampled. Such variability is intriguing, because temporal variability of this magnitude in ground-water chemistry at individual sites is unusual.

Nadakavukaren and others (1984) noted that arsenic concentrations often were low (relative to mean concentrations) during the winter (rainy) season. However, they also reported that equally low concentrations were observed during other seasons, including the summer (dry) season, at several sites. Thus, although they observed temporal variability in arsenic concentrations, Nadakavukaren and others (1984) reported that they were unable to relate temporal variability to environmental factors. Unfortunately, sample-collection procedures were not defined in the paper. One aspect of the data not discussed in the original paper, but that may have significant bearing on interpretation of temporal variability, is that most of the wells sampled were irrigation wells. Irrigation wells tend to be unused during the rainy season, and frequently remain idle for long periods during other parts of the year. Recall that it was proposed that temporal variability of project data was related, at least in part, to well use prior to sampling, and recall, also, that project wells either were actively used domestic wells or were sampled after purging three well-bore volumes. It is possible that the extreme variability in arsenic concentrations reported by Nadakavukaren and others (1984) could be related to previous well use (or lack of well use), especially if the wells were not purged prior to sampling. Certainly, the use of irrigation wells for most of the work presented by Nadakavukaren and others (1984), and the absence of documentation of well-purging criteria, make interpretation of their temporal data difficult. Data of Nadakavukaren and others (1984) suggest that caution be applied when using historical data for which both well-use and well-purging information are unavailable.

The absence of seasonal trends in project data suggests that data collected at different times in the Willamette Basin can be combined for use in definition of spatial variability in arsenic concentrations. However, data of Nadakavukaren and others (1984), although difficult to interpret, suggest that historical data for which the history of well use and well purging are unknown may not always be sufficient for site-specific characterization. Thus, although temporal variability is not likely to be a significant problem for a regional evaluation of ground-water arsenic concentrations, the quality of historical data should be evaluated. Most of the historical data compiled for use in this report were from samples collected by USGS personnel. The remainder of the data (from Linn County Department of Health Services, Environmental Health Program) were collected from domestic wells, which presumably were actively used wells. USGS protocols have long required (at least as far back as 1960; Rainwater and Thatcher, 1960) that groundwater samples be collected from purged or actively used wells. Thus, from a standpoint of well use/well purging, the historical data used in this report are believed to be of adequate quality for a regional assessment of arsenic concentrations in ground water. Resampling of selected wells represented in the historical data supports this assumption, as was shown in the section “Quality of Historical Data.”

Spatial Distribution

Historical and project data were combined and used to evaluate the spatial distribution of arsenic concentrations in ground water of the Willamette Basin. A total of 728 spatially distinct samples thus were available—597 historical and 131 project samples. Of these 728 samples, 721 were from wells, and 7 were from nonthermal springs. These data are available in digital format

(CD-ROM) in a separate data report (Orzol and others, in press).

Concentrations of arsenic in the 728 samples ranged from < 1 to 2,000 µg/L. A histogram of these data is shown on figure 5. Concentrations in 58 samples (8.0 percent) exceeded the USEPA current MCL (50 µg/L), and 158 (21.7 percent) exceeded the WHO provisional guideline (10 µg/L). The 728 samples were not randomly distributed throughout the basin, so it does not follow that 8 percent of all wells in the basin will exceed the USEPA current MCL. Furthermore, because some of the data (in particular, data of Goldblatt and others, 1963, and data from Linn County Department of Health Services) were collected to address suspected arsenic problems, the cumulative data set contains a bias towards high arsenic concentrations (exceeding the USEPA current MCL). The data do, however, indicate the existence of extensive bodies of high-arsenic ground water in the basin.

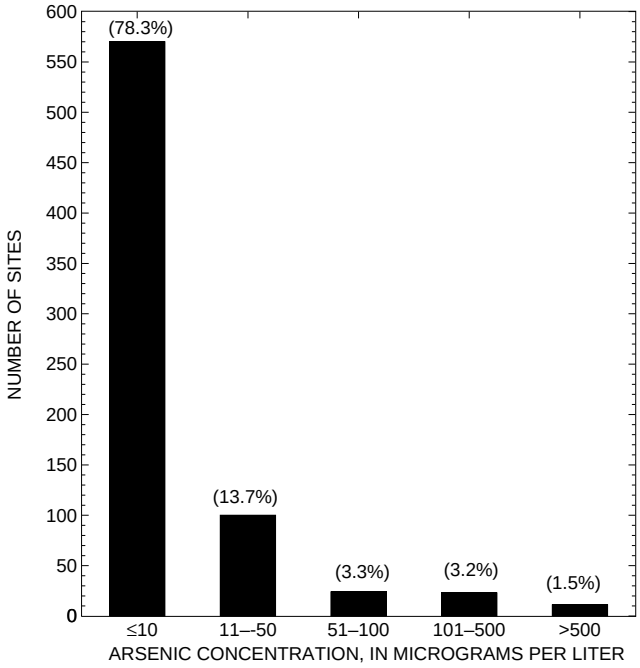


Figure 5. Arsenic concentrations for sites sampled in the Willamette Basin, Oregon. (Number in parentheses is percentage of the total number of sites.)

Depth data were available for 651 of the 728 sites. The relation of arsenic concentration to depth is shown on figure 6. Data from springs were included on this figure; springs were assigned a "well depth" of zero. (For plotting purposes, censored data [concentrations below reporting levels] were arbitrarily plotted at one-half of the reporting

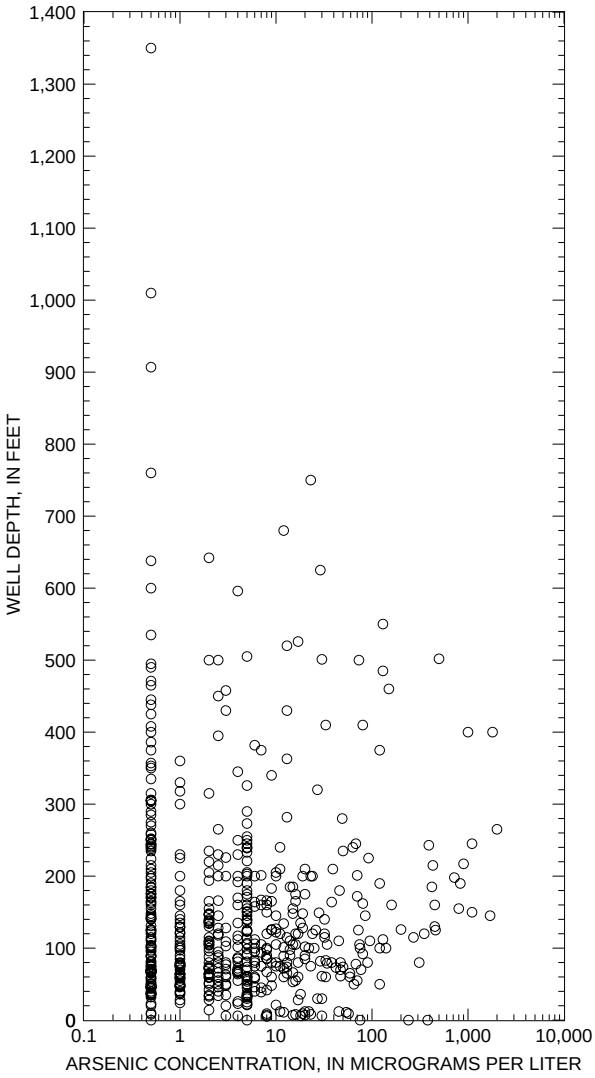


Figure 6. Relation of arsenic concentration to well depth. (Data from six springs also are included; "well depth" is set to zero for springs.)

levels. Censoring occurred at three concentration levels: 1, 5, and 10 µg/L.) No obvious relation of arsenic concentration to well depth was observed. On a regional scale, depth does not appear to be a useful parameter for predicting arsenic concentrations. However, depth may be an important parameter on a local scale.

The spatial distribution of arsenic concentrations is shown on plate 1. Patterns of arsenic occurrence are apparent. Most (53) of the 58 samples with high concentrations of arsenic came from wells and springs in bedrock areas (areas where bedrock is exposed at land surface or is covered by thin layers of alluvium) in south-central and eastern Lane County, and Linn County (pl. 1). The remain-

ing 5 (of the 58) samples came from wells near the center of the Tualatin Basin in Washington County (northwestern part of the Willamette Basin) (pl. 1). These five wells produce water from alluvial deposits. Not only were most of the 58 occurrences of high arsenic concentrations in Lane and Linn Counties, but the highest concentrations also were found there. Arsenic concentrations ranged up to 2,000 µg/L in Lane and Linn Counties, and six samples contained ≥1,000 µg/L. In contrast, the maximum concentration of arsenic in the Tualatin Basin, 77 µg/L, was substantially smaller than many of the concentrations found in Lane and Linn Counties, although still a concentration of considerable concern.

All five exceedances of the USEPA current MCL in the Tualatin Basin were from filtered samples. Many of the exceedances of the USEPA current MCL in Lane and Linn Counties were from unfiltered samples, but concentrations in filtered samples from that part of the Willamette Basin have been observed to exceed 1,000 µg/L. Because filtered samples generally contain primarily dissolved constituents, the presence of high concentrations of arsenic in filtered samples suggests that geochemical conditions can be favorable for development of high dissolved-arsenic concentrations both in the Tualatin Basin and in bedrock areas of Lane and Linn Counties.

Intermediate arsenic concentrations (>10 µg/L and ≤ 50 µg/L) were widespread in the Willamette Basin (pl. 1). As might be expected, many of the occurrences of intermediate arsenic concentrations were located in the same regions where high arsenic concentrations were found. However, intermediate arsenic concentrations were found in many other areas as well, and in a variety of geologic materials.

Occurrence of high concentrations of arsenic in bedrock areas of Lane and Linn Counties appears to be related to the areal extent of two associations of older volcanic rocks: (1) the Fisher and Eugene Formations and correlative rocks (Oligocene and upper Eocene epochs), and (2) undifferentiated tuffaceous sedimentary rocks, tuffs, and basalt (Miocene and Oligocene epochs). (The undifferentiated tuffaceous sedimentary rocks, tuffs, and basalt are approximately equivalent to the Little Butte Volcanic Series of Peck and others [1964].) The surficial extent of these two rock associations is shown on plate 1. At land surface, the two rock associations cover 24 percent of the Willamette Basin. All detections of high concentrations of arsenic in Lane and Linn Counties occur in or very close to places where these volcanic rocks crop out, or in areas where thin layers of alluvial materials cover the rocks. These rocks include extensive volumes of silicic (rhyolitic) volcanic rocks. Ground water high in naturally occurring arsenic commonly is associated with volcanic rocks silicic to intermediate in composition (Welch and others, 1988). Thus, the apparent relationship between high concentrations of arsenic and geologic unit is not unexpected.

Interpretation of relationships between high concentrations of arsenic in ground water and geologic units could be improved upon at a local scale by use of more detailed (local) geologic maps. For example, although high concentrations of arsenic often occur in water within the Fisher and Eugene Formations and correlative rocks, Goldblatt and others (1963) suggest that the Fisher Formation, and not the Eugene Formation, is the source of most of the arsenic in that area. Similarly, water within basalt flows in the undifferentiated tuffaceous sedimentary rocks, tuffs, and basalt is not a likely candidate for high concentrations of arsenic because basalt typically yields water low in arsenic (Welch and others, 1988). The regional nature of the work presented in this report, with the requisite use of regional-scale rock associations, did not allow for finer-scale interpretation of the occurrence of high concentrations of arsenic relative to geologic characteristics. However, investigators involved in local-scale ground-water assessments should be able to make use of more detailed geologic mapping to help guide sampling.

Large portions of the area covered by the Fisher and Eugene Formations and correlative rocks, and the undifferentiated tuffaceous sedimentary rocks, tuffs, and basalt, are not represented by data collected and compiled for this report. Although most of the unsampled areas underlain by these rocks are not densely populated, they are not uninhabited, and the potential for impacts to human health are not insignificant. The surface exposure of these rocks alone represents 24 percent of the area of the Willamette Basin, and their full extent is greater. Additional sampling of wells completed in these arsenic-containing rocks would better define

the spatial distribution of high-arsenic water in areas not sampled during this study. Further, the presence of high arsenic concentrations in other aquifers in the Willamette Basin (pl. 1) suggests that additional sampling might reveal still more problem areas.

GEOCHEMISTRY OF ARSENIC

An understanding of factors controlling the distribution of arsenic in ground water requires a knowledge of arsenic sources and of processes controlling arsenic mobility. To that end, possible sources of arsenic in Willamette Basin ground water are discussed in this section. Processes that have been shown to control arsenic mobility in other natural systems are discussed next. Then, arsenic speciation data collected as part of this project, along with some historical speciation data, are presented. Finally, geochemical data (including the speciation data) and information from existing interpretive reports are used to construct preliminary hypotheses regarding possible geochemical controls over mobilization of arsenic in the Willamette Basin. An understanding of arsenic sources and geochemistry in the basin could help guide future monitoring efforts both in the basin and elsewhere. However, rigorous geochemical investigation of reasonable hypotheses will be required before an adequate understanding of arsenic geochemistry in the Willamette Basin can be said to exist. Thus, this discussion may serve future research.

Sources of Arsenic

Arsenic can be introduced into ground water from anthropogenic and natural sources. Anthropogenic sources may be important in some settings. Because industrial activity tends to be localized, it would be difficult to explain regional patterns of arsenic occurrence in the Willamette Basin by introduction from industrial sources. However, arsenical pesticides such as lead arsenate were historically used in large quantities in agricultural areas of the Willamette Basin (Rinehold and Jenkins, 1993). High-arsenic ground water in bedrock areas of Lane and Linn County tends to occur in nonagricultural areas, so it is unlikely that the observed high concentrations of arsenic in ground water in those areas can be attributed to historical use of arsenical pesticides. However, in contrast to land-use patterns in the bedrock areas of Lane and Linn Counties, land use in alluvial portions of the Tualatin Basin includes a variety of agricultural land uses, and high-arsenic ground water in alluvium in the Tualatin Basin does generally coincide with occurrence of agricultural areas. Closer inspection of the data, however, shows that detections of high concentrations of arsenic in Tualatin Basin ground water generally are near rivers and streams (pl. 1). Ground water near these rivers and streams likely represents ground water near the end of ground-water flowpaths. Occurrence of high concentrations of arsenic in downgradient parts of ground-water flowpaths could result from transport of arsenic from upgradient areas where arsenical pesticides historically had been applied, or from mobilization of naturally occurring arsenic during geochemical evolution as ground water moves along flowpaths. Arsenic is nearly immobile in topsoils, and arsenic in arsenical-pesticide-contaminated topsoil leaches on timescales of decades or more (Aten and others, 1980). Thus, occurrence of high concentrations of arsenic primarily in downgradient areas, and not more uniformly distributed in the Tualatin Basin, is more consistent with a natural source than an anthropogenic source. However, no rigorous ground-water flowpath analysis has been done for arsenic transport in the Tualatin Basin, and instances of leaching of arsenic from sites of historical arsenical use into ground water of the Tualatin Basin cannot be ruled out. Nonetheless, regional patterns of arsenic concentrations in ground water of the Willamette Basin as a whole probably reflect primarily natural sources.

Naturally occurring arsenic commonly is found in volcanic glass in volcanic rocks of rhyolitic to intermediate composition; adsorbed to and coprecipitated with metal oxides, especially iron oxides; adsorbed to clay-mineral surfaces; and associated with sulfide minerals and organic carbon (Welch and others, 1988). Sulfide minerals can contain arsenic either as a dominant mineral-forming element or as an impurity; sulfide minerals are found locally in the Western Cascades (U.S. Geological Survey, 1969). Metal oxides and clay minerals are ubiquitous in the Willamette Basin. Organic carbon is widespread in many parts

of the Willamette Basin, especially in alluvial deposits. Volcanic glass, commonly a major component of volcanic rocks, also is widely found in Willamette Basin aquifers, although much of the original glass in older volcanic rocks has been devitrified (Peck and others, 1964). Thus, arsenic originally associated with such volcanic glass either will have become associated with devitrification alteration products such as clays and metal oxides, or will have been released into solution and subsequently adsorbed or precipitated elsewhere or flushed from the aquifer. However, volcanic glass is still abundant in the Willamette Basin, and thus may constitute a current source of arsenic. At a minimum, the apparent relationship between rock associations containing silicic volcanic rocks and the occurrence of high concentrations of arsenic in ground water in Lane and Linn Counties described earlier in this report suggests that considerable amounts of arsenic might ultimately have come from volcanic glass. Thus, several sources of naturally occurring arsenic dispersed in aquifer materials can reasonably be postulated. However, examination of these various potential arsenic sources for arsenic availability in the Willamette Basin apparently has never been done.

Review of Geochemical Processes Controlling Arsenic Mobility

Two categories of processes largely control arsenic mobility in aquifers: (1) adsorption and desorption reactions and (2) solid-phase precipitation and dissolution reactions. Attachment of arsenic to an iron oxide surface is an example of an adsorption reaction. The reverse of this reaction, arsenic becoming detached from such a surface, is an example of desorption. Solid-phase precipitation is the formation of a solid phase from components present in aqueous solution. Precipitation of the mineral calcite, from calcium and carbonate present in ground water, is an example of solid-phase precipitation. Dissolution of volcanic glass within an aquifer is an example of solid-phase dissolution.

Arsenic adsorption and desorption reactions are influenced by changes in pH, occurrence of redox (reduction/oxidation) reactions, presence of competing anions, and solid-phase structural changes at the atomic level. Solid-phase precipitation and dissolution reactions are controlled by solution chemistry, including pH, redox state, and chemical composition.

Adsorption and Desorption Processes

Arsenic is a redox-sensitive element. This means that arsenic may gain or lose electrons in redox reactions. As a result, arsenic may be present in a variety of redox states. Arsenate and arsenite are the two forms of arsenic commonly found in ground water (Masscheleyn and others, 1991). Arsenate generally predominates under oxidizing conditions. Arsenite predominates when conditions become sufficiently reducing. Under the pH conditions of most ground water, arsenate is present as the negatively charged oxyanions $H_2AsO_4^-$ or $HAsO_4^{2-}$, whereas arsenite is present as the uncharged species $H_3AsO_3^0$ (Hem, 1985). The strength of adsorption and desorption reactions between these different arsenic species and solid-phase surfaces in aquifers varies, in part, because of these differences in charge. Differences in species charge affect the character of electrostatic interactions between species and surfaces.

Arsenate and arsenite adsorb to surfaces of a variety of aquifer materials, including iron oxides, aluminum oxides, and clay minerals. Adsorption and desorption reactions between arsenate and iron-oxide surfaces are particularly important controlling reactions because iron oxides are widespread in the hydrogeologic environment as coatings on other solids, and because arsenate adsorbs strongly to iron-oxide surfaces in acidic and near-neutral-pH water (Dzombak and Morel, 1990; Waychunas and others, 1993). However, desorption of arsenate from iron-oxide surfaces becomes favored as pH values become alkaline (Fuller and Davis, 1989; Dzombak and Morel, 1990). The pH-dependence of arsenate adsorption to iron-oxide surfaces appears to be related to the change in iron-oxide net surface charge from positive to negative as pH increases above the zero-point-of-charge (pH at which the net surface charge is equal to zero) of about 7.7 for goethite (crystalline iron oxide) (Stumm and Morgan, 1996) or 8.0 for ferrihydrite (amorphous iron oxide) (Dzombak and Morel, 1990). Where pH values are above about 8, the negative net surface charge of

iron oxide can repel negatively charged ions such as arsenate.

Iron-oxide surfaces also adsorb arsenite, and both arsenate and arsenite adsorb to aluminum oxides and clay-mineral surfaces. However, these adsorption reactions appear generally to be weaker than is the case for arsenate adsorption to iron-oxide surfaces under typical environmental pH conditions (Manning and Goldberg, 1997). Nevertheless, pH-dependent adsorption and desorption reactions other than those between arsenate and iron-oxide surfaces may be important controls over arsenic mobility in some settings. As is the case for adsorption of arsenate to iron-oxide surfaces, adsorption of arsenite to iron-oxide surfaces tends to decrease as pH increases, at least between the range from pH 6 to pH 9 (Dzombak and Morel, 1990). Unfortunately, arsenate and arsenite adsorption and desorption reactions with other common surfaces are less well characterized, and apparently more complex than is the case for adsorption and desorption reactions with iron-oxide surfaces (Manning and Goldberg, 1997).

As a result of the pH dependence of arsenic adsorption, changes in ground-water pH can promote adsorption or desorption of arsenic. Because solid-phase diagenesis (water-rock interaction) typically consumes H^+ (Stumm and Morgan, 1996), the pH of ground water tends to increase with residence time, which, in turn, increases along ground-water flowpaths. Because iron-oxide surfaces can hold large amounts of adsorbed arsenate, geochemical evolution of ground water to high (alkaline) pH can induce desorption of arsenic sufficient to result in exceedances of the USEPA current MCL in some environments (see, for example, Robertson, 1989).

Similarly, redox reactions can control aqueous arsenic concentrations by their effects on arsenic speciation, and hence, arsenic adsorption and desorption. For example, reduction of arsenate to arsenite can promote arsenic mobility because arsenite is generally less strongly adsorbed than is arsenate. Redox reactions involving either aqueous or adsorbed arsenic can affect arsenic mobility (Manning and Goldberg, 1997).

Arsenic adsorption also can be affected by the presence of competing ions. In particular, phosphate and arsenate have similar geochemical behavior, and as such, both compete for sorption sites (Hingston and others, 1971; Livesey and Huang, 1981; Manning and Goldberg, 1996). Oxyanions in addition to phosphate also may compete for sorption sites. For example, Robertson (1989) suggested that correlation of arsenate with oxyanions of molybdenum, selenium, and vanadium in ground water of the Southwestern United States may be evidence for competitive adsorption among those oxyanions.

Finally, structural changes in solid phases at the atomic level also affect arsenic adsorption and desorption. For example, conversion of ferrihydrite to goethite or to other crystalline iron-oxide phases may occur gradually over time (Dzombak and Morel, 1990). Fuller and others (1993) demonstrated that as ferrihydrite crystallizes into goethite, the density of arsenic adsorption sites decreases. This decrease in density of adsorption sites can result in desorption of adsorbed arsenic. Structural changes in other solid phases may possibly affect arsenic mobility, too. The role of such solid-phase structural changes on ground-water arsenic concentrations has, however, received little attention to date.

Precipitation and Dissolution Processes

The various solid phases (minerals, amorphous oxides, volcanic glass, organic carbon) of which aquifers are composed exist in a variety of thermodynamic states. At any given time, some aquifer solid phases will be undergoing dissolution, whereas others will be precipitating from solution. Arsenic contained within solid phases, either as a primary structural component of or an impurity in any of a variety of solid phases, is released to ground water when those solid phases dissolve. Similarly, arsenic is removed from ground water when solid phases containing arsenic precipitate from aqueous solution. As an example, because arsenic often coprecipitates with iron oxide (Waychunas and others, 1993), iron oxide may act as an arsenic source (case of dissolution) or a sink (case of precipitation) for ground water. Furthermore, solid-phase dissolution will contribute not only arsenic contained within that phase, but also any arsenic adsorbed to the solid-phase surface. The process of release of adsorbed arsenic as a result of solid-phase dissolution is distinct from the process of desorption from stable solid phases.

The interplay of redox reactions and solid-phase precipitation and dissolution may be particularly important with regard to aqueous arsenic and solid-phase iron oxides and sulfide minerals. High concentrations of arsenic often are associated with iron oxides and sulfide minerals (Thornton, 1996). Iron oxides frequently dissolve under reducing conditions, but often precipitate under oxidizing conditions. Sulfide minerals generally are unstable under oxidizing conditions, but may precipitate under reducing conditions. Thus, as a result of the redox-sensitive nature of iron oxides and sulfide minerals, transfer of large amounts of arsenic between these solid phases and neighboring water may result from redox-facilitated precipitation and dissolution reactions.

Arsenic Speciation in the Willamette Basin

Three samples from alluvial wells in the Tualatin Basin and two from bedrock wells in Lane County were analyzed for four common species of arsenic. Concentrations of the two organic species of arsenic analyzed (monosodium methylarsonate, or CH_3AsO_3HNa, and sodium dimethylarsinate, or $(CH_3)_2AsO_2Na$) were below MDLs, so only the data for the two inorganic species are tabulated. These speciation data are given in table 4.

Two additional analyses for arsenic species in ground water from the Willamette Basin were available in the literature. Welch and others (1988) reported arsenite and arsenate concentrations for water from two wells in Lane County. Arsenite represented 7 percent and 62 percent of the total arsenic in these samples (total arsenic concentrations being 25 and 45 µg/L, respectively).

The most striking feature of the data from the two studies is the predominance of arsenite. The predominance of arsenite has both geochemical and toxicological implications. From a geochemical standpoint, the speciation data are of interest because mobility of arsenite differs from that of arsenate (see section “Review of Geochemical Processes Controlling Arsenic Mobility”). From a public-health perspective, the speciation data are interesting because arsenite is more toxic than arsenate in at least some of its effects. In human acute toxicity studies, arsenite has been shown to be more potent than arsenate (U.S. Environmental Protection Agency, 1988). With regard to human chromosome breakage, arsenite is about an order of magnitude more potent than arsenate (U.S. Environmental Protection Agency, 1988). Morrison and others (1989) report that arsenite is 50 times as toxic as arsenate, but do not report the organisms studied. Also, arsenite is more difficult to remove from drinking-water supplies than is arsenate (Gupta and Chen, 1978; Schneiter and Middlebrooks, 1983). However, it would be premature to make generalizations regarding arsenic toxicity in the Willamette Basin based upon such limited speciation data (seven samples). Complicating the matter, in the benchmarks against which drinking water arsenic concentration data commonly are compared—the USEPA current MCL and the WHO provisional guideline—no differen- tiation is made between arsenite and arsenate. But if the apparent predominance of arsenite in Willamette Basin ground water is confirmed by additional speciation work, public health officials and water managers may need to evaluate the scope of the arsenic problem with regard not only to arsenic concentrations, but also to arsenic speciation.

Table 4. Speciation of arsenic

[Total arsenic concentration is from a separate analysis of a separate sample, and differs from the total of arsenite-plus-arsenate because of sampling and (or) analytical variability. Recovery, total of arsenite-plus-arsenate divided by total arsenic; µg/L, micrograms per liter]

Well location	Date	Arsenite (percent of total of arsenite-plus-arsenate)	Arsenate (percent of total of arsenite-plus-arsenate)	Arsenite (µg/L)	Arsenate (µg/L)	Total of arsenite-plus-arsenate (µg/L)	Total arsenic concentration (µg/L)	Recovery (percent)
01N/03W-04CCC	08/19/97	76	24	61.1	18.9	80.0	97	82
01S/03W-10BCA1	08/19/97	96	4	58.8	2.3	61.1	56	110
02S/02W-11CCD1	08/19/97	94	6	15.3	.9	16.2	19	85
18S/04W-14BBA	08/20/97	>99	<1	1,200	6.1	1,210	1,100	110
19S/03W-31E1	08/20/97	68	32	61.5	29.4	90.9	130	70

Geochemistry of Arsenic in the Willamette Basin

Few routine chemical analyses (of major ions and field parameters) are available for high-arsenic ground water from bedrock areas of Lane and Linn Counties. Goldblatt and others (1963) noted that high-arsenic ground water tended to have high pH (>8.0) and high orthophosphate concentrations, although only two routine chemical analyses for high-arsenic ground water were published. Reliable measures of redox conditions were not collected. However, the observation was made during site visits that water from many of the wells in bedrock areas of Lane and Linn Counties that yielded high-arsenic ground water during project sampling also had sulfide odors. The presence of sulfide in water indicates chemically reducing conditions. The observation of sulfide, along with the detection of arsenite (the more reduced of the two major arsenic species) in some ground-water samples, indicates the presence of reducing conditions in some ground water in these areas.

Together, these data suggest that for ground water in bedrock areas of Lane and Linn Counties, one or more of the following controlling factors likely are important in adsorption and desorption reactions that in turn often control arsenic mobility: (1) high pH, (2) presence of competing anions, and (3) occurrence of reducing conditions. The sparse available data do not allow even for speculation about adsorption and desorption reactions related to solid-phase structural changes at the atomic level in ground water of bedrock areas of Lane and Linn Counties. Similarly, evidence is lacking to even begin to develop hypotheses about solid-phase precipitation and dissolution reactions.

Previous investigations of the quality of Tualatin Basin ground water provide some preliminary insight into arsenic geochemistry there. Rounds and others (1994) reported that high phosphorus concentrations (up to 2.9 mg/L [milligrams per liter]) are common in Tualatin Basin ground water. In an analysis of 47 filtered ground-water samples from the Tualatin Basin, Hinkle (1997) reported that the median arsenic concentration in low-dissolved-oxygen samples (dissolved oxygen concentrations < 1.0 mg/L) was greater than the median arsenic concentration in well-oxygenated samples. The difference was statistically significant. Of the 47 samples, the 4 that exceeded the USEPA current MCL not only had low dissolved-oxygen concentrations, but also had high concentrations of orthophosphate (0.36 to 2.0 mg/L) and iron (160 to 1,900 µg/L). However, pH was not unusually high; pH of three of the four high-arsenic samples ranged from 7.5 to 7.6, and was 8.1 for the fourth sample.

These data suggest that for alluvial ground water in the Tualatin Basin, presence of competing anions and occurrence of reducing conditions may be important controlling factors in arsenic adsorption and desorption reactions. These two factors might be more important than pH controls over arsenic adsorption and desorption. Reducing conditions and high concentrations of dissolved iron also suggest that dissolution of iron oxides, with subsequent release of adsorbed or coprecipitated arsenic, may play a role in arsenic mobility in the Tualatin Basin.

Hypotheses about factors affecting arsenic adsorption and desorption reactions should account for arsenic speciation. Limited geochemical data suggest that desorption of arsenic from solid phases may be an important process in ground water both in bedrock areas of Lane and Linn Counties and in alluvium in the Tualatin Basin. Desorption of arsenate from iron oxides commonly results from high pH or the presence of competing ions. Such processes, of course, require the presence of arsenate on solid-phase surfaces. Because redox reactions often are slow and frequently far from equilibrium, it would not be unexpected to find arsenate adsorbed to solid-phase surfaces in chemically reducing environments. It might appear, though, that the predominance of arsenite relative to arsenate in aqueous speciation samples would be inconsistent with a hypothesis of desorption of arsenate from iron-oxide surfaces. However, it may be that arsenate is desorbed from aquifer surfaces and subsequently reduced to arsenite.

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APPENDIX

APPENDIX

Table 1. Wells discussed in report text, tables, and figures, listed by well location name from original source, and cross-referenced by recalculated well location and by U.S. Geological Survey site identification number and Oregon Water Resources Department well log identification number
["--", identical to "Well location (original source)"; N/A, none or not determined].

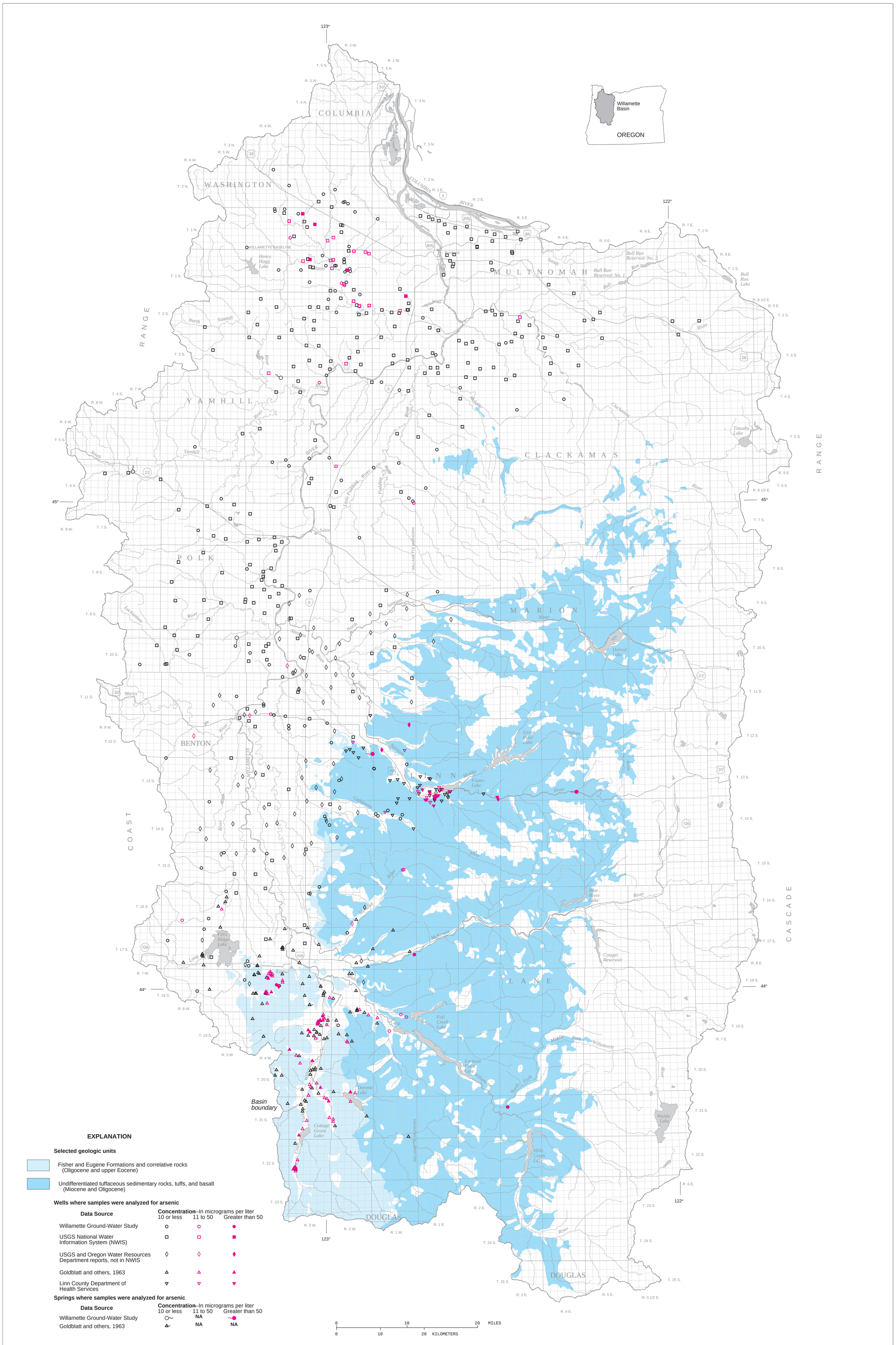
Well location (original source)	Well location (recalculated)	U.S. Geological Survey site identification number	Oregon Water Resources Department well log identification number
01N/03W-04CCC	--	453540123041101	WASH 5967
01N/03W-07CCD1	--	453445123063201	WASH 6037
01N/03W-15ADB1	--	453422123020201	N/A
01S/02W-29DBD	--	452707122572201	WASH 10406
01S/02W-33BBA	--	452651122565001	WASH 10475
01S/03W-10BCA1	--	453002123025301	WASH 143
02S/02W-11CCD1	--	452416122541601	WASH 12572
12S/01W-29N1	12S/01W-29CCA	442934122502801	LINN 9588
13S/01E-33	13S/01E-33DB1	442332122412701	LINN 12832
13S/01E-33AC	--	442348122412301	LINN 12776
13S/01E-35	13S/01E-35BD1	442347122391001	LINN 12914
14S/01E-05	13S/01E-32CD1	442323122424801	LINN 10997
15S/01W-23CCA	--	441447122464501	LANE 50736
15S/01W-23CCC2	--	441446122465701	LANE 5873
17S/01W-24DCA	--	440420122445701	LANE 2085
18S/04W-10D	18S/04W-10BB1	440125123095901	N/A
18S/04W-14ACA	--	440029123080301	LANE 17048
18S/04W-14ACB	--	440024123080901	LANE 17052
18S/04W-14BBA	--	440036123083201	LANE 16780
18S/04W-22B	18S/04W-22BA1	435942123092501	N/A
19S/01W-03ADB	--	435656122471801	LANE 19429
19S/03W-11E2	19S/03W-11BC3	435606123012501	N/A
19S/03W-31E1	19S/03W-31BB1	435237123061801	N/A
21S/03E-08CBD2	--	434528122290901	LANE 23527
22S/03W-17N	22S/03W-17CC1	433859123045601	N/A

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with
OREGON WATER RESOURCES DEPARTMENT

WATER-RESOURCES INVESTIGATIONS REPORT 98-4205
Arsenic concentrations in ground water, and selected geologic units—PLATE 1

Hinkle, S.R. and Polette, D.J.
Arsenic in Ground Water of the Willamette Basin, Oregon



EXPLANATION

Selected geologic units

- Fisher and Eugene Formations and correlative rocks (Oligocene and upper Eocene)
- Undifferentiated tuffaceous sedimentary rocks, tuffs, and basalt (Miocene and Oligocene)

Wells where samples were analyzed for arsenic

Data Source	Concentration—In micrograms per liter: 10 or less	11 to 50	Greater than 50
Willamette Ground-Water Study	○	○	●
USGS National Water Information System (NWIS)	□	□	■
USGS and Oregon Water Resources Department reports, not in NWIS	◊	◊	♦
Goldblatt and others, 1963	△	△	▲
Linn County Department of Health Services	▽	▽	▼

Springs where samples were analyzed for arsenic

Data Source	Concentration—In micrograms per liter: 10 or less	11 to 50	Greater than 50
Willamette Ground-Water Study	○~	NA	~●
Goldblatt and others, 1963	△-	NA	NA

Base modified from U.S. Geological Survey Digital base from
U.S. Geological Survey Digital Line Graphs published at 1:100,000, 1987;
U.S. Bureau of the Census, TIGER/Line(R), published at 1:100,000, 1990;
U.S. Geological Survey Digital Line Graphs published at 1:100,000, 1988
and modified by the State of Oregon. 1994;
U.S. Geological Survey quadrangle maps published at 1:24,000
as digitized by Oregon Department of Transportation;
Universal Transverse Mercator projection, Zone 10
1927 North American Datum

Geology from Walker and MacLeod, U.S. Geological Survey Digital Line G
published at 1:500,000, 1991 and modified by the State of Oregon, 199

DISTRIBUTION OF ARSENIC CONCENTRATIONS IN GROUND WATER, AND SELECTED GEOLOGIC UNITS OF THE WILLAMETTE BASIN, OREGON

By
Danial J. Polette and Stephen R. Hinkle

From: Joel Geier
To: Benton Public Comment
Subject: LU-24-027: Leachate and arsenic issues
Date: Monday, May 5, 2025 7:36:23 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Planning Department staff and members of the Planning Commission:

Please enter the attached presentation into the record for this land-use decisions.

This is a presentation that I developed for local United States Geological Survey (USGS) water quality scientists, for a meeting in January of 2025. Unfortunately due to current disruptions in funding for federal agencies, which have impacted the USGS office in Corvallis, we haven't been able to follow up on this discussion.

Please note Slide 16, "Shifting explanations." These were compiled from past minutes of Benton County's Solid Waste Advisory Committee (SWAC) and from the applicant's "Annual Environmental Monitoring Report."

SWAC volunteers expressed concern about the observed high arsenic levels more than 20 years ago. In response, the landfill's representatives gave them a shifting set of explanations, none of which have stood up to the test of time.

In the applicant's testimony last Thursday, their consultant Jeff Shepherd raised yet another hypothesis for the observed high levels of arsenic in groundwater at the landfill site.

As a scientist, I see hypotheses as a good thing. But hypotheses need to be tested, in order to see if they hold water.

Despite 30 years of anomalously high arsenic levels at this landfill site, the applicant has yet to present a scientific plan to test any of their various arm-waving explanations for the observed high levels of arsenic. That includes their most recent attempt at an explanation, as presented to you last Thursday.

Yours sincerely,

Joel Geier, Ph.D.
38566 Hwy 99W
Corvallis, OR 97330-9320

Water contamination concerns arising from landfills in Oregon

Joel Geier
Mark Yeager
(with contributions from Mason Leavitt)



Main Topics

Contaminants from landfill leachate passed through wastewater treatment plants into Oregon rivers

Sewage sludge (“biosolids”) from same wastewater treatment plants

Arsenic plume apparently forming from Coffin Butte landfill

What's in landfill leachate?

Dissolved metals (major):

Calcium	160 mg/L	
Iron	0.91 mg/L	– exceeds MCL for drinking water
Manganese	1 mg/L	– exceeds MCL for drinking water
Magnesium	160 mg/L	
Silicon	37 mg/L	

Dissolved metals (trace):

Antimony	16 µg/L	– exceeds MCL for drinking water
Arsenic	120 µg/L	– exceeds MCL for drinking water
Barium	570 µg/L	
Chromium	180 µg/L	– exceeds MCL for drinking water
Cobalt	38 µg/L	
Copper	5.3 µg/L	
Lead	1.2 µg/L	– goal for drinking water is zero
Mercury	???	– data missing from reports for Coffin Butte
Nickel	140 µg/L	
Selenium	1.6 µg/L	
Silver	0.1 µg/L	
Thallium	0.1 µg/L	
Vanadium	140 µg/L	
Zinc	37 µg/L	

What's in landfill leachate?

Organic chemicals above detectable limits in 2021 at Coffin Butte:

Acetone	460 µg/L
Benzene	3.8 µg/L
2-Butanone	490 µg/L
Carbon Disulfide	3.7 µg/L
1,4 Dichlorobenzene	2.1 µg/L
Ethylbenzene	5.2 µg/L
p-Isopropyl toluene	1.8 µg/L
Naphtalene	5.2 µg/L
Toluene	37 µg/L
1,2,4-Trimethylbenzene	1.7 µg/L
m,p-Xylene	7 µg/L
o-Xylene	4.3 µg/L

Past years:
cis-1,2-Cichloroethene
Isopropyl benzene
4-Methyl-2-Pentatone

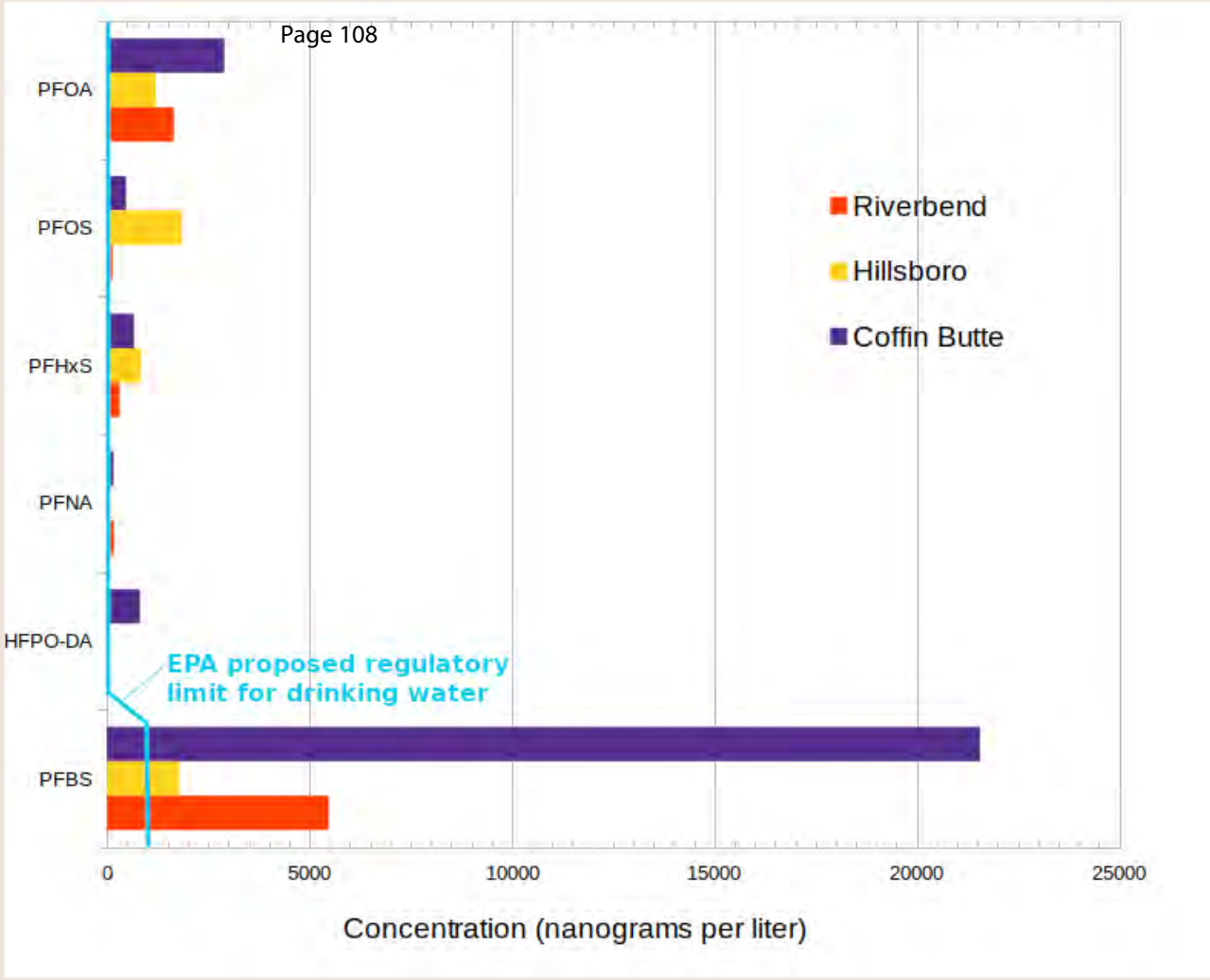
Substances still found in local fields that were "irrigated" with leachate before 1998:
tetrachloroethylene (PCE)
trichloroethylene (TCE)
1,1-dichloroethylene

Only recently tested for: **Per- and polyfluorakyl substances (PFAS)**

PFAS in landfill leachate:

Data for six types now regulated by US EPA as human carcinogens.

Differences among landfills may reflect different average age of waste, as well as different materials accepted (such as incinerator ash)



Municipal wastewater plants not effective for removing PFAS

Concentrations in municipal wastewater expected to decline as regulatory changes reduce PFAS in consumer products.

Landfills will continue to produce indefinitely from “legacy” waste.

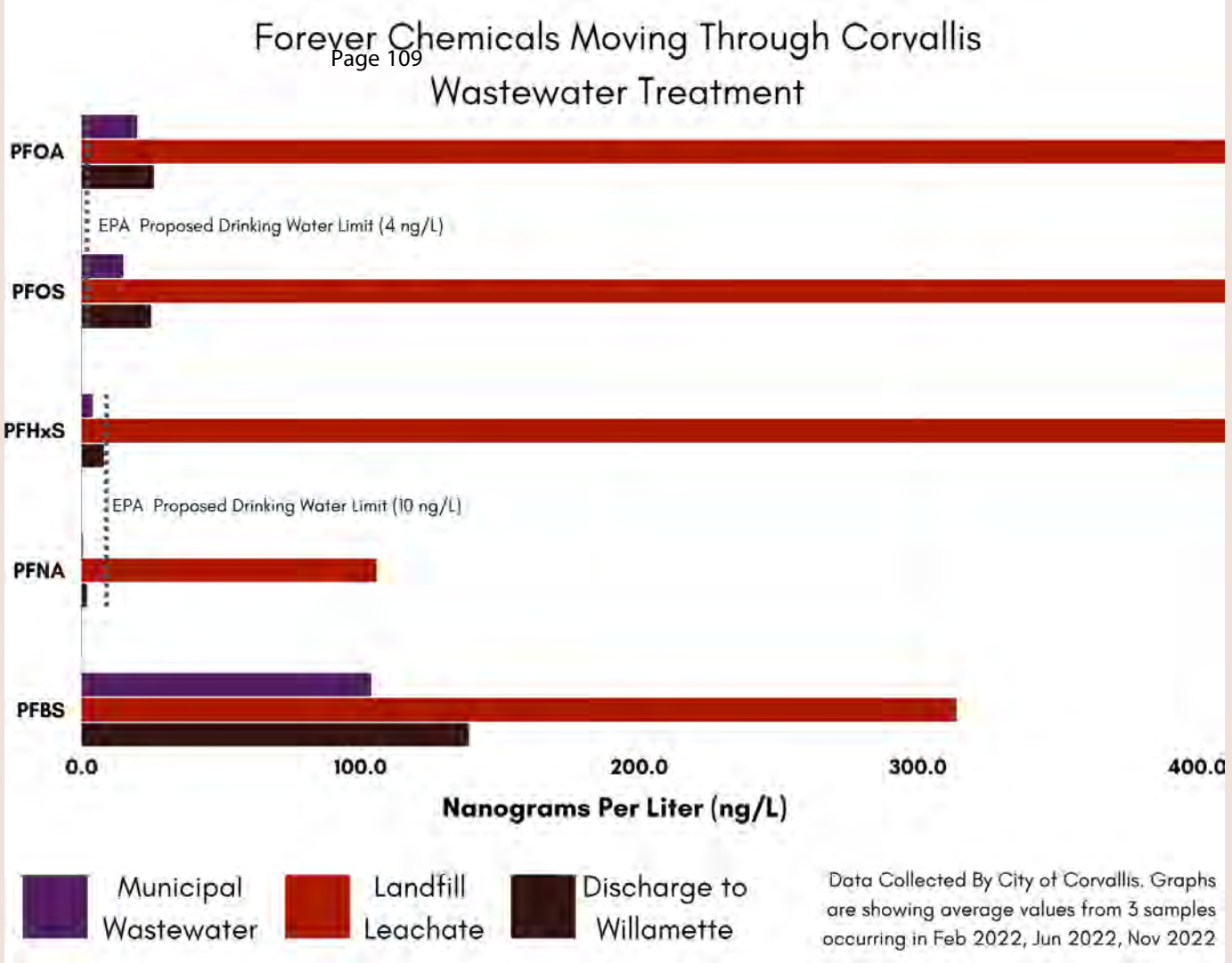
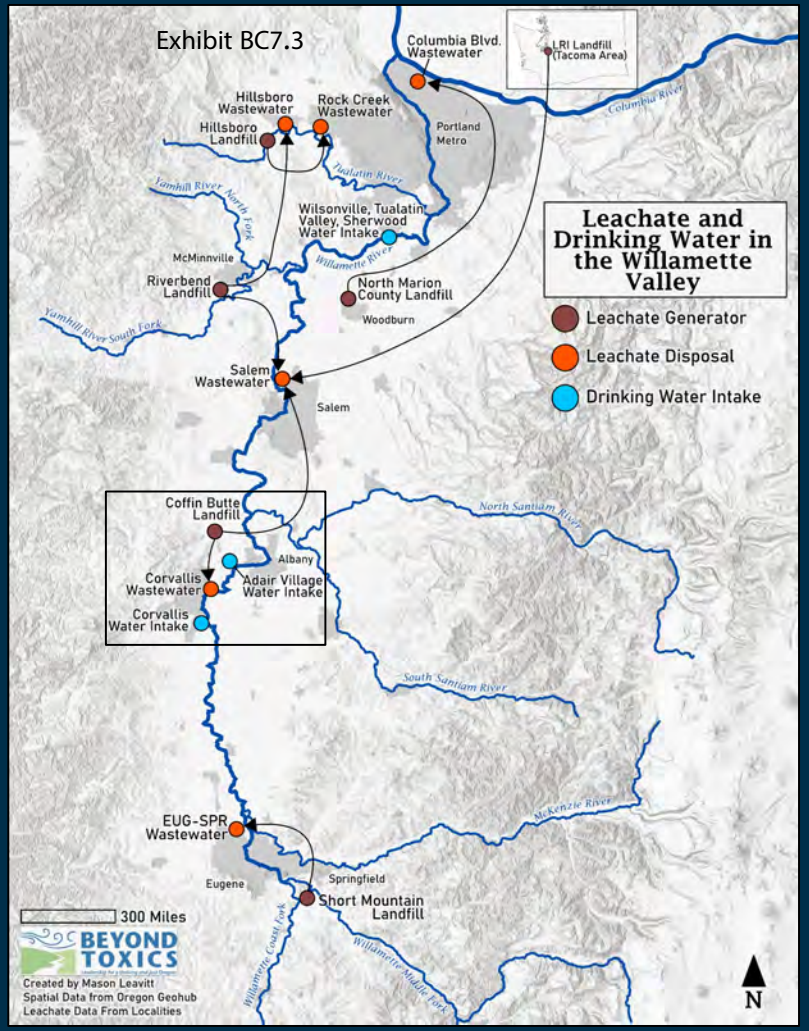
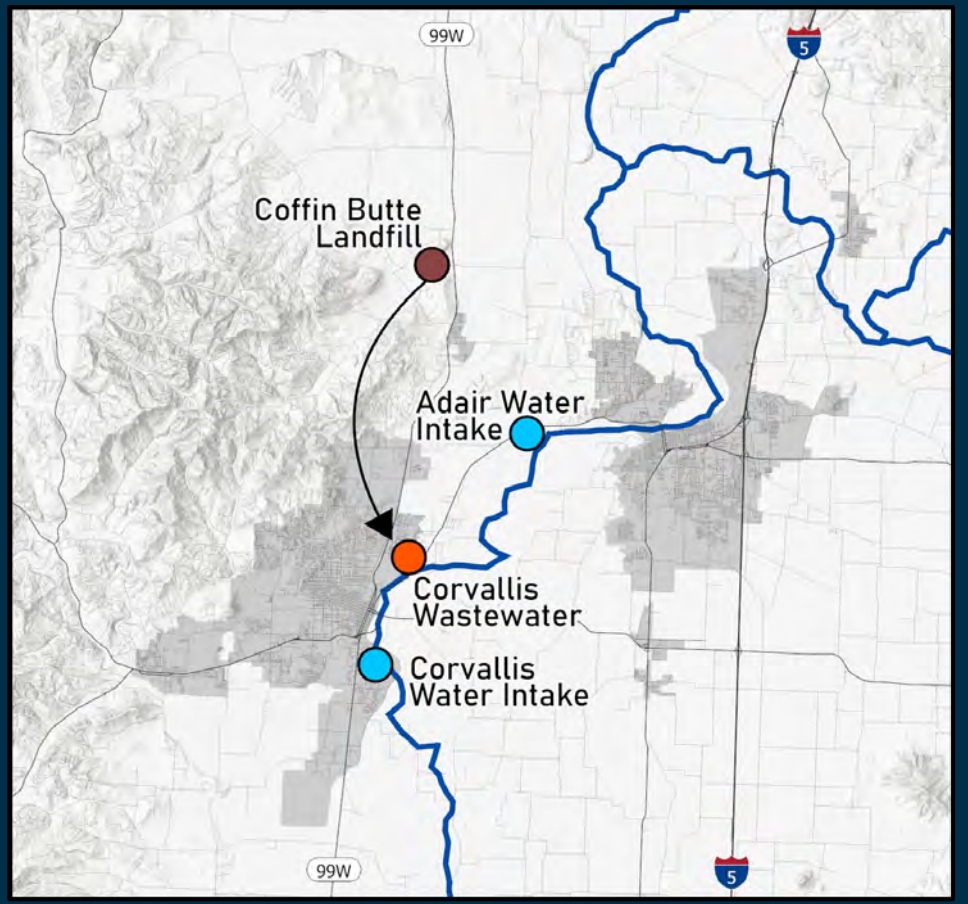


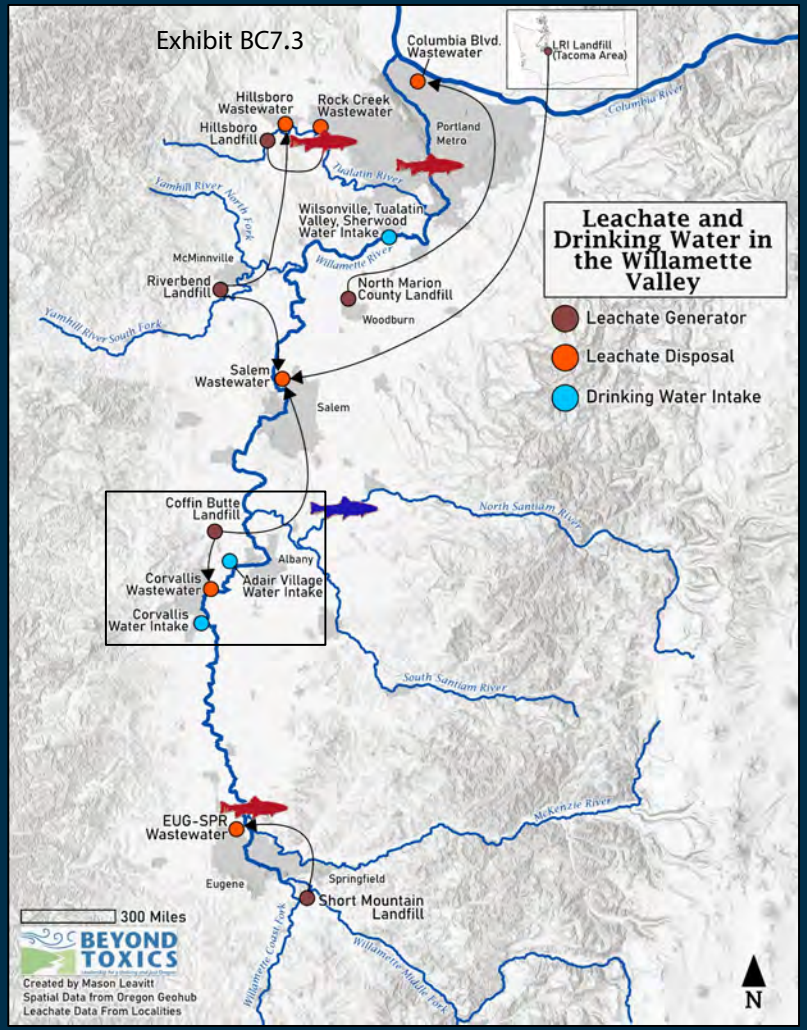
Exhibit BC7.3

Leachate Inputs to Willamette





Evidence of bioaccumulation

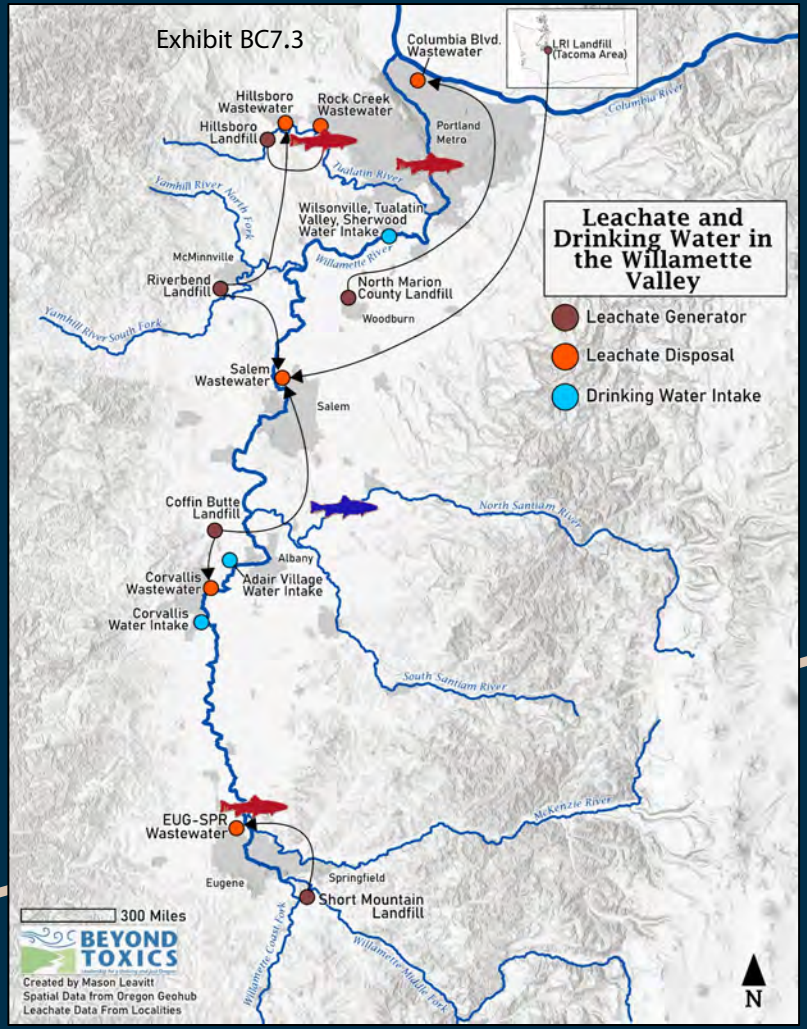


2008 NRSA fish tissue study: PFAS found at detectable levels in fish in all Willamette Valley locations sampled downstream of WWTPs accepting landfill leachate.

Also found in Rogue River fish sampled below White City WWTP where leachate is piped directly from Dry Creek landfill.

Only “clean” sample was from North Santiam River below Stayton WWTP (which processes municipal wastewater but no landfill leachate).

Fish species: Northern pikeminnow (Eugene), mountain whitefish (Stayton), carp (Oregon City and Hillsboro), cutthroat trout (Rogue Valley)



Discussion?

Any recent efforts to sample PFAS in Oregon rivers?

Any new information about accumulation in biota, river sediments or hyporheic zone?

How much PFAS and heavy metals end up in sludge (“biosolids”)?

Any efforts to understand fate & transport of contaminants from sludge in the environment?

Arsenic issue: Anomalously high concentrations in monitoring wells on south/east side of landfill, fluctuating over time



First noted in mid-1990s after acknowledged seepage event.

Arsenic Concentrations East-side wells 1994-2021

Data from 2021 Annual Environmental Monitoring Report

Compliance boundary wells MW-26 and -27 have regularly exceeded MCL of 10 µg/L since installed in 2013.

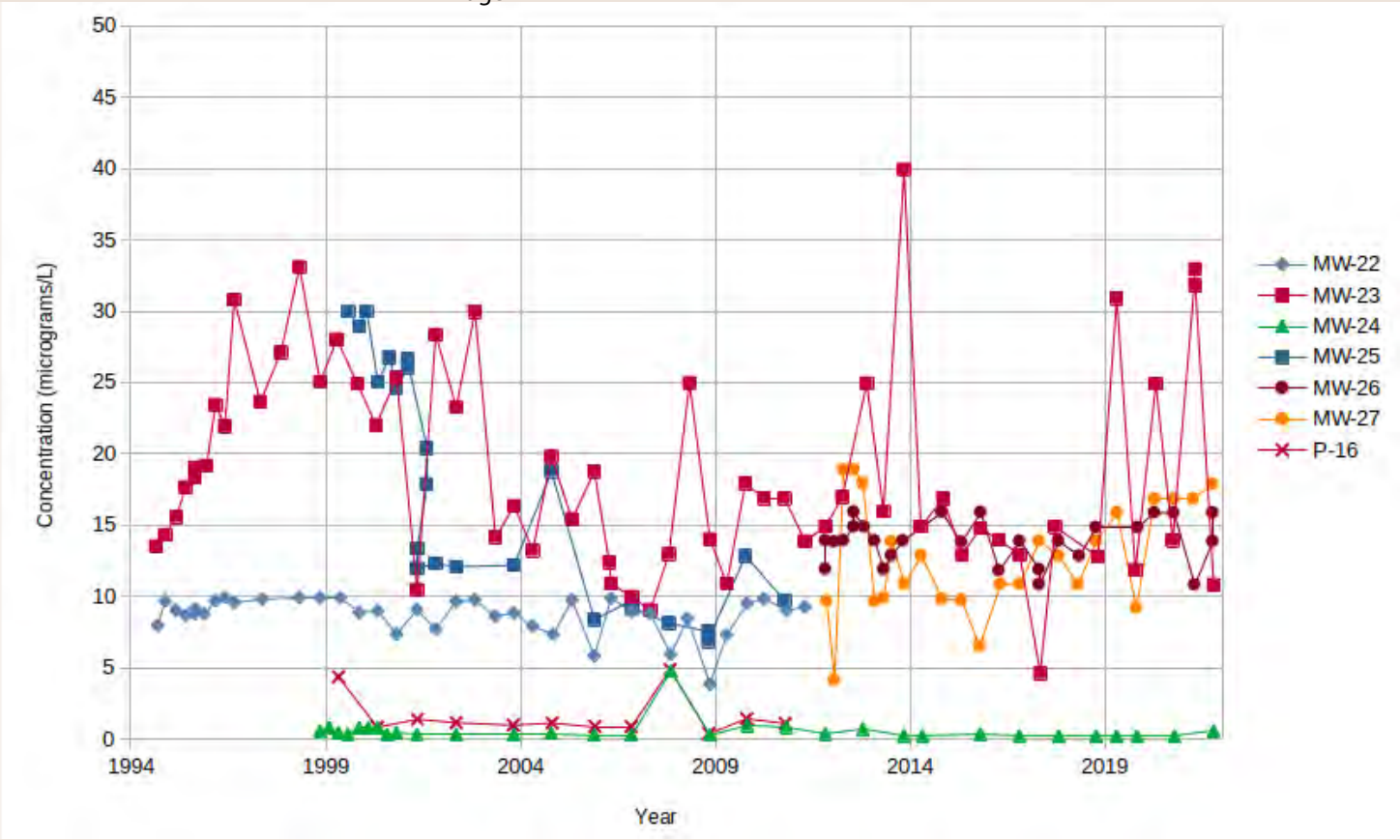
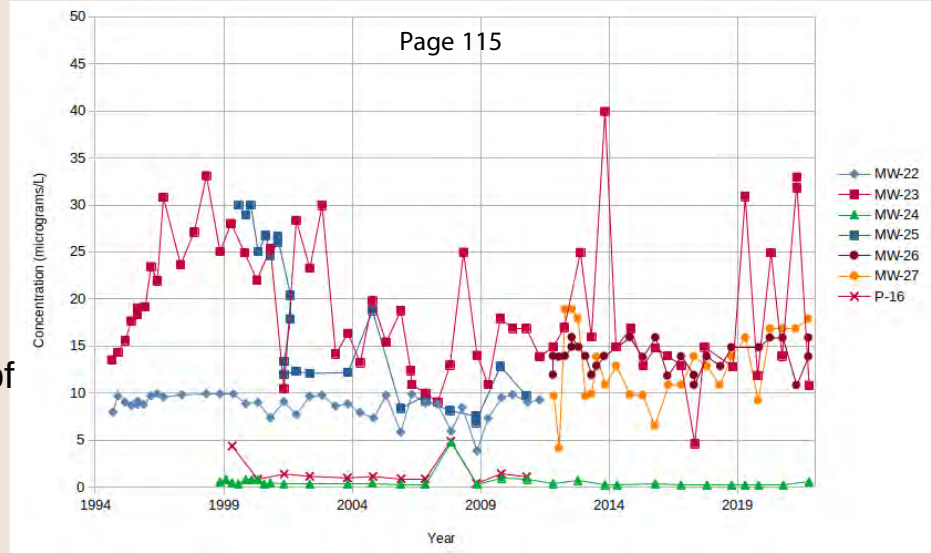
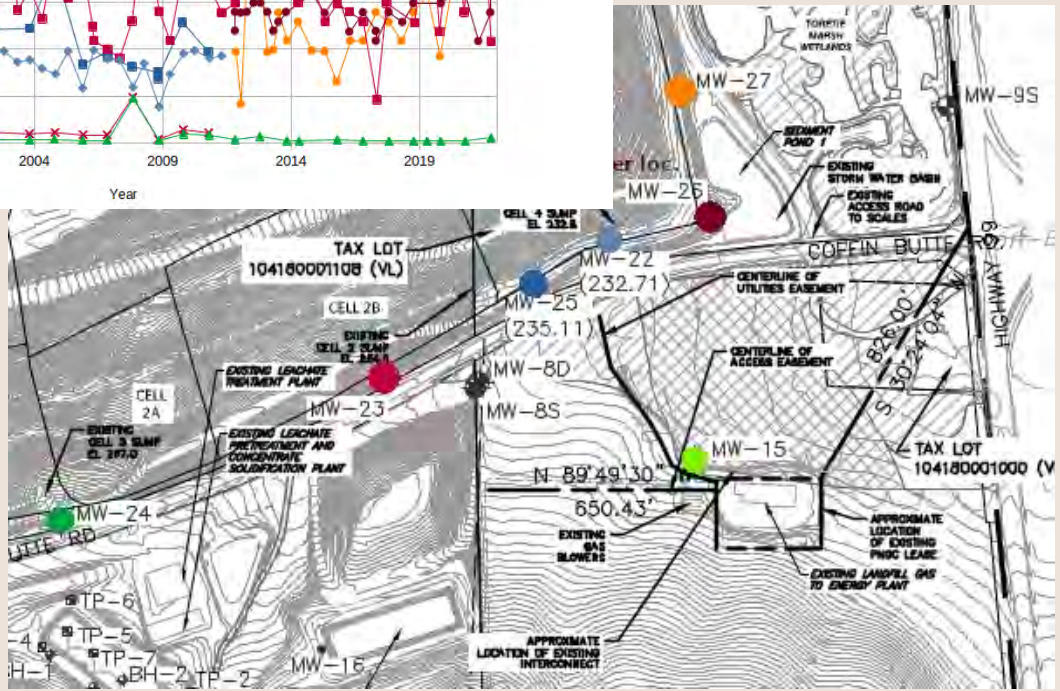


Exhibit BC7.3



High arsenic in MW-23 and all wells down-gradient of early/mid 1990s seepage incident.

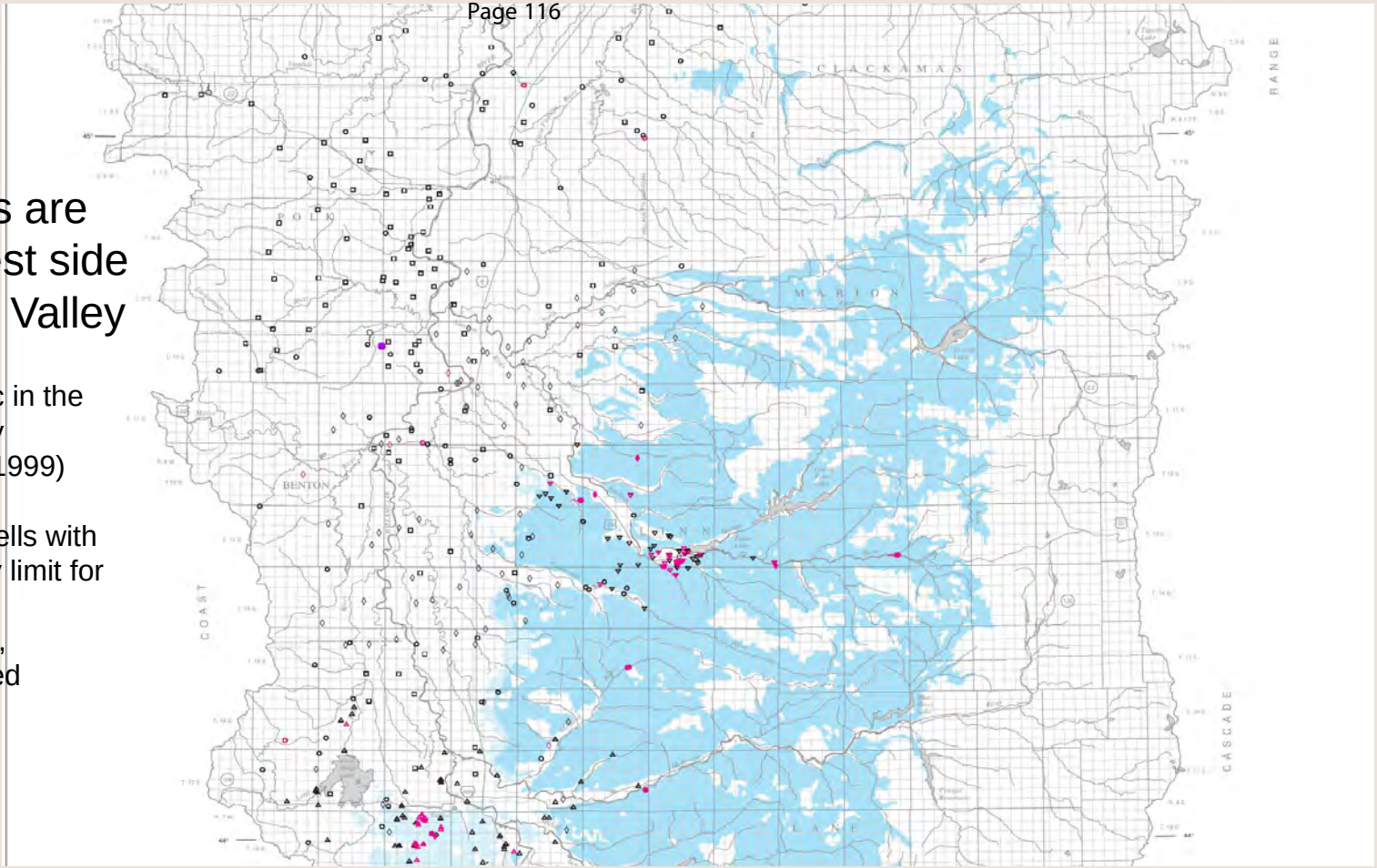
No problems in:
MW-24 (higher up drainage)
MW-15 (across gradient)
P-16 (across gradient)



Observed levels are anomalous for west side of mid-Willamette Valley

USGS Study of Arsenic in the Willamette Valley
(Hinkle and Pollette, 1999)

Red markers indicate wells with arsenic above regulatory limit for drinking water:
>10 µg/L if hollow,
>50 µg/L if solid red

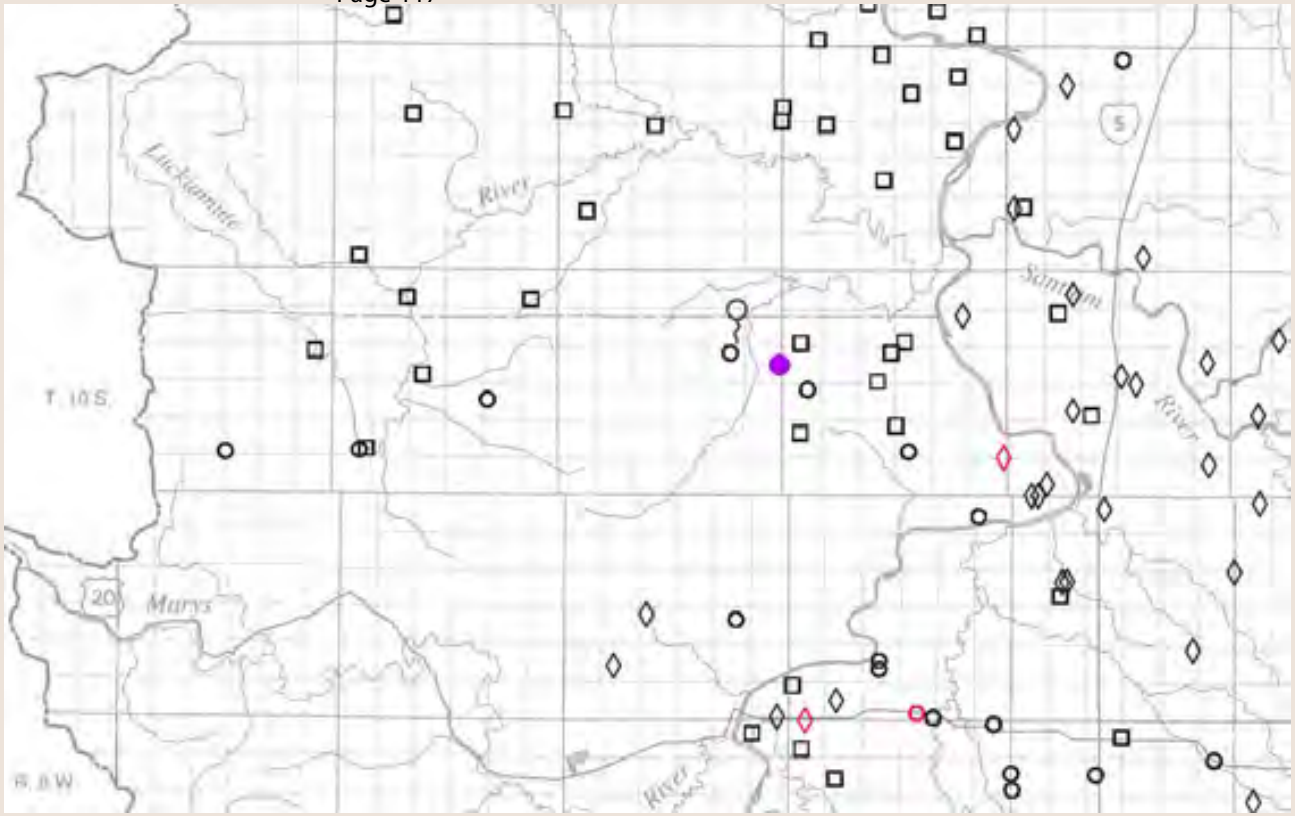


Observed levels are anomalous for west side of mid-Willamette Valley

USGS Study of Arsenic in the Willamette Valley
(Hinkle and Pollette, 1999)

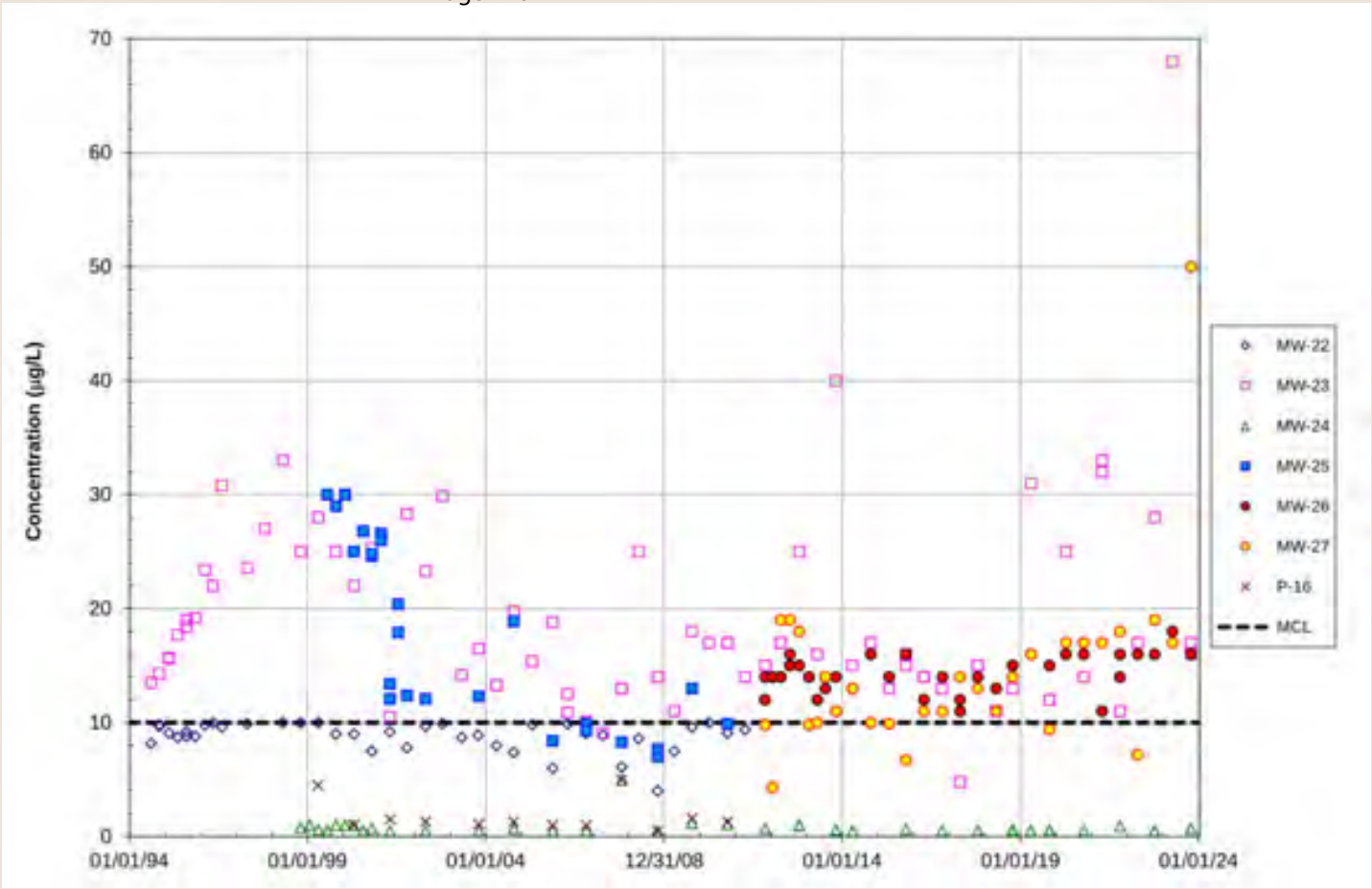
Red markers indicate wells with arsenic above regulatory limit for drinking water (10 µg/L but less than 50 µg/L).

Purple dot shows location of Coffin Butte Landfill.



Most recent data: Arsenic Concentrations East-side wells 1994-**2023**

Data from 2023 Annual Environmental Monitoring Report



Shifting explanations

“These are background levels of arsenic, typical for that part of the site.”
Problem: Values are anomalous for this part of Willamette Valley, and also fluctuate with time.

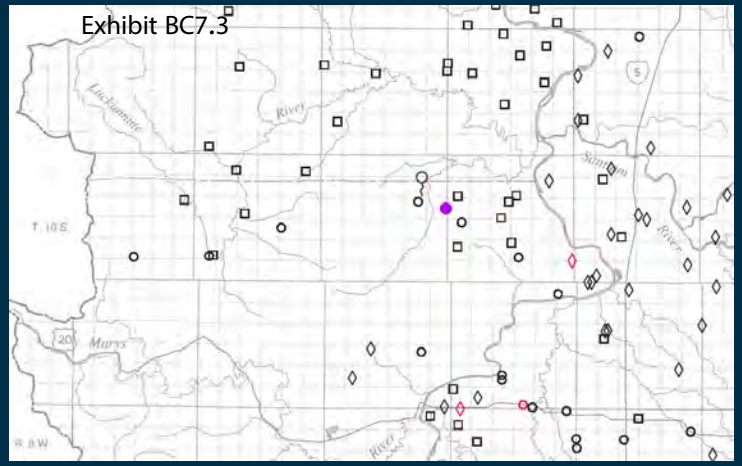
“Arsenic doesn’t normally come out of landfills.”
Problem: Leachate from this landfill has measured As concentrations ~120 µg/L

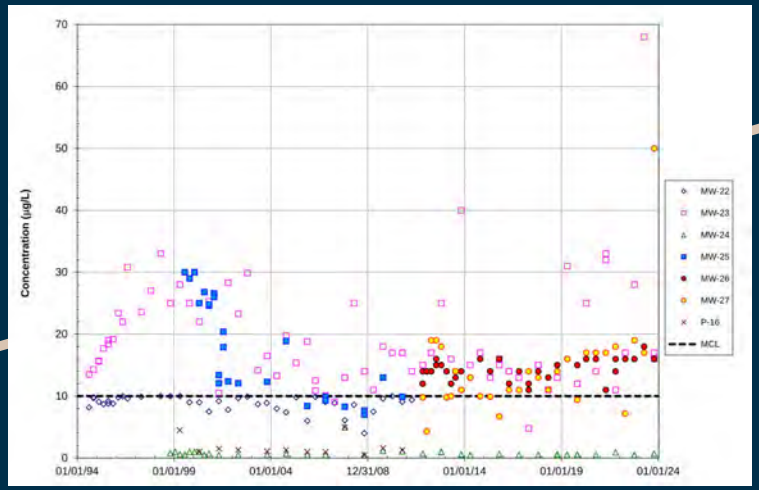
”Higher concentrations are observed in MW-9S near highway”
Problem: MW-9S is in disturbed location (drilled into a former cloverleaf intersection ramp from 1940s), at edge of an artificial wetland that was bulldozed out during the early 1990s seepage event, and filled with runoff from the acknowledged seepage area. So MW-9S was compromised before it was ever sampled for arsenic.
Also new data approaching 70 µg/L in MW-23 exceed highest levels ever measured in MW-9S.

”MW-27 is difficult to sample because it’s screened in a low-permeability layer.”
Problem: This doesn’t explain upward trend in recent years. Might be a good argument for adding another compliance-boundary well.

”Other indicators of leachate (Fe, Mn, and TDS) do not show similar trends.”
Problem: Both Fe and Mn have been trending upward in recent years, and have exceeded the site-specific action limits.

”These are typical values for the southern Willamette Valley”
Problem: Coffin Butte is in the mid-Willamette Valley.





Closing discussion

Alternative hypotheses for high arsenic – direct leakage or mobilization?

Possibilities for off-site measurements?

Precautionary well testing for down-gradient households?

Anything else?

From: Joel Geier
To: Benton Public Comment
Subject: Oppose/Deny LU-24-027: Resubmittal of 2021 testimony on heron impact
Date: Thursday, May 8, 2025 12:43:14 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Chair Fowler and Members of the Planning Commission:

As additional testimony on the issue of sensitive Great Blue Heron rookeries (Development Code Sections 87.200 through 87.230), I'm herewith resubmitting my testimony from a very similar application by the same applicant in 2021 (LU-21-047). I am also attaching related testimony by Debbie and Norm Johnson for that same proposal, which includes facts that are still relevant regarding heron rookeries and the applicable state forestry rules and county development code.

My 2021 testimony applies in its entirely to the current application, except regarding the details of the changes in topography.

The main difference is that LU-21-047 proposed a 270 ft tall ridge constructed of waste that would completely block the existing flyway through existing, broad topographic saddle between Coffin Butte and Tampico Ridge. In 2021 I noted that this would cut off access to one or more foraging areas that are used by the herons during nesting season.

The current proposal, if taken at face value, would not entirely block this flyway, but it would severely constrict it by building another huge hill of garbage out from the north end of Tampico Ridge. Only a narrow "valley" would be left along the road running between the new and old landfills. Herons using that valley to fly to foraging areas to the west and then to carry food back to their nests would be vulnerable to harassment by Bald Eagles which (as the applicant has documented) congregate around the dump site.

Again, **that's only if the current proposal is taken at face value.**

As noted by the VNEQS attorney, Jeffrey Kleinman, during his oral testimony on May 6th, if you approve LU-24-027, there is no real impediment to the applicant reverting to the original plan set forth in LU-21-047. All that would be needed is a vacation of the section of Coffin Butte Road between the new and old landfills, which would not require approval of the Planning Commission. Indeed, the Applicant's submissions to Oregon Department of Environmental Quality (DEQ) for the current application are essentially unchanged from their submissions for LU-21-047. In particular these two exhibits in the Applicant's Burden of Proof are the same as were submitted to Oregon DEQ for LU-21-047:

Exhibit 24. Oregon DEQ Permit Work Plan.
Exhibit 25. Oregon DEQ Approval of Work Plan

The field investigations described in Exhibit 5 (geotechnical engineering explorations

of the Development Site) were all carried out under the same 2021 work plan. Thus the Applicant would not need to change any of its filings with DEQ, to go ahead with the original plan.

If the Applicant reverts to their original 2021 design after securing your assent to LU-24-027, then the impacts on the herons in their current nesting location, just east of Lot 1200, will be the same as for the original design put forward in LU-21-047.

Please note this applies to all aspects of LU-24-027. Denial of LU-24-027 is your only way to assure that the Applicant doesn't implement by stealth what you rejected unanimously in 2021.

Yours sincerely,
Joel Geier, Ph.D.
38566 Hwy 99W
Corvallis OR 97330

Joel Geier
38566 Hwy 99W
Corvallis, Oregon 97330-9320
(541) 745-5821
joel.geier@peak.org

Benton County Planning Commissioners
c/o Planning Division
360 SW Avery Avenue
Corvallis, Oregon 97333-1139
Phone: 541-766-6819
FAX: 541-766-6891

November 1, 2021

RE: LU-21-047 Coffin Butte Conditional Use Permit

Dear Ken Kenaston, Chair, and Members of the Benton County Planning Commission:

Thank you for this opportunity to comment on this Conditional Use Permit (CUP) application. I am submitting additional comments based on documents from county staff and others that were not made available to the public until after my previous comments on October 22nd. My supplemental comments here are to note the insufficiency of county staff recommendations regarding a specific topic:

Great Blue Heron rookeries in the path of this development will be disturbed (BCDC Sections 87.200 through 87.230)

Summary: The conditions of approval recommended by staff are insufficient to prevent disturbance and likely permanent loss of at least one significant rookery known to be active in 2021:

- The recommended conditions of approval only address disruptions by preliminary construction activities at ground level.
- They do not address impacts of constructing a high ridge that will obstruct flyways between the rookery and important feeding areas.
- They do not address impacts of future garbage tipping activity including heavy equipment, noise, and bright lights on an adjacent slope above the trees that host the rookery.
- There is no provision for independent monitoring and assessment of disturbance.
- There is no provision for mitigation in the likely event that this landfill expansion causes the rookery to be abandoned.

In the absence of a plan to ensure that disturbance can be avoided and in the absence of a mitigation plan to compensate if and when the rookeries are abandoned, **Section 87.230 requires you to reject this application.**

Background: Two Great Blue Heron rookeries active within the past decade are known to exist in the immediate vicinity, one just east and one on the west edge of the proposed new landfill disposal area (Figure 1). The **eastern rookery**, in hybrid poplars south of Coffin Butte Road, was still active during the 2021 nesting season, with counts of up to 24 occupied nests. The **western rookery**, in dense

conifers west of the existing leachate pond, may still be active but is difficult to observe from the public right-of-way along Coffin Butte Road. Applicant acknowledges that their staff have seen herons using both areas.

The western rookery site will mostly be *buried under* the proposed new disposal area. Portions on an adjacent lot to the west are directly in the path of the proposed new haul road for quarry and landfill traffic. Applicant has already bulldozed a route through this area (observable from Soap Creek Road), apparently without waiting for biologist surveys to check for evidence of recent use.

The eastern rookery is on a lot zoned as FC (Forest Conservation, Lot 1200). The proposed new haul road will run close the the west edge of the poplars that host the eastern rookery. Applicant also proposes to excavate the hillside to the south, to build two large new leachate ponds.

Thus future landfill operations will be on three sides of the rookery, rather than mainly just the northern side. With a state highway and truck merging lanes to the east, there will be disturbance to this rookery from all four sides.

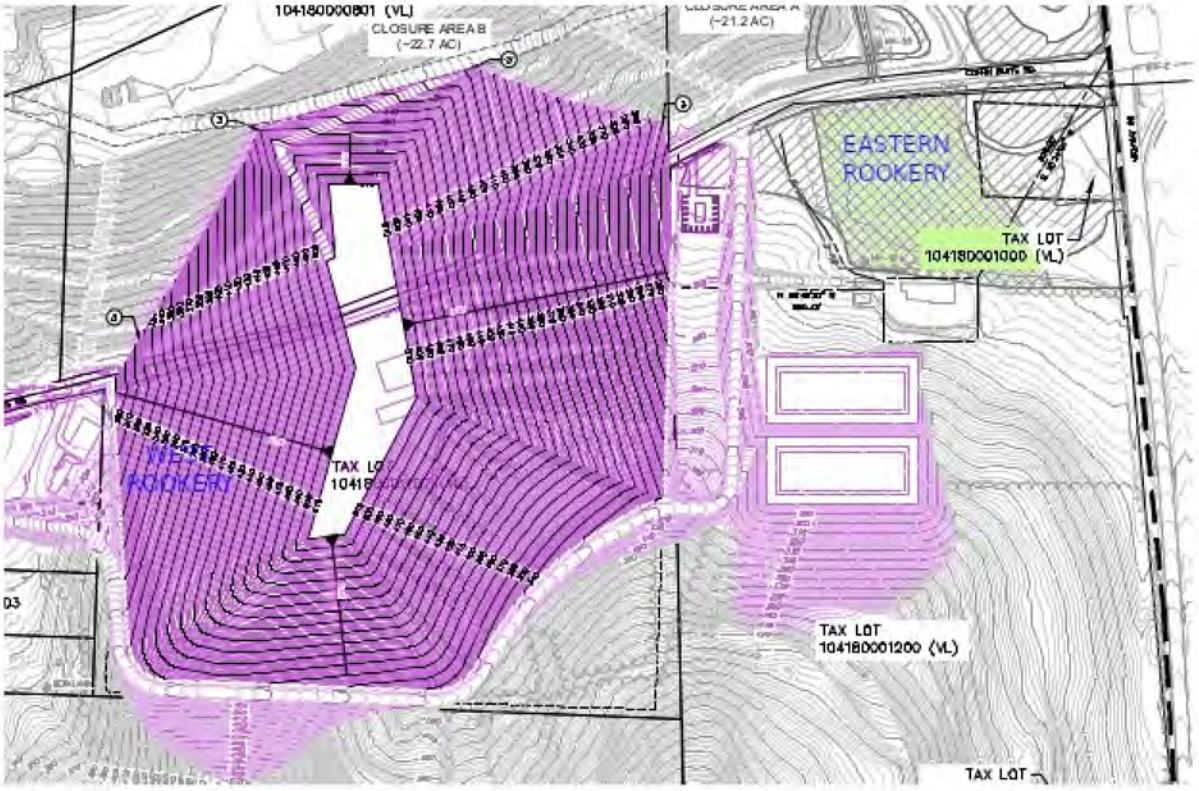


Figure 1. Location of eastern and western Great Blue Heron rookeries in relation to proposed new landfill disposal area and related roads and leachate ponds. Purple shading shows the extent of areas that are directly impacted by construction plans, including a new haul road, new employee building, new ponds, and areas to be regraded. The new ridge line to be created by garbage disposal is shaded in darker purple. Numbered contours are at 10-ft intervals.

Applicant proposes to build the new disposal cell to a height 270 ft above the east end of Coffin Butte Rd. This means that active tipping areas will be on a slope high above the tops of the nesting trees, increasing exposure of the colony to predators such as ravens and eagles.

Persistence and reproductive success of Great Blue Heron rookeries depend on multiple factors. From personal communication with wildlife biologist and noted heron expert Ann Eissinger, key factors include:

- Proximity to multiple nearby foraging areas as food sources;
- Undisturbed flyways between the rookery and foraging areas;
- Buffers around nesting trees to protect from disturbance by human activity including pedestrian access, equipment noise and bright lights.

While some heron rookeries may tolerate some degree of disturbance by acclimation to regular human activity nearby, increases in the level of disturbance, the proximity, or types of disturbance could lead to colony abandonment.

The conservation status and population trends for the Willamette Valley nesting population are not understood, due in part to a chronic dearth of resources for non-game species monitoring by the responsible state wildlife agency, ODFW. Thus the consequences of disrupting a rookery of this size (20+ pairs) for the regional population are unknown.

Site-specific conditions and impacts:

Observations of this particular nesting site by skilled local observers, over the past two decades, indicate that herons nesting here utilize foraging areas both to the east (prairie restorations and wetlands on E.E. Wilson Wildlife Area) and west (pastures in the Soap Creek Valley), as well as fields to the north near Wiles Rd. and Robison Rd. Thus there are multiple nearby foraging areas, all of which may be necessary for reproductive success of this rookery.

The natural, gentle topographical saddle between Coffin Butte to the north and Tampico Ridge to the south currently provides flyways for herons to travel easily to all of these foraging areas, either by flying west through the saddle and then north or south along Soap Creek, or flying east toward E.E. Wilson Wildlife Area.

If the development proceeds as proposed, a 270 ft tall ridge constructed of waste will completely block the existing flyway through this saddle, cutting off access to one or more foraging areas.

Heavy equipment operating on this rising mountain of garbage will, within just a few years (based on the disposal rates implied by Applicant's projected capacity of just 12 years) be operating at tree-top level or higher, relative to the adjacent rookeries. This will be a *new type and new direction* of disturbance, different from what has not existed for these rookeries in the past.

Code requirements: Benton County, in Development Code Sections 87.200 through 87.230, has recognized the sensitivity of heron rookeries. ODFW biologists have submitted comments noting that this development has a significant chance of impact. Section 87.230 specifically states:

> *(i) The County shall impose conditions on the proposed use in order to* ***ensure that it will not destroy the sensitive habitat or result in abandonment of the area.***

> *(ii) The County **shall deny the application if such impacts of the proposed use can not be mitigated** and that the development **may** lead to destruction or abandonment of the sensitive habitat.*

The conditions of approval suggested in the Benton County staff report **do not ensure** that the proposed use will not result in abandonment of the area. They only provide for guidelines to reduce disruptions during preliminary construction activities at ground level, and then subsequent monitoring to see if the herons stay or abandon the site.

These conditions **do not address** impacts of constructing a 270 ft high ridge that will obstruct flyways between the rookery and important feeding areas.

They **do not address** impacts of future garbage tipping, trash compaction, daily cover application, and other activities that will result in heavy equipment activity, noise, and bright lights on an adjacent slope above the trees that host the rookery.

The conditions call only for monitoring by a biologist under contract to the Applicant. Applicant has very strong financial motivation for this multi-million dollar expansion to proceed without impediment, and no financial incentive to ensure that the heron rookeries persist. **Independent monitoring is needed to avoid this clear conflict of interest**.

The mitigation measures suggested by county staff are very weak, suggesting only that "*the applicant's biologist shall consult with ODFW on improvements that can be made to the site, and the applicant shall incorporate those improvements, that will enhance nesting productivity, mitigate disturbance, and enhance nearby foraging habitat.*"

Note that these proposed conditions contain **no provision nor requirement** for off-site mitigation or enhancements. The applicant's land does not contain enough open foraging habitat to sustain this rookery. Open foraging habitat on Applicant's land could only be expanded by logging of trees on adjoining parcels, which are required to buffer neighboring residences, and furthermore restricted by FC zoning.

The proposed conditions make no requirement for Applicant to fund or post bond for habitat mitigation on nearby lands not owned by Applicant, in the very likely event that this landfill expansion causes the rookery to be abandoned.

Thus the proposed conditions are not adequate, as required by Section 87.230, to ensure that the proposed use will not result in abandonment of the area. The development may – and very likely *will* – lead to abandonment of the sensitive habitat.

In these circumstances, Section 87.230 of the Benton County Development Code clearly states that the County **shall deny the application**.

Thank you for considering these comments. I reserve the right to give further written and oral testimony on this and other issues according to the time frame allowed by statute.

Yours sincerely,

Joel E. Geier, Ph.D.

cc: Ann Eissinger
cc: Audubon Society of Corvallis, Portland Audubon Society, Salem Audubon Society, and Lane County Audubon, Defenders of Wildlife – Northwest Region

From: Joel Geier
To: Benton Public Comment
Cc: REED; Dave Mellinger; AnneMary Myers; Shawn Woods
Subject: Fwd: Great Blue Heron monitoring at the Coffin Butte landfill site and adjacent areas of E.E. Wilson, 2000-2025
Date: Friday, May 9, 2025 5:48:33 AM

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Dear Chair Fowler and Members of the Planning Commission,

I noted in last night's hearing that Commissioner Biscoe in particular seemed interested in establishing the record regarding the nesting area currently in use by the herons adjacent to the proposed development site.

Here's an acknowledgement that I received from the Oregon Department of Forestry (ODF) when I shared my report with them as well as Oregon Department of Fish & Wildlife (ODFW) on March 14, 2025.

I did not receive any acknowledgement from ODFW at that time, but I'm cc:ing ODFW's District Biologist Greg Reed here, in the hope that he can confirm receipt of that report.

I have not yet sent the nest tree GPS coordinates referenced in the e-mails below. Those coordinates are sensitive information due to the risk of yet further disturbance to these herons during nesting season, so I won't place them in the public record, but I will be making them available to Mr. Reed and refuge manager Shawn Woods via a separate communication.

Yours sincerely,
Joel Geier

From: "Jennifer Weikel" <jennifer.weikel@odf.oregon.gov>
To: "Joel Geier" <clearwater@peak.org>
Sent: Friday, March 14, 2025 4:08:15 PM
Subject: RE: Great Blue Heron monitoring at the Coffin Butte landfill site and adjacent areas of E.E. Wilson, 2000-2015

Thank you Joel. I received your email. I am not working as the wildlife biologist right now, but I passed on your information to the person who is in that roll right now.

Appreciate the detailed report.

Jennifer Weikel
Oregon Department of Forestry
(503) 931-9521

From: Joel Geier <clearwater@peak.org>
Sent: Friday, March 14, 2025 3:55 PM
To: REED Gregory C * ODFW <Gregory.C.REED@odfw.oregon.gov>
Cc: AnneMary Myers <AnneMary.Myers@state.or.us>; WEIKEL Jennifer * ODF <jennifer.weikel@odf.oregon.gov>; WOODS Shawn K * ODFW <Shawn.K.WOODS@odfw.oregon.gov>; Jim Fairchild <jim@alderspring.net>; Jayshaun Talbert <talberja@oregonstate.edu>
Subject: Great Blue Heron monitoring at the Coffin Butte landfill site and adjacent areas of E.E. Wilson, 2000-2015

You don't often get email from clearwater@peak.org. Learn why this is important

Hi Greg,

Hope all's well as you look forward to field season, despite what I suppose could be complications for any programs relying on federal funds this year.

As I mentioned to you last year, I've been keeping track of community observations of the Great Blue Heron nesting colony at the Coffin Butte site, including my own observations as well as those of volunteers affiliated with the Mid-Willamette Bird Alliance (formerly known as Audubon Society of Corvallis).

Here's a report that summarizes nesting-season observations both of heron nesting activity and potential causes of disturbance, from 2000 through the current year (right up to today, in fact). I hope this will help to inform you in your own assessment of the status of this heron nesting colony, and how it might best be protected for future seasons. Please feel free to give me a call if you have any questions!

A bit of data still missing from this report: Back in mid-January, I went into the ash grove area and mapped the trees with nests remaining from the 2024 nesting season. I have GPS coordinates for those trees as well as notes and sketches of the nest configurations. There are five nest trees (most of them with multiple trunks) holding a total of 13 "full-sized" stick nests, plus three smaller/partial nests that don't appear to have been completed.

I can get those nest-tree data to you at a later date, and will also share those with Shawn Woods (cc:d here) in case it's helpful for his management decisions in that area.

As a side note, I found a couple more elk/deer carcasses in there (pretty far decomposed) which I'll add into ODFW's roadkill project on iNaturalist (I'm up to about 8 now).

I'm also cc:ing Anne Mary Meyers and Jen Weikel here to keep them in the loop, as well as Jim Fairchild and Jayshaun Talbert on behalf of MVBA.

All the best,
Joel

--
Joel Geier
38566 Hwy 99W
Corvallis Oregon 97330-9320
tel +1 541 745-5821
clearwater@peak.org

Benton County Exhibit 7 (BC7)

BC7.4	C. and P. Merrill

From: Cressey Merrill
To: Benton Public Comment
Subject: Oppose/deny LI-24-027
Date: Tuesday, April 29, 2025 6:12:26 PM

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Dear Benton County Planning Commissioners,

My name is Cressey Merrill and I live at 38544 hwy 99 w, Corvallis, Oregon 97330.

I am writing because I strongly oppose Republic Services' Conditional Use Permit application LU-24-027 to expand the Coffin Butte landfill. I urge the Planning Commission to deny this application.

The proposed expansion would seriously interfere with the character of the surrounding area and impose an undue burden on public resources, in violation of Benton County Code 53.215 (1) and (2). Specifically, this expansion raises major concerns about:

- Air and water pollution threaten our local ecosystems and community health many times the odor is so strong that people will not come over to visit, and I can not be outside and enjoy my property.
- Traffic increases that pose safety risks on nearby roads and pathways. The increased traffic has started creating sinking of the roadway.
- Odor and noise issues that degrade quality of life for residents and visitors. The blasting noise is excessive sometimes, and will shake my house and rattle my windows.
- Negative impacts on wildlife, recreation, and property values. My property value is going down and the poor wildlife is being displaced.
- Long-term climate and environmental consequences for future generations

The proposed expansion does nothing to align with Benton County's 2040 Thriving Communities Initiative. This expansion undermines our shared goals for responsible environmental stewardship, prioritizing public health, and sustainable waste management.

I believe Benton County should invest in waste reduction, recycling, and circular economy solutions, not expanding landfills that perpetuate pollution and place a long-term burden on local communities!

Please reject LU-24-027. Thank you for your consideration and for protecting the health and future of Benton County.

Sincerely,
Cressey Merrill
38544 hwy 99 w, Corvallis, Oregon 97330

Cressey Merrill

Bottom Dwellers Inc
541-231-7186

From: CRESS MERRILL
To: Benton Public Comment
Subject: Deny LU-24-027
Date: Tuesday, April 29, 2025 7:27:59 PM

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My name is Paulette Merrill and my husband and I own the property at 38544 Hwy 99W Corvallis, Or. 97330.
I am writing to urge the denial of the expansion of the Coffin Butte Landfill. As many of my neighbors have already communicated, this proposal is against many of the standards of living that the residents of Corvallis hold dear. I will mention specifically water quality--most of the neighbors of the present landfill have private or shared wells. I understand rock blasting will be required for this project. Blasting can disrupt the established water ways.
Traffic using the landfill is already excessive. A few years ago there was an accident in my neighbors frontage. More traffic means more potential for accidents.
I won't even bother to devote the time and space needed to go on about quality of life issues. We are certainly living in trying times and need all the peace and tranquility we can get. I don't see expanding the landfill as doing anything to promote peace or tranquility.
I urge you to deny LU-24-027.
Paulette Merrill
38544 Hwy 99W
Corvallis, Or. 97330
16390 Hiram
Oregon City, Or 97045
503-656-4629

Benton County Exhibit 7 (BC7)

BC7.5	J. and P. Morrell

From: Morrell, Tisha
To: Benton Public Comment
Subject: Comment on Republic application for Coffin Butte Expansion
Date: Saturday, April 19, 2025 9:17:04 PM
Attachments: Landfill response.docx

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To whom it may concern:
Attached please find my comments on the application by Republic to expand Coffin Butte Landfill,
Thank you,
Patricia Morrell

Patricia D. Morrell
Professor Emeritus, University of Portland, School of Education
Professor Emeritus, The University of Queensland, School of Education

19 April 2025

I am submitting these comments in response to the Republic Services proposed landfill expansion. With my husband, I own a home and property south of the landfill and close to the proposed expansion site: (38464 Highway 99W).

I am hoping that the expansion proposal will be denied for a variety of reasons. Some of the more pressing concerns are bulleted below:

- Current methane emission levels are unsafe. Methane levels have been linked to health concerns as well as adding to exacerbating conditions for climate change, increased concern with landfill fires, among others. While Republic is "working on" the issue, they have not yet remedied the current methane emissions and Increasing the size of the landfill will only add to the problems. Additionally, emission of other landfill gases, along with dirt and particulate matter (e.g., fiberglass dust) raises other health concerns.
- Odors from the landfill have obviously increased as the amount of waste they receive has increased. Unfortunately, since reporting the odors doesn't result in any real action by the State and certainly not the landfill. As a result, we don't bother to complain. I can't imagine how many more days I'll need to keep my house windows closed if the size of the landfill increases.
- Reports of unsafe practices (e.g, truck washing, questions of proper ash disposal, proper maintenance of equipment, malfunctioning systems, to name a few) have been witnessed and reported.
- Currently less than 10% (perhaps closer to 6%) of the waste in the landfill originates in Benton County, yet it is Benton County, its population, and its community that are being impacted negatively by the increased waste acceptance.
- Questions about ground water leachate without proper state and federal regulating capabilities make it unwise to risk the problems that would likely arise with an expansion into another groundwater system (i.e. different hill).
- There have been concerns raised with what would happen to the intake cap if the expansion is approved. We have already been told that the current cap has been ignored.
- The "meteorological, geologic, and population density are not conducive to a larger landfill tonnage" as described in a Benton County government issued document dating back two years prior to these latest two requests (see https://cd.bentoncountyor.gov/wp-content/uploads/2023/12/history_doc_-_updated_3-27-23.pdf)

The landfill is a for-profit operation, is not a good neighbor, and has dragged its feet in addressing issues, doing as little as possible to maximise profits. It does, however, provide the County with a financial incentive to keep it growing, but at what cost to our community? Remember, the landfill needs to be managed long after it reaches capacity. And the landfill was originally approved with a set capacity in mind. Given past behavior, it is also of concern that Republic will be emboldened by an approved expansion and continue to ask to expand further.

The current landfill would not have been built where it is given our present-day knowledge of appropriate sites. Coffin Butte landfill should be permitted to reach its current preset life span and then be closed. It is time to move to better ways of managing our waste.

Respectfully submitted,
Patricia D. Morrell
morrell@up.edu

To: Benton County Planning Commission
From: Jeffrey Morrell
38464 Highway 99W
Corvallis, OR 97330
Re: LU24-027 Coffin Butte Landfill Expansion Proposal

I am writing this comment in regard to Republic's proposed expansion of the Coffin Butte Landfill.

By way of background, we have owned our house at 38464 Highway 99W for over 40 years. Our property is approximately 1 km south of the landfill and the proposed expansion will be just over the hill from our house. I have also served on the Solid Waste Advisory Committee (SWAC) and the Disposal Site Advisory Committee (DSAC) for over 16 years and am very familiar with the current operation as well as how it has changed. Most recently, I served briefly on the revived DSAC but had to resign as I took a five year position in South Australia; however, our son now lives in our house, and we continue to be registered voters in Benton County.

At the start, I will state that I have no problem with the position of the current landfill site. It was there before we purchased our house and will be there in one form or another long after we pass from the earth. However, for the entire time I served on the SWAC and DSAC, we were continually told that the landfill had decades of capacity and had no intention to cross the road. We were also told that the land to the south was purchased as buffer, not destined to be active landfill.

When the landfill was owned by Valley Landfills, we were impressed with their forward thinking in terms of methane generation through the co-generation facility and, temporarily, through their attempt at reverse osmosis to treat their leachate water to keep all of the leachate on site. These illustrated a company that while working to be profitable, was embedded in the community. Although many of the people who worked with Valley remain, the approach has changed dramatically since Republic has assumed ownership with markedly increased fill rates and, as we notice it, more odor issues. We have never reported these because we have accepted the reality of our location.

I have read through the documents provided by Republic in their application and have the following comments

Traffic: This proposal differs from the previous plan in that it no longer proposes immediately closing Coffin Butte Road to markedly increase landfill capacity; however, it would be disingenuous for the Planning Commission and the County Commissioners to consider this proposal in isolation and ignore the previous proposal for a much larger expansion with the associated closure of Coffin Butte Road.

The logistics of having a public highway running between landfill cells will be daunting and will ultimately lead to a request to close the road to the public. This proposal really sets the stage for the inevitable increasing landfill footprint, leading to the eventual road closure that Republic desires.

Closure of Coffin Butte Road will eliminate the one well-constructed access to Highway 99W from the Soap Creek Valley. This is critical in inclement weather because residents will be forced to use either Sulphur Springs Road or Tampico Road, both of which are narrow and difficult to drive under winter conditions. This will slow emergency response time, potentially creating life threatening situations.

Alternatively, drivers could take Tampico Road heading north around Coffin Butte to exit on either Robison or Airlie Roads. All of this is currently on unimproved dirt track. Multiple tests driving from the junction of Tampico and Sulphur Springs Roads showed that this detour resulted in an increased driving time of 15 minutes to reach Highway 99W. This delay could be lethal for emergency responses.

The current proposal only offers to improve Coffin Butte Road in the areas directly impacted by the expansion but makes no provision for further improvements, leaving these costs to the county and local residents.

It is hard to examine this proposal as a single submission without considering how it will support continued expansion to the south of Coffin Butte Road nor is it hard to imagine that County would not want to continue receiving the millions of dollars in unencumbered funds it receives annually from dramatically increased landfill activities.

Odor Issues: Odors are a reality at any landfill, although we do appreciate Republic's attempts to minimise this issue through landfill gas collection, tarping and daily cover. However, moving the landfill further south will inevitably result in increased odor complaints. As noted earlier, we have noted many more days when we can detect the landfill, but normally do not complain as we see little purpose, especially when we learned that most of these complaints go to the State who then talks to the landfill operators and dismisses them. Residents will be forced to deal with increasing odors. The smell alone is an issue, but recent reports from flyovers suggest that methane levels are often far in excess of minimum effects levels. Expansion will further increase local methane exposure regardless of attempts to capture some of the releases. This has the potential to impact the health of local residents.

Future Capacity: It is a reality that all landfills eventually reach their designed capacity and close. We have already seen this in several other Willamette Valley facilities. Furthermore, most regions are seeking alternative disposal strategies that place landfills as the last option for dealing with municipal solid waste. Alternatively, landfills are being sited in more remote areas with lower rainfall to reduce some of the environmental impacts (e.g Arlington, Oregon).

Many of the emerging technologies are less financially attractive, but they create opportunities for reuse in the circular economy. Corvallis and Benton County have both been leaders in identifying local, environmentally appropriate strategies for dealing with waste. Expanding the landfill to permit continued decades of disposal goes against this overall strategy.

In summary, the proposed expansion of the Coffin Butte facility will result in increased traffic, more odor issues, potential health issues and a general approach that will readily facilitate continued expansion at the expense of the adjoining properties. We respectively ask that the Planning Commission carefully consider and deny this proposal as it does little to benefit the local community and has the potential to do greater harm to the surrounding area.

Sincerely

Jeffrey Morrell

38464 Highway 99W

Benton County Exhibit 7 (BC7)

BC7.6	R. Wilson

From: ryan.wilson1768@gmail.com
To: Benton Public Comment
Cc: angela.krueger.94@gmail.com
Subject: Oppose/Deny LU-24-027
Date: Monday, April 28, 2025 9:26:00 AM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hello,

Ryan Wilson 28903 Tampico Road Corvallis Oregon 97330
Hello, I am writing to testify against the expansion of coffin butte landfill.

Aside from the obvious reason to stop the landfill expansion such as private companies unfairly profiting off of the local resources of the area, pollutions contaminates and the fact that Benton County should not be the primary dumping ground for all of Oregon. My primary concern is for the safety of farming in the area. Due to our proximity to the landfill where we grass a herd of cattle for local food production, we have been finding a staggering increase of air blown trash coming from the dump. We get styrofoam, plastic bags, and metallic chip bag that become air born from the landfill and litter the pastures we use to raise livestock. This poses a significant risk to the animals. If a cow or calf were to eat a plastic bag or styrofoam this would certainly mean their death. With an expansion to the landfill it can only be expected to intake more trash that will lead to more airborne plastics reaching susceptible animals, both wildlife and nearby associated livestock. We feel it is imperative that Republic Services is responsible for the care the material they take into the landfill and should use methods to prevent airborne debris from leaving their site.

Some of these trash finds can be found under Pastur teaur story
https://www.instagram.com/stories/highlights/17938813898405124/

Ryan Wilson, LEED Green Assoc.
OSU Alumni - CEM, MBA
Cell:5037793488
Email: ryan.wilson1768@gmail.com

Benton County Exhibit 7 (BC7)

BC7.7	G. Carlin

From: Grant Carlin
To: Benton Public Comment
Subject: Landfill testimony "Oppose"
Date: Sunday, April 27, 2025 10:39:28 PM
Attachments: Testimony against landfill expansion April "25.docx

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Virus-free.www.avast.com

Email to: publiccomment@bentoncountyor.gov.

Benton County Planning Commission Testimony

Regarding Application 3 LU-24-027

"Oppose LU-24-027

4/27/2025

My name is Grant Carlin; my address is 38581 Soap Creek Rd. Corvallis, OR 97330. I am writing in opposition to Republic Services' proposed Coffin Butte landfill expansion.

Noise Pollution:

My wife and I live nearly adjacent to and just west of Republic's proposed cell site's location south of Coffin Butte Rd. We and our neighbors, will be directly and adversely impacted if Republic Services' application to expand is approved.

I will address the issues most concerning us ranging from personally experienced and periodically on-going, to those likely to arise given Republic's history with it landfill neighbor nationally.

NOISE LEVELS:

In its the initial CUP, Republic's hired sound consultant cavalierly dismissed our concerns stating that even though the new cell would be a half mile closer, "Noise emissions for the on-site operations are unlikely to increase…" That is total hogwash, to put it politely. Facts prove otherwise. On several days since the initial application was withdrawn, Republic has engaged in operations directly east of their current office location, in the area of the proposed expansion. These operations have included placing and later removing a huge pile of fill dirt that was stored there as excavations were being done on top of Coffin Butte. Among the equipment used were countless trucks clanging doors, braking loudly and sounding horns, loud pile drivers and large front-end loaders with back-up horns that can be heard for two miles. When Republic has been operating temporarily in this proposed expansion site it is so noisy that my dogs are too frightened to go outside. When I called Republic to inquire what was going on, the site manager politely apologized

for the racket and said it would be done in a few more days. This is a direct refutation of the company's hired sound consultant's preposterous claim.

I ask each of the Commissioners, would you be satisfied living under those circumstances on a daily basis for many years to come? If Republic's application is approved, that is what you will be asking my family and our neighbors to do. Not only would it create an untenable situation for us, but it would also render our property worthless, as no one in their right mind would want to live where we do under a constant 5:30 AM to 6PM loud din.

GROUNDWATER POLLUTION:

Groundwater pollution is another issue: Republic Has a long history of groundwater pollution violations; in May of 2021 it agreed to a nearly ½ million dollar stipulated settlement with the San Francisco Regional Water Board of California for civil liability claims including possible water pollution from leakage at the bottom of its landfill in Richland, CA; instead of reporting within the mandatory 5 days, Republic took 145 days. The Board also noted that Republic had prior violations at its OX Mtn. landfill within the previous five years.

Recently, "On Monday, April 2, 2025 a court ruled in Lower Susquehanna Riverkeeper Association's favor that Republic Services' Modern Landfill violated the federal Clean Water Act 419 times from July 2019 through April 2023. The landfill, located in York County, PA, generates approximately 200,000 gallons per day of leachate wastewater. The landfill is subject to a permit under the Clean Water Act that authorizes pollutants to be discharged into Kreutz Creek, a tributary of the Susquehanna River. Those discharges must strictly adhere to the pollution limitations of the permit, however, and the court found Republic Services violated those terms, subjecting it to strict liability under federal law."https://www.publicjustice.net/republic-services-modern-landfill-clean-water-act-violations/

At Coffin Butte's proposed cell, even if best practices are followed, there is no guarantee that ground water won't be polluted, or that timely reporting will be done.

Once neighborhood well water is polluted, the only recourses left neighbors are litigation and then relocation.

POSSIBILITY OF RADIOACTIVE WASTE BEING BROUGHT TO THE SITE:

There is no guarantee of what Republic Services would like to bring into its expanded site if its application is approved. A good example of this is a site owned by Republic Services in Wayne County, Michigan. It was set to receive radioactive waste from New York in the fall of 2024, before towns sued the company, seeking to halt the disposal plan.
https://www.wastedive.com/news/wayne-disposal-hazardous-waste-lawsuit-michigan-republic-services/728268/

Some projects, even with the most stringent of imposed conditions, are just not conducive to acceptable outcomes. I believe that this proposed landfill expansion is one such project. In summary, all of the above will dramatically and adversely impact the character of the entire area as well as devalue our property and that of our neighbors. Area residents will pay dearly for many years into the future, just so Republic can squeeze out only a few more years of profit. Legally, approval of this permit will thus be in direct violation of Benton County's Ordinance 53.215 Section 1.

Accordingly, I urge the Commission to do what's right for the public, not what's good for Republic's bottom line, … and thus deny the Conditional Use Permit.

Grant Carlin

541-745-3968

Benton County Exhibit 7 (BC7)

BC7.8	L. A. Davis

From: Lue Ann Davis
To: Benton Public Comment
Subject: Oppose/Deny LU-24-027
Date: Monday, April 21, 2025 9:40:37 AM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Benton County Planning Commissioners,

We are writing because we stongly oppose Republic Services Conditional Use Permit application LU-24-027 and urge the Planning Commission to deny this application, as it is in direct violation of Benton County Code 53.215 (1) and (2).

We live at 28925 Blaze Drive, which is located on the backside of the proposed expansion. We get our water from the well that is located on the north end of our property. We not only use the water for daily household use but we also have a small hazelnut orchard and garden that relies on regular irrigation throughout the summer months.

We are worried about the sustainability of the well and the serious impact the expansion could have. There is a very real possibility of groundwater contamination that could do irreparable damage to our home and our financial well being. I also don't have a lot of faith about the landfill's site preparation phase that might affect groundwater levels and cause our well to go dry during the summer months. That would severely interfere with our orchard and plants and cost a lot of money.

The smell is so bad at times I have to stay inside, which interferes with the numerous chores that have to be done. It not only affects my property, but I was at Adair Park with my dog the other day and had to immediately return home due to the horrendous methane stench. It's a lovely park that should be shared by all, but it's not possible if you can't breathe and your eyes start watering.

The operational noise is already so loud and obnoxious, with the rattling of windows as the sounds of the semi tractor trailers downshift and grind along, it would only increase with the expansion. Since there would be no cap on how much garbage could be brought in, the traffic and noise would only increase, disturbing the rural community atmosphere and turning it into a heavily industrialized area.

We understand Republic Services' main goal is to make as much money as possible, regardless of the harmful consequences that may occur. You need only to look at the numerous unanswered code violations for this site and their other operations to know they are not acting in good faith.

The consequences of your decision will have long term ramifications for the surrounding community for generations to come.

Please follow the recommendations of the Environmental and Natural Resources Advisory Committee (ENRAC) and deny/oppose LU-24-027.

Sincerely,

Steve Frazier and Lue Ann Davis
28925 Blaze Drive
Corvallis, OR

Benton County Exhibit 7 (BC7)

BC7.9	I. Finn

From: Ian Finn
To: Benton Public Comment
Cc: Mark Yeager; Barb Fick
Subject: Testimony in Opposition to LU-24-027
Date: Tuesday, April 29, 2025 12:46:34 PM

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Chair Nicholas Fowler and Planning Commission Members

RE: Testimony in Opposition to LU-24-027

Via: publiccomment@bentoncountyor,gov

My name is Ian Finn, and I was born, raised, and now live at 28984 Blaze Drive, Corvallis, 97330.
My home is the closest residential property to the proposed landfill expansion, located due south of the expansion property.
I have several concerns about the proposed development and its direct effect upon my property. The impacts that affect my ability to use and manage my properties include noise, odor, groundwater contamination and dewatering, blowing trash, fires, and property values.
Moving the landfill to the south side of Coffin Butte Road will bring the entire operation more than 2,000 feet closer to my home and will now be within 800 feet of where I live.
The **current operation on the north side of Coffin Butte Road seriously interferes with the use of my property** due to never-ending odor intrusions, constant noise from trucks and diesel engines, banging metal doors when trash trucks dump, backup alarms, flying paper and plastic, lights at night, fireworks used to deter scavenger birds, to name a few. The massive increase in the volume of trash coming to the existing dump in the last 8 years has been overwhelming. And if this expansion is approved, the annual trash tonnage limit will be removed thereby opening the door to yet more trash coming in every day. **Moving the proposed operation 2,000 feet closer to my home will exacerbate these impacts**!
Noise from the operation regularly begins at 4 a.m. in the summer and often continues until 8 or 9 pm six days a week. It is impossible to take advantage of my landscaped property during the best time of the year due to the noise and constant odors. And I understand that they now want to begin operations 7 days a week. Truly no peace from the constant noise. **The proposed expansion will seriously interfere with the uses on my property**.
The odors from the existing facility seriously interfere with the use of my property. When the odors occur, you must stay indoors and close your windows. We know the landfill is leaking large amounts of methane, but with the methane come lots of other toxic landfill gases that are likely endangering our health. **Being essentially right next door to my house, the proposed expansion will seriously interfere with my use of my property**.
Groundwater contamination of my domestic drinking water well is a constant concern. All landfills leak leachate and other pollutants into the groundwater. Two landfill cells on the north side of Coffin Butte Road are unlined and were closed in the 1970s. The landfill operators are capturing 2 million gallons of leachate from those cells every year, but this is no estimate of how much pollution is going into the groundwater that is the source of my drinking water.
And while the new landfill will have a liner, those liners will eventually leak after being punctured by millions of pounds of trash that are compacted on top of the liner system. My drinking water supply is under further threat by the location of the new landfill.
The proposed excavation of 3.5 million cubic yards of material just to the north of my property to create the hole to put trash into threatens to disrupt the groundwater system and potentially dewater my well. This massive excavation will create a low spot in the vicinity of my property and may impact the availability of water from my well. If my well is impacted by the excavation, it will seriously interfere with the use of my property. The applicant and the County have done nothing to evaluate the threat from this proposed excavation.
When I was born in 1994, the amount trash coming to the dump was about 200,000 tons per year. Today, there are over 1 million tons of trash being dumped into this landfill from around the state and neighboring states, and the impacts from this massive industrial operation will undoubtedly affect my ability to sell my property in the future.
Given all the documented impacts of landfill operations, the proposed expansion will seriously interfere with the use

of my property in violation of BCC 53.215(1), and therefore I urge the Planning Commission to deny this application for a conditional use permit.

Respectfully submitted,

Barbara Fick

Ian Finn

ianfinn40@gmail.com
541-231-1132
Mechanical Engineering
Oregon State University

Benton County Exhibit 7 (BC7)

BC7.10	A., C., R. Holdorf

From: Rose Holdorf
To: Benton Public Comment
Cc: Debbie Palmer; Cathy Holdorf; Andrew Child; Adam Hyla E. Holdorf; Willow Holdorf; Chrystal Young; ben bliss
Subject: Please oppose/Deny LU-24-027
Date: Monday, April 21, 2025 7:14:56 AM

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Dear Benton County Planning Commissioners,

My name is Rose Holdorf and I live at 38483 Plowshares Road–one of the landfill's closest neighbors. My parents purchased the land and built our family home the year I was born, 1989. We reside on tax lot 10419B001500 and share a property line with Republic Services.

I am writing because I strongly oppose Republic Services' Conditional Use Permit application LU-24-027 to expand the Coffin Butte landfill. I urge the Planning Commission to deny this application.

It is horrifying to consider what might come if Republic Services is allowed to expand a landfill site onto Tampico Ridge, the same ridge that shares a forest, foundation, and water table as my home and the homes of my neighbors. In the past five years as Republic has ramped up business, the existing landfill has drastically changed the character of my neighborhood. It is a more prominent eyesore on my drive home, I have to pick up more fly away garbage from our property, it smells worse and more frequently than I ever remember in my 36 years of calling this place my home, and for the first time in my life I can actually see the landfill from my living room. The lights from the top of the landfill glare through the trees and the truck motors and beeping backup noises echo through my window early in the morning.

The proposed expansion could devastate the assets my family has cultivated on this land. Building a new landfill cell on the opposite side of Coffin Butte Road keeps me up at night. After 36 years, will we be forced to move? Will we lose all property value? Will our well water become contaminated and undrinkable, or dry up? Will living even closer to a landfill cell give us cancer or make us sick? How will the excavation of the cell, digging deep into our shared hillside, affect the literal foundation from which my family's life in the Soap Creek Valley was built?

The proposed expansion would seriously interfere with the character of the surrounding area and impose an undue burden on public resources, in violation of Benton County Code 53.215 (1) and (2).

In my adult years, every choice I have made–which jobs I choose, how I spend my

free time, how I envision my life ahead of me–has come down to a central question: how can I continue to steward and thrive in the place where I am from? I love where I live and feel so lucky to reside in a house and tend to the land that my family has nourished for my whole life. I feel I live in the most beautiful place in the world. I look forward to taking care of this place and making it even better for the generations to come. I hope Benton County will do its part and envision a future for our community that is sustained by clean air, drinkable water, and solutions to our waste that prioritizes its residents health and wellbeing.

Please reject LU-24-027. Thank you for your consideration and for protecting the health and future of Benton County and my lifelong home.

Sincerely,

Rose Holdorf
38483 Plowshares Road
Corvallis, OR 97330

From: Cathy Holdorf
To: Benton Public Comment
Cc: Holdorf Rose; Debbie Palmer
Subject: Landfill permit app #LU-24-027
Date: Monday, April 21, 2025 12:53:45 PM

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To the Benton County Planning Commissioners,

I am writing to testify in opposition to the landfill expansion - Republic Service's permit application #LU-24-027.

Our house and 60 acres is at 38483 Plowshares Rd. We share part of our northern boundary with the landfill.
My husband (deceased) and I designed and built our 3900 sq ft house 36 years ago with the intention of having a multi-generational property that could be carried on by our family after we were gone. We sit on 30 acres zoned R10 and 30 acres EFU.

We felt we'd done our due diligence in researching the future and impact of the landfill. It was relatively small at the time and not very noticeable from our property, nor from Hwy 99. It was well-kept by the Bunn Bros, with the installation of the wildlife area near the highway, and timely covering of garbage. They even planted wildflowers and clover in the covering soil. And we were told that the landfill would "sunset" in 30 or so years.

Well, things have certainly changed. Now we have a true mountain of garbage, much of which is visibly uncovered and in plain sight from Hwy 99, Tampico, and Soap Creek Roads. Even when areas are covered with plastic, it takes a long time before being covered with soil. There is an endless stream of trucks and noise, and an almost constant stench at all times of day and night.

Republic Services does not seem to show any regard for it's impact on neighboring properties - only on how much garbage they can pack in.

I am very concerned that if Republic is allowed to start a new landfill on the south side of Coffin Butte Rd, our property value would plummet and our well water would be at risk for contamination - or perhaps dry up altogether. This, in addition to the certainty of more noise, worse odors, and likely carcinogenic contaminants in the air. (Already, we are witnessing terrible dust clouds from some of the dumping vehicles.)

And aside from the issues of those of us along the ridge… what about all of those new Adair Village houses? That is a fast-growing community very close by.

This landfill is already a health hazard and has a big negative impact to the community at large - as an eyesore, from the stench and from the garbage along the roads and in fields & yards, and from the endless trucks that bring garbage from so many counties far away. And what of the leachate from all of that toxic garbage? What is that contaminating?

There is so much bad that will come if this landfill is allowed to get bigger. A landfill this size should be far away from a residential area. Please do not allow it to grow.
PLEASE deny this application!

Respectfully, Catherine Holdorf

From: Adam Holdorf
To: Benton Public Comment
Subject: Please oppose/Deny LU-24-027
Date: Sunday, April 27, 2025 4:50:36 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Benton County Planning Commissioners,

I am writing in opposition to Conditional Use Permit application LU-24-027, to expand the Coffin Butte landfill. I urge the Planning Commission to deny this application.

My sister, her partner, and my stepmother reside on tax lot 10419B001500 and share a property line with Republic Services. This lot has been our family's home since 1989. Our well is within 1,000 feet of the crest of Tampico Ridge.

In denying the initial Conditional Use Application a few years ago, members of the Planning Commission expressed the need for a comprehensive solid waste management strategy. Such an approach would balance the case for this landfill's expansion with a consideration of alternatives.

Evidently, no such action has taken place. Benton County, with just 2 percent of the population of Oregon, takes the waste of 20 percent of all state residents. My family, our neighbors, and other residents of Benton County bear a disproportionate burden for the state's failure to justly plan for solid waste disposal.

We pay in the stronger-than-ever smell of the landfill on the frequent—more frequent than ever—mornings when its nuisance gases seep through the still air.

We pay in fear: What should we do if our well water is already contaminated? How would we know?

And within a few years, we will face a morbid reckoning as a mountain of trash overtakes the highest point of Coffin Butte.

Humans—innately vigilant for threat and opportunity—have always looked to the horizon. Shortsighted planning by county officials will soon mean that for miles around, for tens of thousands of county residents, a new

landmark will mar our vision. North of Coffin Butte Road, when the sky bends toward the earth it will touch only garbage.

The proposed expansion would seriously interfere with the character of the surrounding area and impose an undue burden on public resources, in violation of Benton County Code 53.215 (1) and (2).

My family has lived on this land for more than 35 years, with a hope to continue our stewardship, and with an understanding that the landfill's owners would continue to use its buffer property to the south of Coffin Butte as just that: a buffer. We have lived uneasily in the shadow of our neighbor, watching its operations grow, but we have determined to live and made meaningful investments in our property. My family has the same right as every one of your constituents to breathe clean air and drink clean water at the place we call home.

Sincerely,

Adam Holdorf
2434 SW Holden St., Apt A
Seattle WA 98106-3487

Benton County Exhibit 7 (BC7)

BC7.11	D. Hackleman

From: David Hackleman
To: Benton Public Comment
Subject: LU-24-027
Date: Thursday, April 17, 2025 10:24:47 AM
Attachments: Adjacent Landowner Comments DH 4 17 2025.pdf

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Attached are my written testimony as an adjacent landowner. I have also mailed a physical copy with my signature to Benton County Community Development Department, 4500 SW Research Way, Corvallis, OR 97333 today.

Sorry I will be unable to attend in person, I am out of the country from 18 April through 3 May.

Sincerely, David Hackleman
39125 Military Road
Monmouth OR 97361

16 April 2025
David Hackleman (503.569.2504)
39125 Military Road
Monmouth, OR 97361

To:
Benton County Planning Comission
Benton County Community Development Department
4500 SW Research Way
Corvallis, OR 97333

Re: File Number LU-24-027
Comments regarding Conditional Use permit proposal to expand the Coffin Butte Landfill,

From my perspective, it is not in the best interest of Benton County nor my adjacent property to support the expansion proposal. The impact of the landfill on adjacent property uses and the overall character of the area has become more and more significant since the site was changed from local to regional. Dramatically increasing the annual intake of refuse is not the answer. In addition, an increasing burden is being imposed upon the local infrastructure, primarily regarding state and county roads and emergency services, but also including habitability of the local region for humans and wildlife. An expansion of the landfill will only exacerbate this situation.

My commentary in no way is to be construed as an affront to the talents and work performed by the operators of the landfill. They perform their work in a very professional manner. It is not their fault that this landfill is in an inappropriate location for expansion and actually should be capped and terminated. Having a major landfill in an area with significant rainfall - immediately upstream and adjacent to a wetland wildlife refuge for aquatic flora and fauna is not in the best interest of future generations. We can do far better!

The vastly increased intake of refuse has already negatively impacted the value of my property. Refuse is apparent on Hwy99W in increasing amounts from improperly secured transport vehicles. Odors that were uncommon for decades are on the increase and noise from the vehicular operations is heard more as the landfill height increases. In addition, the observation by passing motorists on Hwy99W is now one of sheets of plastic instead of grassy green slopes.

There is a great deal of inertia regarding refuse disposal. Work is underway to move us in the direction of less need for landfills, but at a minimum one could locate landfills in regions far superior to one which is adjacent to a wetland and has a moderate to high level of rainfall. Long ago, Oregon commenced development of a means to utilize a landfill located in an arid region of our State for refuse including the use of public funds to build transfer stations on railway systems. It is time we utilize this form of conveyance and also take steps to further encourage compost operations and reclaim. By not supporting an expansion of the existing landfill, the movement toward such a future would be encouraged.

Observations:

1. The air quality at my residence and all the others on the North side of the Butte seems to be increasingly affected by odors believed to be emanating from the landfill as it is now growing at a far greater rate than it was in prior years. It is suspected that this is due to the increased elevation and change of the location of the dumping sites, but may also be impacted by covering practices. This last year, I have noticed many days in which an odor is present, however I have been remiss in reporting each day of an odor event as they are so frequent. Once I am indoors, the filtering in my HVAC system reduces the intensity. I do not measure the composition of the emissions detected. These odors are those of decaying organic matter.

2. Airborne debris are being deposited on my property from the landfill at a rate that has been increasing during the last few years. I can supply photos of such material should these be necessary. The majority are plastic films such as bags and wrappers commonly discarded in refuse streams.

3. The view from the apex of the Butte is now being occluded by portions of the landfill. The ramifications are a lack of the ability to view Hwy99W at this time. The horizon view has not been occluded to date, however in the event the landfill and any structures reach a height approximately 50 feet below the location of the telecommunications systems, their presence will negatively impact the site viability for such operations.

4. In addition, the ambient audio noise at the hilltop due to the vehicular and equipment operations at the landfill during operating hours is significantly greater than it was when fewer vehicles were traversing the area and when the landfill dump site was not as elevated. This does reduce the quality of the conditions at the geodesic dome.

5. The noise floor (a technical term related to telecommunications) has increased from S1 as measured by radio apparatus in 1990 to S6 as measured this year. This represents an increase in the local electronic noise from radio sources of approximately 30dB, or a factor of 1000. This increase has reduced the quality of the site for telecommunications operations. It is unclear as to the source of this radio noise, it is under investigation. The noise floor at my residence on the North Side of the Butte has remained at S1 and not increased.

6. Property value estimations (Zillo) have been declining over the last few years. While uncertain of the precise reasons for such declines, the net result is that the absolute value of the property I and others on the North Side of the Butte own may be further at risk if expansion is supported.

Recommendations:

1. Monitoring and reporting of the air quality including both Greenhouse gas emissions (Carbon Monoxide, Carbon Dioxide, Methane, etc.) and known odor compounds (such as Sulfides and Non-methane organic compounds) with alert notifications to the public and any personnel that can take actions toward abatement if levels exceed either emission standards for public areas or significant odor detection levels. Monitors should be placed at the periphery of the landfill properties. A minimum of four such monitors downwind from the landfill in the top four prevailing wind directions.

2. A means to eliminate the airborne debris.

3. Public dissemination of the water quality of all test wells on a website that is easily accessible with appropriate comparison to similar regions beyond the local landfill area.

4. Testing and reporting of the water quality for all local residential drinking water wells performed at a minimum annually with comparison to Oregon standards for Drinking water.

5. Covering of all areas of the landfill deemed "filled" with an appropriate layer of local fill dirt and nurturing of appropriate grasses on this fill that will not penetrate the polymer layers below and provide a more pleasing view to motorists passing the landfill along Hwy99W. It is important not to import fill dirt that may contain invasive species seeds from remote locations.

Following are some details of the impacts I have experienced, many of which are increasingly interfering with my intended uses and can be construed as becoming a burden for the public as well.

I have owned and resided on 40 Acres of land on the north side of Coffin Butte since 1980. My property extends from Military Road Southward and over the crest of Coffin Butte and contains the summit. A portion of my property extends on the south face of Coffin Butte and adjoins the landfill properties. I chose this property based on its qualities for residence, agriculture, forestry and radio telecommunications. These uses have been identified in the legal documents I prepared regarding my land use. I have supplemented the forest through planting and maintained its integrity to the present day. I had a road constructed that reaches the top of the Butte. Along that road, there are several test wells. Water samples are drawn from these wells by Republic or its representatives on a periodic bases. Reports of the water quality have not been received by me so I am uncertain of even my own water well quality.

Radio Telecommunications:

The apex of Coffin Butte is one of the best sites for radio telecommunications in the local area. This is one of the primary reasons I selected the property. I have made significant capital improvements to the hilltop to enable the telecommunications:

- a 35-Foot geodesic dome
- three 50-foot self supporting towers
- two smaller self supporting towers
- a self-supporting 50 foot rotating mast
- Solar panels to harvest electric energy
- Storage batteries
- Radio Telecommunications electronic hardware
- Antennas for communications
- Remotely operated amateur radio communications equipment
- There is a well situated on the hill crest

Soap Creek valley is the secluded valley immediately West of Hwy99W and South of the Landfill area. My property is the site of an amateur radio emergency services radio relay (repeater) station for that valley as it is the ideal location for such a communications gateway. The repeater is powered via solar panels with battery storage and is fire hardened as it is buried below its antenna tower. It is in place to facilitate emergency communications to and within the Soap Creek valley. This emergency communications system is an adjunct of the Benton County Emergency Services network. It is owned

and maintained by the Soap Creek valley Amateur Radio community, a volunteer group composed of local citizens within the valley. They have also connected non-amateur radio citizens in the valley through the use of FRS (Family Radio Service) communications tools.

I am an amateur radio operator, having been first licensed in 1966 and continually hence. I am a member of the Amateur Radio Relay League and president of the Oregon Chapter 108 of the Quarter Century Wireless Association. While these are not professional employment activities (amateur radio operators and communications are stipulated by law to be non-commercial), they enable me to aid my fellow citizens in times of natural and other disasters when other forms of communication are not available or unreliable. I have been a Benton County Emergency Services volunteer since 1980.

The Quarter Century Wireless Association Oregon Chapter has installed a remote amateur radio transceiver system within the dome I own on the hilltop. It is powered by solar panels with battery storage. There is a wireless communications control link to this system to one of the Amateur Radio operators in Soap Creek Valley. These types of communications links operate in the 3 to 5 GHz region of the radio frequency spectrum and are considered “line of sight”. This means if something blocks the path, communications are not possible.

As long as the landfill surface stays at a minimum 50 feet below my lower property line, it should not deleteriously affect signal transmissions to the site. At the present time, increased radio and audio interference is present for signal reception. At this point is it more of a nuisance than a major issue, however it does reduce my ability to utilize my property in the manner I have been using it since 1980. The earlier local (not regional) landfill was not increasing in size at a rate that would significantly alter my use for radio communications for the foreseeable future, but with the increase from 40KTons to 1MTons annual input, the time to potential interference was reduced by a factor of 25 to roughly 6 years instead of 150 years.

Forestry:
The property was purchased with timber remaining in 1980. Harvesting was performed prior to my purchase, but probably no later than in the 1940's. Trees spanning up to 40 – 50 years age were on the property. To improve the forest, I have planted hundreds of tree starts on the North side of the Butte. The trees on the North side now range in age up to at least 100 years and many exceed 100 feet in height. This year I am in the process of improving the forest further through the removal of invasive species and possibly some selective thinning. The trees do not seem to be affected by the proximity to the landfill, however significant quantities of plastic film-like materials have been found throughout the property. These were not present when I acquired the property in 1980 and are likely the result of a modest amount of material being lofted by wind from the landfill. As the height of the landfill operation level increases, more such material will be lofted and deposited on the North side of the hill. This type of deposit is primarily a nuisance. It does degrade the quality of the property from my perspective and for anyone that might be considering acquisition of it after me.

Agriculture:
The property at the top of the hill and at the bottom on the north side are suitable for pasture use. The land quality is adequate for fruit trees and berry bushes, but not very suitable for row crops. Currently, the hilltop has not been employed as pasture for livestock in part due to its remote location. Odors from the landfill will probably not affect use of this nature unless there are toxic elements to the emissions. It is unknown if toxic or otherwise dangerous emissions exist from the landfill as no monitoring of the emissions is evidently taking place. The odors detected by personal observation seem to be from the landfill, but the composition of these is unknown for the above mentioned reason.

Since some odors may stem from sulfides that could be toxic, it would be appreciated if monitoring were in place. Whether or not an expansion takes place, it is likely emissions will increase as the landfill active area is elevated and hence such monitoring is increasingly important to ensure safety both for personnel living near and utilizing or working at the landfill.

Residence:
I have resided at 39125 Military road the majority of the time since 1980. While the landfill was a small county facility, I had a close and friendly relationship with Mr. Weber and his operations. I was well aware of the landfill and was of the understanding that it was to focus on local refuse. The rate of landfill deposition was far lower until the change to a regional landfill. While I am a local landholder, I was not aware of any opportunity to comment regarding the change to a regional landfill. That change has affected my quality of life, property use, and the character of the region. In spite of this, my relationship with Valley Landfills and Republic has been friendly. I have happily cooperated with access to the monitoring wells and other items. It is not them that are creating the issue, it is the location and geology of the site.

Odors and audio emissions from the landfill have been on the increase over the last several years. While odors have been present frequently, I have not sent in very many notes regarding odors or audio emissions. At this time, odors are present frequently, and do detract from the ambiance of my residence. Odors are present even during periods in which the landfill is closed. Noises (back-up beepers, etc.) are heard more often lately during the operations, disturbing the ambiance as well.

As the landfill increases in extent, the market potential for my property diminishes. Should the landfill be completed and closed, my property value will likely stop diminishing, odors and emissions will reduce and the view from the apex of the butte would be of green grass instead of black plastic. Due to our climate, rainfall permeates the landfill and enables materials to migrate through runoff beyond the confines of the landfill, either as surface water or even possibly penetrating and entering the aquifer.

No matter what takes place, I shall remain committed to my term of participation in the Benton County Disposal Site Advisory Committee. We have recently worked as a team and developed a plan towards increasing the preparedness of the site in the event of a wildfire entering or emerging during the fire season. Thanks go to Republic and the Adair Rural Fire Department on this matter!

Sincerely, Dr. David Hackleman

Benton County Exhibit 7 (BC7)

BC7.12	B. Briskey

From: Bill Briskey
To: Benton Public Comment
Subject: Oppose/Deny Reference Application File Number LU-24-027
Date: Wednesday, April 16, 2025 4:15:22 PM
Attachments: KEklund Petra Schuetz letter 1-2025 methane.pdf

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

I have three primary concerns:

1. Landfill gas impact on health of my family, which includes an infant and a 5-yr-old
2. Effluent concerns since I have a well
3. Impact on how I use my land

My property shares 1580 feet of fence line with the NW corner of the landfill and the topology brings the smell right to us anytime there's a south component to the wind direction. When we bought our land 35 years ago, we were told by a Valley Landfills, Inc. representative that the original deposit location, called Cell 6, was closed so all future garbage would always be moving away from us. Since Republic moved all the refuse out of Cell 6 and Knife River blasted to remove more of the Butte at that NW corner, we've already experienced more odor and picked up more airborne garbage that blows over the fence. The quarry blasting has caused structural shifts in our house, broke a window, and we now have major cracks in concrete slabs in out-buildings. Understandably, we're very interested in the outcome of the expansion discussion.

I am becoming increasingly concerned about my family's exposure to toxic gasses every time a breeze comes from SE to SW. The gas being comprised of methane, carbon dioxide, plus other aerosols including toxic PFAS (per- and poly**fluoroalkyls**) was just last year measured by the EPA to exceed the maximum allowable emission level by 219 times. I have not seen any evidence that the ongoing problems in the existing methane collection system have been corrected since the last EPA visits, just continued gas emissions indications from satellite images and my own nose. This clearly violates BCC 53.215 (1) and makes me wonder why it doesn't get the attention it deserves by Benton County and EPA officials.

I haven't complained about the odor because, hey, I live next to a dump. But the **increase in odor** is also raising my awareness to the apparent lack of mitigation and potential long-term damage from toxicity exposure. I hosted business associates once and the stench forced me to cancel the meeting and everyone left – I haven't been able to host events since then. Before there's any expansion allowed, I'd like to see Republic get a handle on what they already have to manage. I'd also like to see evidence that they are actually solving the problem instead of dismissing complaints.

My family's well is located 500 feet from the landfill property. The migration of effluent

carrying toxic levels of arsenic to the east is alarming. When Republic starts filling Cell 6 with garbage and takes advantage of the newly exposed hillside there, I'm hoping that there won't be a westward flow of escaped effluent into the aquafer that feeds my well. Its depth is roughly 250 feet (130 ft ASL) below the bottom of the closest corner of Cell 6.

I used to have a small pond on my place, on the east side of the landfill. Water from the pond fed a small livestock tank downhill from the pond. A few years back the pond dried up. It turns out that even before Cell 6 was excavated and the quarry blasting began, the landfill decided to divert surface and shallow water flow off the Butte away from my property without discussing it with me. They did call me prior to that and offered to buy that portion of my land because they said that there was a chance that my field would experience "brighter areas" caused by runoff from the landfill. So my intended use of the pond for a livestock reservoir has been permanently curtailed.

There's no easy solution for waste, but how about accountability? It's pretty clear to me that the practice of hiding violations in the past has turned into a standard operational procedure. It's unlikely that Republic can change its practices to be transparent with the County, and the county's contract representative (legal counsel) is not negotiating on behalf of the stakeholders in our county. Ken Eklund, past Chair of the Disposal Site Advisory Committee, has been closely following the connected issues of climate damage through methane and odor impacts, both of which come from excessive leaks of landfill gas. The letter he wrote (attached) to the Planning Official and her consultant, Winterbrook Planning, does an admirable job of summarizing several areas of concern that mirror my own and highlight a lack of accountability.

I see first-hand how the landfill disregard for environmental and local land use impacts my family. I encourage our county commissioners to visit a neighborhood downwind of the landfill and think about the long-term impact when they stand there breathing in the potpourri of nasty gasses. It might be several years before science solidly connects these gasses to human health issues – even if Republic is still a viable company at that time, the expected class-action lawsuit will certainly target Benton County. The short-term financial benefits might look nice now, but the future impact will destroy Benton County and that legacy will be tied to the people making decisions today. I vote no for any expansion and would prefer that landfill operations cease. It's time for another county to carry the load.

William J. Briskey, PE
39101 Military Road
Monmouth, OR 97361

Dear Petra,

I have some notes for you, as you consider the final Application by Republic Services in order to make an official determination about its completeness as Planning Official.

1. The missing 2024 EPA Inspection Report.

> A final report from the 2024 EPA inspection is not yet available, but Applicant is aware that the inspectors found exceedances while conducting surface emissions monitoring.
>
> – Jeff Condit, Burden-of-Proof-Revised-January-15-2025.pdf, p. 102

This final report of the 2024 EPA Inspection is available, and was available prior to January 15. (I received a copy third- or fourth-hand on January 14; more about this report and its implications here). **A discussion of this report is vital to an honest narrative about methane emissions at the landfill.** A reminder that when the EPA released its inspection of the landfill in 2022, Republic similarly did not relay its report to the County, but suppressed it instead for over a year.

In the 2024 report, as in the 2022 report, the inspectors narrate a process where they find an exceedance, document it, walk a short distance (often very short), find another exceedance, and so on. They are finding another exceedance three minutes later or fifteen feet apart. In each report they cover a remarkably small proportion of the landfill surface yet find a similar high level of exceedances. The photo documentation in the 2024 report shows visually obvious problems that have been problems for some time, i.e., tears in the tarp with weeds growing out of them that are three feet high. Most notably, the 2024 report includes an instance where *a gas well was uncapped entirely*.

The 2024 report casts doubt on the Applicant's "we were upgrading the gas collection system" narrative of their 2022 report, suggesting instead a narrative where the Applicant is in a perpetual state of system "upgrade" because of deferred maintenance. The "we were upgrading the gas collection system" account does not explain why every time that an entity that is not paid by Republic has pointed a methane detector at Coffin Butte Landfill in the last two years, that entity finds excessive landfill gas emissions :

- in June 2022, the first EPA inspection uncovers 61 exceedances, including several that flamed out/approached or exceeded the lower explosive level of methane;
- in July 2023, Carbon Mapper aerially surveyed the landfill for a ten-day period and mapped multiple landfill gas plumes from multiple sources, with a combined average leak rate of approximately 3.4 metric tons of landfill gas *per hour*;

- in July 2024, the EPA's return inspection again found multiple exceedances, including one with a methane concentration over 110,000 ppmv (the EPA threshold for reporting is 100 ppmv and for remediation is 500 ppmv);
- in September 2024, Carbon Mapper surveyed the landfill from space and found the landfill was still super-emitting methane with an average leak rate of approximately 1.8 metric tons of landfill gas per hour.

In no instance did a survey fail to find dozens of leaks, including leaks with high and very high methane concentrations (EPA) or leaks that are super-emitters many times over (Carbon Mapper). The narrative that these independent sources establish is one where Coffin Butte Landfill's condition has not been maintained properly and now landfill gas emissions are burgeoning out of control of the operator.

2. DEQ's notification of investigation, August 2024.

> In August 2024, members of Oregon's congressional delegation called for the U.S. Environmental Protection Agency to complete an investigation into concerns about the landfill. Also in August 2024, DEQ issued a formal warning to Coffin Butte for not complying with new requirements to reduce methane emissions from the state's landfills.
>
> – Tracy Loew, Salem Statesman-Journal, January 10, 2025

Several DEQ officials accompanied the EPA inspectors on their 2024 inspection, and when the EPA prepared its report in August 2024, DEQ issued the formal warning highlighted above. **A discussion about this warning from DEQ is necessary for the application to be deemed complete.** The formal warning from DEQ calls into question the Applicant's narrative that it is in compliance with federal and state regulations; instead it seems that Applicant is in a recurring state of being out of compliance with regulations, and successful only at keeping one step ahead of being fined.

Side note: the Applicant's Environmental Manager, Ian Macnab, resigned in fall 2024, after the second EPA inspection, the formal warning from DEQ, the calls for the EPA to take action about the landfill's non-compliance, and the release of the Carbon Mapper quantifications of its methane emissions data.

3. The rapid decline in the efficiency of the Applicant's gas collection system.

> The US Environmental Protection Agency estimated in 2019 that Coffin Butte Landfill's methane collection system converts 57% of its methane to CO2, as compared to other Oregon landfills such as Columbia Ridge (85%) and Dry Creek (80%)[90] … Republic Services' notes that data it submitted to the EPA for inclusion in its 2021 greenhouse gas report estimates that Coffin Butte's landfill gas collection system has a collection efficiency of 91.2 percent.
>
> — The BCTT report, page 669

In the January DSAC meeting (link), methane was on the agenda, a continuation of questioning begun in DSAC's December meeting. CBL's new Environmental Manager, Paul Koster read these notes (with landfill General Manager Bret Davis chiming in):

> [begins around 1:23:22]
>
> PK: So, our last gas model was completed in 2023, and we'll be completing a new gas model spring of this year. So, looking at the gas model from '23, our efficiency was estimated about 70% for '24, and 73% in 2023. This is the total amount of methane generated 2024 – was about 3,923 to 4,100 scfm throughout the year, on average, every day, every minute. The loss in flow was largely due to – we did lose some flow between '23 and '24, was largely due to the commissioning of the new and closed flare construction project. So we had some changeover. We did lose a little bit on that.
>
> BD: Thank you for [adding]. We do a – we added wells, and so on. And so yeah, the system's not able to collect it a hundred percent. When we're adding wells or more collection.

So, to summarize, the landfill's gas collection system, which Republic reported was operating at 91.2% efficiency in 2021, by 2023 had declined to 73% and sagged further in 2024, to 70%, according to Republic's own gas modeling. **This is a critical consideration for any honest narrative about the landfill's methane emissions level**, as each decline of 1% in gas collection efficiency signifies a commensurate rise in fugitive emissions of landfill gas (by my calculations, each 1% decline in efficiency =

approximately 1.2 more metric tons of landfill gas released per day). The Applicant's representative, Paul Koster, stated this information became known to the Applicant in 2023, and was updated in 2024, and so it was well-known to the Applicant when they were preparing their application.

Note that the data is converging regarding this decline in gas collection efficiency: EPA inspectors have found it on the landfill surface, Carbon Mapper has surveyed and quantified it from the air and now from space. More data is imminently forthcoming, now that methane-detecting satellites pass over Coffin Butte Landfill several times a day. The decline in gas mitigation efforts requires a honest conversation about how low efficiency will go and what environmental impacts will be happening at that level.

4. Surging methane emissions equals surging landfill gas odors.

Methane is a pollutant and a potent greenhouse gas, and well deserves its focus in abatement efforts. The landfill gas from Coffin Butte Landfill is generally about 50% methane, 40% carbon dioxide, and 10% a mixture of many other gases, including odorifics and toxic gases such as aerosolized PFAS. So the unregulated releases of methane detected in EPA and Carbon Mapper surveys of Coffin Butte Landfill are evidence of increasing amounts of toxic and odorific gases being released by the landfill (the lead inspector for the EPA specifically mentions landfill odor in the 2024 report).

Odorific gases accompany methane, but they also occur in the pre-anaerobic phase of landfilling, and processes such as soil cover that oxidize methane do not necessarily reduce odorific gases.

The application should not be considered complete without a discussion of the relationship between the increasing amounts of landfill gas being released and the increasing number and duration of "dump day" odor events in the landfill region. As we've seen, over the past three years the Applicant has normalized a steep decline in its gas collection efficiency, so this discussion should include what measures if any the Applicant will implement to reverse the increasing odor impact upon other land uses in the region where they're occurring.

These are my first observations about the Applicant's revised application; I will likely be adding more. I'm happy to answer any questions, and hope this information will be of use to you and your consultants.

Respectfully,

Ken Eklund
37340 Moss Rock Drive
Corvallis OR
408-623-8372

Benton County Exhibit 7 (BC7)

BC7.13	D. and N. Johnson

File Number LU-21-047

Comments on the application for a Conditional Use Permit for the Coffin Butte Landfill to place a new disposal cell south of Coffin Butte Road, relocate the leachate ponds south of Coffin Butte Road, vacate Coffin Butte [presumably this means Coffin Butte Road] and relocate the roadway around the area of the new disposal cell.

Debbie and Norm Johnson
28831 Tampico Road
Corvallis, OR 97330

We oppose this conditional use permit for the following reasons:

1. **Habitat for the Great-blue Heron Rookery Must be Protected and Enhanced**
   The project location hosts a great-blue heron rookery which was documented by the Oregon Department of Forestry in a Notification of Operations (NOAP) under NOAP ID: 2019-551-05885. Great-blue herons are colonial nesters, and as many as 20 heron nests have been observed in the rookery. Under the Oregon Forest Practices Act heron rookeries are protected. Between February 15th and July 31st no forest operations (including truck traffic) are allowed within one-quarter mile of active nest trees and trees cannot be harvested within 300 feet of heron nests.

   Heron rookeries are also protected under the Benton County Development Code as a "Goal 5" resource. According to 87.210 (Sensitive fish and Wildlife Habitat Overlay) a 600-foot area around the great-blue heron rookery must be protected and a site-specific management plan is needed to ensure that "proposed uses and activities will not destroy or result in the abandonment of these areas. [Ord 91-0080, Ord 93-0098]"

   Although anecdotal information suggests that the rookery, or portions of the rookery have moved since the 2019 ODF NOAP was filed, a site-specific management plan is needed before the Coffin Butte conditional use permit can be considered. The management plan should evaluate the quality of heron nesting habitat at the location documented in the ODF NOAP as well as any other locations that are currently in use or have been used in the past. If a previous heron rookery location offers better nest tree structure, then that location should be preserved so that the rookery has an opportunity to move back (Figure 1).

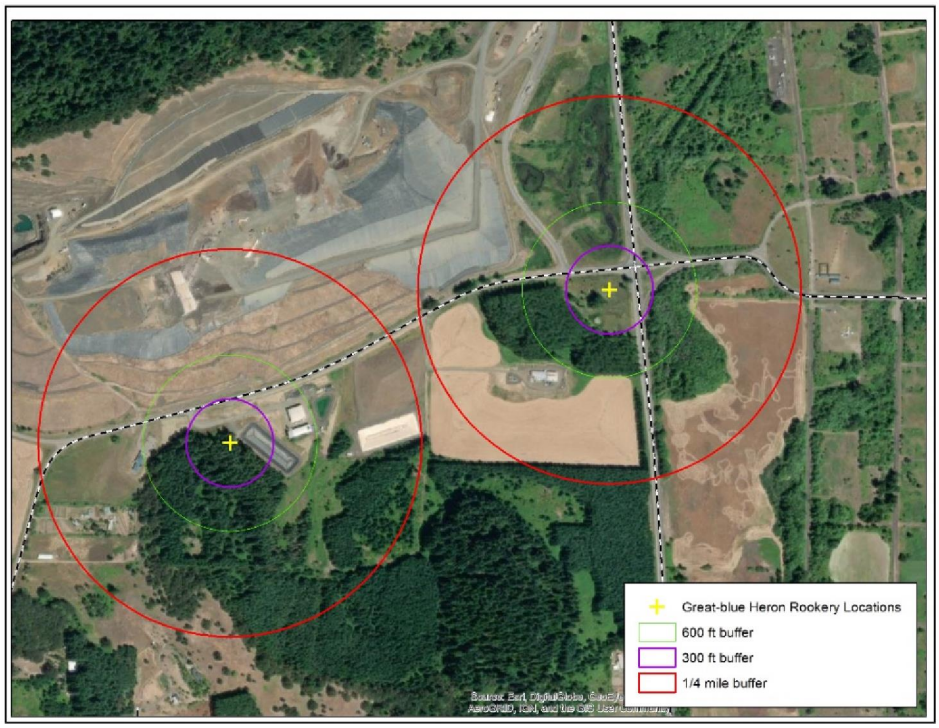


Figure1. Location of known great-blue heron rookeries and buffers associated with the Oregon Forest Practices Act and the Benton County Development Code.

Benton County Exhibit 7 (BC7)

BC7.14	G. Lind Flak

From: Community Development, Benton County, Oregon
To: Benton Public Comment
Subject: LU-24-027 Coffin Butte Proposed Expansion Written Feedback
Date: Tuesday, April 29, 2025 8:12:44 PM

Subject of Testimony: LU-24-027 Conditional Use Permit Application Regarding Landfill Expansion

Full Name: GINA LIND FLAK

Email: gflakmn@gmail.com

Street Address: 28891 BLAZE DR, CORVALLIS OR 97330

Written Testimony:

Dear Benton County Planning Commission:

I am writing to comment on the Conditional Use Permit (CUP) application submitted by Valley Landfills Inc. I am vehemently opposed to any expansion of the Coffin Butte landfill.

My husband and I live near the landfill. We have animals on our land and a well and septic system. I am already concerned about the quality of our water, and I believe that any expansion of the landfill will put our health and the health of the animals on our land at risk.

Losing access to the water in our well would seriously interfere with the use of our property. We do not currently have a water tank so we would need to buy one at great expenses and pay to have water trucked in. We would no longer be able to lease our farm-zoned property for livestock as we do now as it wouldn't be economically feasible.

We have not seen any evidence presented by Republic or Vallery Landfills to show that their plans will not interfere with our existing land use, or well water, or the beauty of the area, which is why we purchased our home here 9 years ago.

I'm also concerned about the blasting that would take place since we already experience noise – often beginning as early as 5:30 am when trucks begin arriving, and the dust and odor emanating from the landfill and all of the traffic.

Each morning, I drive on Coffin Butte Road, cross Hwy 99 and continue on Camp Adair Road on my way to work in Albany. Camp Adair Road is littered with trash as far as Independence Highway and even onto Hwy 20. Last summer, I followed a trail of pink insulation in the ditches and hanging from bushes and trees along the road, all the way from Hwy 20 to the Coffin Butte landfill in my neighborhood. There were bright pink pieces of insulation on Hwy 20 heading toward Corvallis, Independence Highway, Camp Adair Road, Hwy 99, and Coffin Butte Road up to the landfill entrance. A year later and I still see pieces of that pink insulation. It's disgusting we allow this to happen.

--
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Submitter's IP Address: 98.97.35.195

LU-24-027 Supplemental Staff Report to Benton County Planning Commission

Benton County Exhibit 8 (BC8)
Compiled Testimony from Opponents

Contents:

BC8.1	M. Yeager and R. Irish
BC8.2	J. Kleinman representing VNEQS
BC8.3	VNEQS
BC8.4	M. Leavitt representing Beyond Toxics

Benton County Exhibit 8 (BC8)

BC8.1	M. Yeager and R. Irish

From: Mark Yeager
To: Benton Public Comment
Cc: Ron Irish; Mark Yeager
Subject: Traffic Impact Analysis Review - LU-24-027
Date: Monday, April 21, 2025 4:16:34 PM
Attachments: Traffic Impact Analysis Review Testimony.pdf

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Chair Fowler and members of the Planning Commission -

The attached testimony presents our review of the Traffic Impact Analysis (TIA) report prepared by Transight Consulting, LLC, and submitted by Valley Landfills, Inc., in their conditional use permit application for expansion of Coffin Butte Landfill.

Our review of the information and analysis presented by Transight Consulting concludes that the submittal is not adequate to allow a reasonable evaluation of the impact of the proposed landfill expansion on the transportation system. In the absence of a revised TIA that accurately describes the proposed development's impact on the transportation system and the required improvements to mitigate those impacts, we recommend denial of this application.

Sincerely,

Mark Yeager

Ron Irish

April 21, 2025

Dear Chair Nicholas Fowler, and

Members of Benton County Oregon Planning Commission

Subject: LU-24-027, Traffic Impact Analysis Review

This letter provides a review of Transight Consulting, LLC, Traffic Impact Analysis (TIA) for Coffin Butte Landfill Expansion, dated February 26, 2024.

The information and analysis presented in the Transight Consulting TIA is not adequate to allow for a reasonable evaluation of the impact of the proposed landfill expansion on the transportation system. In the absence of a revised TIA that accurately describes the proposed development's impact on the transportation system, we recommend denial of this application.

The primary deficiencies are discussed in detail later in this review, and include:

- Site trip generation and system performance analysis is limited to use of the site's 2023 driveway movement volumes.
- The TIA lacks an evaluation of whether there are any "in process" developments or changes to the County road or State highway system that could impact the study area.
- The method used by the TIA to estimate future site trip generation inaccurately assumed that the proposed site expansion would not result in the potential for any increase in site trips beyond what could have otherwise occurred at the existing facility.
- The TIA's analysis of needed transportation system improvements is insufficient due to its being based solely on (underestimated) 2023 volumes.

Site Trip Generation/Distribution:

The TIA provides a project description that starts on page 2. It describes a future facility operation process where commercial account uses will access the existing scales on the north side of Coffin Butte Road, then be directed to the expansion area on the south side of Coffin Butte Road. Private passenger vehicles would continue to use the existing facilities on the north side of Coffin Butte Road, with the collected consolidated material then hauled by commercial truck to the south side of Coffin Butte Road. Figure 12 on page 14 of the TIA shows existing 2023 movement volumes along with the rerouted movement volumes that would result from the proposed expansion. The TIA accurately reflects the rerouted commercial truck movements but does not include the additional "internal" trips that will be created as a result of the new facility operation process. The new "internal" trips would be truck movements needed to transfer the private consolidated material to the south expansion area and then return. Because the new "internal" trips using Coffin Butte Road aren't accounted for by simply reassigning current driveway movements, they were also unaccounted for in the TIA's system performance analysis of system operations.

In Process Changes:

The TIA does not document that any outreach or research was undertaken to verify whether there are "in process" developments or changes to the area transportation system that could impact the study area. Because the site adjoins Highway 99W, ODOT should be asked to verify the presence or absence of any planned improvements to the highway system that could impact the site.

Estimate of Future Volumes:

The TIA provides a discussion regarding estimation of future trip generation beginning on page 10. The TIA found that site trip generation for uses similar to Coffin Butte was related to tonnage, and tonnage was in turn related to the population served. Annual population growth for the Linn-Benton area was estimated to be just under 1%, and approximately 1.7% for Oregon.

While the TIA provided an analysis method for how to estimate future site generated trips, the analysis was incomplete and, in any event, not used. The TIA contains no estimates (or the related performance analysis) for future site generated traffic or driveway and intersection movements. Even if a future year volumes/analysis had been provided based on the TIA's discussion it would have been limited to use of a local area growth factor to estimate an increase in tonnage based on population growth. In this situation, the use of a local area population increase alone would be insufficient.

The reason is that Coffin Butte has been operating under an annual cap of 1.1 million tons for the past several years and has consistently operated at or just under the cap threshold. The area's population has increased steadily over that time, but the tonnage processed by Coffin Butte has essentially remained flat and just under the cap. That suggests the tonnage cap has effectively depressed site trip generation by forcing the facility to limit non-local commercial use. The depressed volumes include the time period when vehicle trip data was collected for the TIA, meaning that simply adjusting those volumes based on population increases would not capture the full future demand. In addition, and perhaps even more importantly, if the expansion is approved the existing tonnage cap will go away altogether. The area served by the facility would expand due to an increase in non-local commercial users (by a currently unknown amount) along with associated trip generation and transportation system impacts.

An accurate estimate and analysis of future vehicle volumes that accounts for increases in local population, service area, and non-local commercial customers is needed in order to adequately evaluate the impact of the proposed expansion and its impact on the transportation system.

Needed Transportation System Road Improvements:

The TIA limits its performance analysis to the site's two driveway connections to Coffin Butte Road, and uses the adjusted 2023 movement volumes that, as described above, do not include all new "internal" trips nor any factor for future growth. The TIA does include suggestions for limited improvements to Coffin Butte Road in between and immediately adjacent the site's driveways but

describes them as "voluntary" mitigation measures that may be omitted if the design cannot be accommodated due to roadside ditches, drainage areas, or other constraints. The list of suggested improvements include: 12-foot travel lanes, a 14-foot center left turn lane, 5-foot bike lanes, and a 2-foot gravel shoulder. The 14-foot center left turn lane is shown in Figure 3 (page 4) as a westbound left turn pocket into the new driveway serving the south expansion. The site's two driveways were projected to operate (Table 1, page 15) during the peak PM hour at LOS A with v/c ratios of less than one. The TIA noted that "even with a 50% increase in traffic" both driveways would operate at LOS B. The reason the TIA concluded the improvements were "voluntary" appears to be an analysis of the site's two driveways using ODOT guidelines for left turn lane use. The projected volumes at the driveways were not high enough to meet ODOT guidelines for installation of a left turn lane.

There are several problems with evaluating the suggested improvements and verifying their adequacy to support the proposed development and its impact:

- The TIA's performance evaluation relied on 2023 rerouted movement volumes, omits the new "internal" trips that will be using Coffin Butte Road as described previously above, and does not account for future growth in site trips due to tonnage cap removal and service area expansion.
- In a land use decision, it's not feasible to apply a condition for a "voluntary" improvement that the applicant can later decide not to implement. Residents concerned about a particular issue have no assurance that a "voluntary" improvement intended to address that issue will actually occur, and no good way to evaluate whether an appeal is necessary or not.
- The new expansion area and site operational process will create a second access to Coffin Butte Road and result in turn movements and conflicts along the road that didn't previously exist. The amount of site generated traffic and resulting conflicts with through movements would continually increase over time. Because those are new impacts directly attributable to the proposed site design and expansion, evaluating how the proposed improvements will function in the future as site and background traffic increases is critical. Instead of doing that, the TIA used incomplete traffic volumes to document how the improvements would have worked had the expansion occurred in 2023 and then stopped. While a statement was included that driveway LOS would be "B" if driveway volumes doubled, no volumes were provided nor were was there any analysis in the report documenting that conclusion. The left turn lane analysis in the TIA was also limited to use of the incomplete 2023 volumes. The only future documentation in the TIA is two unexplained worksheets at the end of the report. They are identified as being 2040 performance analysis for the site's two driveways, but they use the exact same incomplete movement volumes as the year 2023 analysis.
- Existing road improvements on Coffin Butte Road along the entire frontage of the development site do not meet county road standards. The applicant's proposal for "voluntary" improvements would only address a fraction of the development site's frontage. Bike lanes would be created between the site's two driveways but not extended

to connect to Highway 99W or the site's west boundary. It would essentially be a bike facility that connects to nothing at each end. At a minimum, road improvements should extend along the entire frontage of the development.

- The use of ODOT guidelines as the sole basis for a decision regarding the installation of left turn lanes is not appropriate for this situation. The TIA is certainly correct when it mentions that "Typically, a traffic study will assess left turn lane warrants based on ODOT Methodology." The situation being proposed for Coffin Butte Road is, however, not typical. The proposed improvement will create two driveways separated by 750 feet on a county road with heavy trucks accounting for more than half of all vehicle traffic. Coffin Butte will operate on both sides of the roadway and utilize a 750-foot section for what amounts to "internal trips" by large trucks. The site generated movements on the road will involve slow moving trucks making turn movements to and from a 750-foot section of 55-mph county road. Trucks that are accelerating, slowing, or stopped for a left turn when not in a left turn lane will block all through movements, resulting in delay and increasing the potential for rear end crashes. That specific safety concern is why the applicant proposed a westbound left turn lane into the new driveway to the south expansion area. Because the TIA underestimates 2023 movement volumes and does not include an estimate for future growth and driveway operation, it's not possible to evaluate whether the proposed westbound turn lane has sufficient storage, nor whether an eastbound left turn lane is needed at the other end into the site's existing driveway.
- The TIA does not include a performance analysis for the Highway 99W/Coffin Butte Road/Camp Adair Road intersection that adjoins the development site. The justification for that omission is on page 15 of the TIA and states "There is no change to external trips beyond what could occur today assuming continued use of the Coffin Butte landfill site, and therefore no additional transportation impact beyond the two accesses." As previously described, the assumption that the proposed expansion will not have an impact on external trips is incorrect because of the current annual tonnage cap. In the absence of an applicant proposal to retain the existing tonnage cap, the TIA needs to include a projection of future growth in external trips along with an analysis of the impact that growth will have on both Coffin Butte Road and the 99W/Coffin Butte Road/Camp Adair Road intersection.

In the absence of a revised TIA that accurately describes the proposed development's impact on the transportation system, we recommend denial of this application.

Respectfully submitted,

Ron Irish
2345 NW Hayes
Corvallis, Oregon

Mark Yeager, PE
P.O. Box 1290
Albany, Oregon

Benton County Exhibit 8 (BC8)

BC8.2	J. Kleinman representing VNEQS

From: Jeffrey L. Kleinman
To: Benton Public Comment
Subject: File No. LU-24-027 (Republic Services/Valley Landfills Inc.)
Date: Monday, May 5, 2025 9:50:37 PM

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Hello,

Attached for filing and delivery to the Planning Commission in the above matter please find the Memorandum of Valley Neighbors for Environmental Quality and Safety. Kindly confirm receipt.

Thank you very much.

Jeffrey L. Kleinman
Attorney at Law
The Ambassador
1207 SW Sixth Avenue
Portland, OR 97204
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May 5, 2025

MEMORANDUM OF VALLEY NEIGHBORS FOR ENVIRONMENTAL QUALITY AND SAFETY

TO: Benton County Planning Commission

FROM: Jeffrey L. Kleinman

RE: File No. LU-24-027 (Republic Services/Valley Landfills Inc.)

I. INTRODUCTION

I represent Valley Neighbors for Environmental Quality and Safety ("Valley Neighbors") in this proceeding. Valley Neighbors comprises a large group of property owners and residents in the area surrounding the proposed landfill expansion site, including but not limited to the Soap Creek Valley and Tampico community. The members of Valley Neighbors will be directly and adversely affected by the proposed expansion.

The comments presented here summarize some of the legal obstacles to approval of this application which the applicant has failed to overcome. A number of the members of the affected community who will testify orally, in writing, or both, have the professional and personal expertise to flesh out the issues in detail. Some will be filing (or attempting to file)

media which we strongly encourage you to view, as county rules apparently do not allow them to be played or displayed during hearings.[1]

For all the reasons set out below and those to be adduced on the record of this proceeding, the applicant has not come close to meeting its burden of proof under the county's approval criteria. Simply stated, this application must be denied.

II. GENERAL COMMENTS REGARDING STAFF REPORT; ADDITIONAL CONSIDERATIONS

Valley Neighbors offer the following comments:

1. What is the applicant's rush? It has just converted the Knife River quarry site on its property to the west of its existing operation to landfill use. The applicant has 12-14 years of capacity at that location.

2. The staff report reflects a diligent effort, with excellent graphics, and a clear understanding of the issues facing the county. Valley Neighbors agree with its ultimate conclusion that this application must be denied.

3. At the same time, staff did not have the benefit of the written and oral testimony of Valley Neighbors and others, which reinforces the grounds for denial and adds others with a similar degree of importance.

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[1]Media containing video and audio are essential to forming an understanding of the impacts of this proposal. Staff has indicated then any media submissions such as thumb drives will be discarded. For the record, Valley Neighbors object to this "rule" and procedure, as they interfere with the substantial rights of parties to present their case. Such materials are necessary to understand the impacts of the proposal before you.

4. It is not just the southward movement of Republic's operation that will cause the increased, adverse impacts in question. Rather, that movement will serve to sustain a dump operation which would otherwise be greatly constrained in scope. Thus, this proposal cannot be characterized as one for a preexisting use, inherently accepted as part of the character of the area. The character of the area entails a large operating landfill north of Coffin Butte Road that is close to shutting down. Its past role in establishing the character of the area cannot be "grandfathered" into the present time, much less the future. To the extent that you may be advised to the contrary, we strongly (but respectfully) disagree. The application must be treated as one for a brand new landfill, because that is precisely what it is.

5. The county can impose as many conditions of approval as it wishes. Unfortunately, the applicant's existing operation has a solid track record of noncompliance with conditions, and the county has a solid track record of failing to enforce conditions.

6. Valley Neighbors have two initial comments concerning the work product of Benton County Talks Trash (BCTT):

(a) Just to be clear, BCTT's report was "accepted"–deemed received–by the county's board of commissioners. It was not *adopted*, much less in a manner which would make BCTT's proposed interpretations of the Benton County Development Code binding upon you, or upon the board itself in any appeal hearing.

(b) The legal subcommittee of BCTT, which recommended certain of those interpretations, included four attorneys. Three of those attorneys were not neutral participants, but have consistently favored landfill expansion. Two work for Republic, its in-house attorney, Holly Doyle, and its local counsel, Mr. Condit. The other is the county counsel, Mr. Croney.

7. If you are inclined to be persuaded that approval of this application would not result in "serious interference," please picture yourselves as homeowners or farmers at or near the expansion site. We can nearly guarantee that you would find that the proposed operation seriously interferes with your use and enjoyment of your property, as well as with the character of the area. Under no circumstances would you move to or wish to live anywhere near it, regardless of depressed property prices. You will hear testimony that the prospect of an expansion causes potential buyers to back out of home and farm purchases in the area. Being unable to sell your property comprises "serious interference."

III. CONDITIONAL USE APPROVAL STANDARDS-BCC 53.215

The general Conditional Use approval criteria provide:

> **53.215 Criteria.** The decision to approve a conditional use permit shall be based on findings that:
>
> (1) The proposed use does not seriously interfere with uses on adjacent property, with the character of the area, or with the purpose of the zone;
>
> (2) The proposed use does not impose an undue burden on any public improvements, facilities, utilities, or services available to the area; and

(3) The proposed use complies with any additional criteria which may be required for the specific use by this code.

A. WHAT IS THE MEANING OF "SERIOUSLY INTERFERE" UNDER BCC 53.215(1)?

This is discussed at pages 18-19 of the staff report. Valley Neighbors agree at least in part with the interpretation propounded there, especially that the proposed use causes "more than an inconvenience or irritation but is a lesser threshold than rendering the uses on adjacent property impossible." *Id.* at 19. Of course, little short of an armed attack would render such uses impossible, so it is important to find a way to draw the line.

The following discussion is a bit lengthy, but reflects our best effort to get there.

For words not otherwise defined in the Code, LUBA and the Oregon courts look to their plain meaning, quite specifically as set out in *Webster's Third New International Dictionary* (unabridged ed 2002). Webster's defines "seriously" as "in a serious manner or vein : to a serious extent * *." *Webster's Third New Int'l Dictionary*, 2073. In turn, "serious" has several definitions depending upon the context in which it is used. The applicable ones are these:

> 4a : IMPORTANT, SIGNIFICANT * * *
>
> **c. : such as to cause considerable distress, anxiety, or inconvenience**
> * * *

Id. (Emphasis added.)

LUBA has discussed the meaning of "significant" in the related context of statutory conditional uses in farm and forest zones. Those uses are subject to the requirements of the "significant impacts" test set out in ORS 215.296(1):

> (1) A use allowed under ORS 215.213 (2) or (11) or 215.283 (2) or (4) may be approved only where the local governing body or its designee finds that the use will not:
>
> (a) Force a **significant** change in accepted farm or forest practices on surrounding lands devoted to farm or forest use; or
>
> (b) **Significantly** increase the cost of accepted farm or forest practices on surrounding lands devoted to farm or forest use.

(Emphasis added.)

In *Stop the Dump Coalition v. Yamhill County* ("*SDC*"), 72 Or LUBA 341, 359 (2015), another case dealing with the proposed expansion of a landfill, LUBA examined the meaning of "significant":

> Because the term "significant" is undefined, and of common usage, it is permissible to consult dictionary definitions. The most pertinent definition of "significant" in Webster's Third New International Dictionary (2002), 2116, appears to be "3 a : **having or likely to have influence or effect : deserving to be considered**[.]" Because ORS 215.296(1) is framed in the negative (the applicant must demonstrate that the proposed use "will not" force a significant change, etc.), it seems appropriate to consider related antonyms such as the term "**insignificant," which Webster's defines in relevant part as "e : of little size or importance**[.]" *Id*. at 1169.

(Emphasis added.)

The above discussion sets out the most accurate and appropriate definition for the Planning Commission to apply. In summary, "SERIOUSLY"=TO A SERIOUS EXTENT. "SERIOUS"=SIGNIFICANT=LIKELY TO HAVE INFLUENCE OR EFFECT : DESERVING TO BE CONSIDERED=NOT OF LITTLE SIZE OR IMPORTANCE.

Regardless of the definition or interpretation of "seriously interfere with," the evidence will be replete with sufficient evidence to show that the applicant has not met its burden of proving the absence of serious interference with "uses on adjacent property, with the character of the area, or with the purpose of the zone." At the same time, it would be a disservice to both the community and the Development Code to artificially constrain the effect of this approval standard.

B. INTERFERENCE WITH USES ON ADJACENT PROPERTY

One can assume for the sake of argument that, as staff states, "adjacent property" includes the adjacent and nearby properties mapped on page 20 of the staff report. It would be nothing short of bizarre for conditional use criteria to be concerned only with directly abutting properties, especially in light of the size, scale, and diverse intense impacts of the use proposed here. At the same time, properties as to which serious interference can be demonstrated should be included within the definition of adjacent property, in order to give effect to the purpose and intent of the conditional use criteria.

The staff report discusses adjacent properties in the Exclusive Farm Use zoning district. Blowing waste, especially plastics, and the attraction of gulls to the landfill who then

root around in and uproot newly planted crops, were found to be a significant impact in SDC. As just one example of such impact, if every speck of plastic is not assiduously removed by a hay farmer, and any amount of it is picked up by their harvesting equipment and thus mixed into the harvested hay, it will render the crop unsaleable. It also takes very little plastic to knock the farmer's equipment out of commission.[2]

Further, owners and residents of adjacent properties will provide evidence of the impacts they would endure under this proposal, especially as the landfill comes ever closer to them and gets much larger–and the more methane is emitted and the more leachate is generated. The impacts include truly intrusive and disruptive noise and odor impacts, and wind-blown garbage which will require constant clean up by property owners. These are impacts which neither the members of the Planning Commission nor attorneys, consultants,

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[2]Note that BCC 60.220, discussed later in the staff report, addresses this issue directly:

> **"60.220 Conditional Use Criteria.**
>
> (1) A use allowed under BCC 60.205 or 60.215 may be approved only upon findings that the use:
>
> (a) Will not force a significant change in, or significantly increase the cost of, accepted farming or forest practices on agriculture or forest lands * * *."

LUBA's holding in SDC is directly applicable to the Planning Commission's analysis under this provision.

county staffers, or BCTT participants would abide for even a single day. When you get right down to it, this is the reality of "talking trash."

Noise

Dump operations are proposed to be conducted from 5:00 AM to 5:00 PM, Monday through Saturday and noon to 5:00 PM on Sunday. (However, movement of heavy equipment regularly starts by 4:00 A.M., to prepare the fill for the arrival of trash.) It would be difficult to overstate the extent to which landfill-related noises will "seriously interfere with uses on adjacent property." Hundreds of heavy diesel trucks hauling waste to the site, climbing the working face of the fill, traveling over the fill itself, and braking down the slope and departing from the site will produce a nearly constant heavy roar and squeal, most intrusive during the warmer months when residents are trying to enjoy being outdoors on their property. The dumping operation itself will produce the regular sounds of vehicle hydraulics and clanging tailgates as loads are dumped. Perhaps worst of all will be the high-intensity chirping of back up beepers (whether or not outfitted to be triggered only by proximity to obstacles[3]), on both the haul trucks and landfill equipment such as bulldozers. Noise impacts alone will render adjacent properties nearly unlivable.

With respect to noise, staff found as follows:

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[3]The applicant proposes to require proximity-generated buzzers for their own equipment. These devices produce an alarm-clock-like buzzing which is louder than the traditional beeping.

The applicant identified the closest noise-sensitive properties (residential uses) and evaluated potential noise impacts on these uses. The applicant did not evaluate noise impacts on other adjacent properties at greater distances. Staff concurs with the applicant's reasoning that if noise does not seriously interfere with close noise-sensitive uses, it will not seriously interfere with noise-sensitive uses farther away, as noise diminishes over distance.

As noted by the applicant, the cited DEQ Noise Rule does not appear to be directly and entirely applicable to the proposed application. However, staff concurs with the applicant's use of that DEQ regulation to set a threshold for noise increase to "seriously interfere" with noise-sensitive uses.

However, as noted in MFA findings above, the proposal appears to exceed the DEQ regulatory noise threshold proposed for use by the applicant to evaluate consistency with this standard.

In the absence of a proposed solution to meet identified noise impacts, staff recommends denial of the application due to noise impacts on adjacent noise-sensitive uses.

Valley Neighbors generally agree with staff's findings. However, we would reinforce them with the following modifications:

(1) Even hypothetical compliance with DEQ noise standards, which are effectively unenforceable in any event[4], may seriously interfere with uses on adjacent property. The proposed conditional use and the disturbing sounds it will generate are simply incompatible with adjacent residential uses, and even with the outdoor activities of small farm operators who have placed comments into the record.

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[4]Sadly, this is putting it very mildly. The applicant's representative testified on May 1 that DEQ no longer conducts enforcement. DEQ in fact stopped updating noise regulations in 1991, which is when it ceased noise enforcement. The applicant is not constrained by DEQ regulations.

(2) The science of acoustics does not lend itself to straight-line calculations. For example, based upon the height of the fill at any given time, varying atmospheric conditions, and the occasionally sheltering effect of the fill itself, properties further away may suffer greater impacts than "the closest noise-sensitive properties." Thus, the applicant did not meet its burden of proof when it only evaluated potential noise impacts on those properties and their uses, and not on other properties within the as-defined adjacent area.

(3) The applicant is only able to exercise some semblance of control over its own vehicles. The vehicles of other haulers and private customers will be entirely out of their control. Assurance of compliance with any relevant or agreed noise standards will be impossible.

Odor

With specific regard to odor impacts, staff found as follows:

* * * Staff has two general concerns with the applicant's analysis:

1. Odor-sensitive uses. The analysis does not appear to identify adjacent uses that are likely to be more sensitive to odor impacts. For example, a residential use is likely to be more sensitive to odor impacts than a farmed field. Locations of odor-sensitive uses are not clearly defined in the odor analysis or mapping, and the potential impact on these uses is not specifically evaluated. Of special note, there may be odor-sensitive uses within the boundary area identified in the applicant's odor analysis.

2. As identified in the MFA engineering response, several technical elements of the analysis appear to be inadequately supported.

Due to these concerns, and the lack of options for conditions to mitigate these concerns, staff recommends denial of the application.

Staff Report at 33. The evidence placed in the record will strongly support your staff's determination.

In addition, commissioners should not assume that some community members would be unaffected by or benefit from this proposal because the landfill and its working face would be further away than before. If the current fill (and the expansion into the quarry to its west) reach full capacity and this application is not approved, then the impacts other than residual fumes and odors (which are supposed to be controlled in the first place) would for the most part disappear. That is the baseline condition you must measure against, not the supposed baseline of an operating dump.

You have been presented with testimony that the applicant and county promised and planned that the landfill use would be temporary ever since the first CUP for a landfill in the Forest Conservation zone was granted in 1973. Afterward, it was to have been capped, and revegetated, so as to return the parcels on which it was located to the original pastoral character of the area. There has never been a provision for the landfill to be an ever-growing, permanent operation. The commitment to fully and permanently cap and close the landfill and restore the site to its original condition reflecting the pastoral character of the area, is part of the county's only duly adopted Solid Waste Management Plan (the 1977 Plan, a copy of which is attached as Exhibit A). This commitment has been made repeatedly but never fulfilled. It was contained in the 1983 zone adoption and change, and revalidated in every single land use decision since that time that addressed landfill operations, in 1994, in

2001, in 2003, and most recently in the 2021 CUP proposals.

One characteristic that can be drawn from the preexisting operation, though, is the applicant's manner of operating a landfill. In this regard, please be aware that the voluminous application materials on file do not disclose that Republic's Pollyannaish description of its methane emissions overlooks an ongoing action by the US Environmental Protection Agency. (Please see the recap attached as Exhibit B.) Simply stated, the EPA does not believe Republic's numbers and has the dump under investigation.

This reflects the way this operator operates. Leaking malodorous, unhealthy methane (that also contains airborne PFAS and many other air pollutants as described by the applicant during its May 1 testimony) onto adjacent properties will interfere with all uses on those properties, and with the character of the area (however "area" is defined).

Visual Impacts

While perhaps not as impactful on its adjacent properties as would have been the applicant's 2021 proposal on its affected properties to the north, the new mountain of garbage will nonetheless have a dramatic visual impact on the nearby properties to the south. . The applicant proposes to plant trees to screen the visual impacts. The main problem with this is that screening the landfill is already a Condition of Development for the zone (as well as a requirement of the 1967 Highway Beautification Act). But the current landfill operator has never been able to adequately screen a 500-foot tall artificial landform with "proposed trees" that might reach 15 feet in height by the time the expansion is full. There is no indication

that this will change. The operator has not capped and revegetated a closed cell since the mid-1990's. Instead, it covers cells with unsightly, deteriorating tarps which can be seen for miles. This conduct too will never change. The applicant acknowledges that even if the proposed vegetative screening is installed and maintained, the new landform made of trash "may be visible." The applicant also states that expanding the landfill will "reduce * * *visual impacts * * * caused by the current operation" which, under prior Conditions of Development, are already required. What are we to make of the applicant's suggestion that it will now belatedly, voluntarily comply, after the passage of 50 years?

Note also that the "artist's rendering" of "visual impacts" depicts the landfill mass in a green color. The landfill mass is in fact the colors of a patchwork of decaying tarps. Thus, the new topology of trash should be depicted in its current unnatural colors.

C. INTERFERENCE WITH THE "CHARACTER OF THE AREA"

The "area" in question covers considerably more territory than "adjacent properties." In spite of alternative characterizations offered by the applicant, the character of the area surrounding the proposed fill site is pastoral and considerably more quiet and free of industrial noises and landfill debris and odors than it would be if this application were approved. There is even a nearby wildlife refuge. the E. E. Wilson Wildlife Area, to the east, and a public hiking trail to the north which will have direct views of the 59-acre parcel. The use and enjoyment of both will suffer interference due to landfill noise and odors. The applicant's tree-planting proposal, even if implemented and duly maintained over time, will not mitigate

these impacts. By definition, moving the fill operation south of Coffin Butte Road will seriously interfere with the character of the area to the south.

You will receive direct first-person testimony and evidence with respect to the proposal's serious interference with the character of the area. The discussion of noise and odor impacts above applies to the surrounding area as well, as those witnesses will explain. Valley Neighbors propose that you rely upon the actual testimony placed in the record to determine the boundaries of the relevant "area" under the Development Code.

Visual Impacts

The applicant first proposes to strip the 59-acre parcel of all its vegetation and topsoil, then dig a 155-foot hole in the side of the geographic feature that is the ridge, fill the hole (below the water table) with garbage, and then pile more garbage atop what previously were the natural contours of the hillside. It is possible that preparing the site to accept trash will actually have more of a visual impact than filling it with trash will (the applicant has not provided Benton County with a timeline for site preparation), so it is appropriate to consider the visual impacts of site preparation in addition to the impacts of the operating fill as well as its impacts after final closure.

The area south of Coffin Butte Road currently lacks the view of the giant trash pile the applicant proposes to erect. Even if the height of that pile is lower than would have been the height of the one proposed for the area north of Coffin Butte Road in 2021, its visual impacts

will nonetheless seriously interfere with the character of the newly affected area. Under your code, this impact cannot be glossed over.

D. FINDINGS OF THE PLANNING COMMISSION IN DENYING THE 2021 APPLICATION (LU-21-047)

The applicant's 2021 conditional use application was different in scope from this one, especially in seeking to close and fill over Coffin Butte Road.[5] However, many of the other impacts would be quite similar and are directly applicable to this application. There are other ways to say the same thing and reach the same result, but the Planning Commission took a great deal of time and care in crafting its findings of denial. We do not feel a need to reinvent the wheel, and thus set out the most relevant ones here:

Uses on adjacent property:

> Many residents of the area testified that the odor and noise has continually gotten worse over the years. Some testified that they have to seek shelter inside to avoid the noise and smell. They warn that the levels expected in the future will affect their rural residential uses. Some farmers have testified that getting workers to work in the stench has been an issue.
>
> Odor: Methane emission rules do not capture the impacts to the character and use of the area because many people testified that the smell inhibits them from going outside and enjoying the use of their property. Property owners within miles of the site stated they could smell the landfill. The current mitigation of an earthen cap over cells does not mitigate smell and smell reflects emissions of other gases such as Volatile Organic Compounds (VOCs) and hydrogen sulfide. The same mitigation is proposed for the

[5]Valley Neighbors believe that may still be the plan. If the proposed expansion is approved, it is not at all inconceivable that the county would apply (to itself) to vacate the road so that Republic would own and could fill over the right-of-way. It is not impossible that this could be carried out without significant public scrutiny or review. Thus, this application could well be a Trojan horse.

expansion and if it currently does not mitigate the odor then it cannot be used as a mitigation for the future and be expected to minimize the concern.

Bad air quality: People living in areas with poor air quality does pose serious interference with livability. Risk of health concerns is likely with the landfill expansion; enough so nearby residents speak out about it. Some residents point to increasing cancer clusters in their neighborhood and suggest that poor air quality may be responsible. One nearby resident pointed to studies in Europe that tied poor air quality in the proximity of landfills to bad health issues. The applicant noted they cannot control all of the releases of VOCs or hydrogen sulfide and these gases are understood to be potent carcinogens. The applicant did not address the long-term effects of those gases in varying concentrations in different weather situations but the Planning Commission certainly heard from people that they can smell these.

Noise: The noise study contracted by the applicant has been criticized as faulty and inadequate. Proposed mitigations do not seem feasible and such conditions couched as "whenever feasible" or "if permitted by safety conditions" are not stringent enough. Further concern of noise from banging truck gates, loud noises from unloading, was not addressed. Point noises are often the most debilitating and background noise is easier to live with. * * *

Much of the applicant's response to these issues is to rely on subsequent review and approval by Oregon Dept. of Environmental Quality (DEQ); however, there is no ability for the Planning Commission to review the situation after DEQ's approval to ensure that DEQ's standards were adequate to prevent the proposed use from seriously interfering with uses on adjacent property.

Conclusion: The proposed use does seriously interfere with uses on adjacent property.

The character of the area:

[We cite only the relevant portion of the findings here, which would be directly related to the southward march of the fill. The evidence presented to you will demonstrate those impacts upon such properties.]

* * * Residents of the area point to the change in the character of the area. * * *

> * * * The livability of the area because of noise, odors, and the visibility of the garbage pile will continue to degrade.

Benton County File No. LU-21-047, Planning Commission Findings at 2-3.

D. SERIOUS INTERFERENCE WITH THE PURPOSE OF THE FC ZONE

The purpose of the Forest Conservation zone is set out in BCC 60.005. The relevant subsection is set out below, with the most directly relevant language italicized:

Forest Conservation Zone.

60.005 Forest Conservation Zone.

> (1) The Forest Conservation Zone shall conserve forest lands, promote the management and growing of trees, support the harvesting of trees and primary processing of wood products, and *protect the air, water, and wildlife resources in the zone. Resources important to Benton County and protected by this chapter include watersheds, wildlife and fisheries habitat, maintenance of clean air and water*, support activities related to forest management, opportunities for outdoor recreational activities, and grazing land for livestock. Except for activities permitted or allowed as a conditional use, non-forest uses shall be prohibited in order to minimize conflicts with forest uses, reduce the potential for wildfire, and protect this area as the primary timber producing area of the County.
>
> As staff points out:
>
> The FC zone conditional use criterion BCC 60.220(1)(c) requires consistency with BCC 53.215. As discussed above, staff does not consider BCC 53.215 criteria to be met with respect to noise and odor impacts; therefore, the proposal also is not consistent with the purpose of the FC zone.

Staff Report at 46.

We concur with that portion of staff's findings. We would also point out that the LS classification was created so that landfills would not be located in FC zones. Hence, the

proposed siting on FC parcels of accessory uses which would be part of the landfill operation would subvert the intent of the county's zoning scheme. Note also that landfill "buffers" are not a by-right use in the FC zone, and are not allowed at all in the RR zoning district.

The only parcel in the applicant's ownership that is currently permitted for landfill "buffer" is the 59-acre parcel that the applicant proposes to put a new landfill on. This is the buffer between existing landfill operations, which are slated to continue for the next 12 years, and the RR-10 and FC parcels with residences on them to the east, west, and south. A landfill cannot "buffer" itself. The 59-acre parcel was zoned LS in 1983 to provide visual/noise/odor screening from adjacent parcels, and that is its current function. Without rezoning existing rural residential parcels to LS, or obtaining Conditional Use Permits on FC parcels for landfill "buffering," this use is not compatible with surrounding existing uses.

IV. BCC 53.215(2) AND OTHER CRITERIA RELATING TO TRAFFIC AND THE APPLICANT'S TRAFFIC IMPACT ANALYSIS; DRAINAGE AND LEACHATE MANAGEMENT

Returning to the Conditional Use criteria of BCC 53.215, subsection (2) requires the applicant to prove:

> (2) The proposed use does not impose an undue burden on any public improvements, facilities, utilities, or services available to the area.

In this regard, the staff report discusses both traffic impacts and drainage and leachate management issues.

The applicant's TIA seems to have withstood staff and consultant scrutiny thus far. However, it is not clear that the TIA and its reviewers understood that the Knife River quarry operation on land leased from Republic had ceased. Republic has now prepared that portion of its property for landfill use, and commenced to fill it. That use will have traffic impacts which are substantially different from and more intense than those generated by Knife River. The defects in the applicant's TIA are separately addressed in a submittal from Mark Yeager.

Considerable testimony will be placed in the record with respect to drainage and leachate management. The record will show that the applicant has not demonstrated that it can or will construct and operate a compliant landfill. Additionally, none of the applicant's studies–not traffic, nor noise, nor odor–takes into account the impact of removal of 3,500,000 tons of material from a topographic feature, the relocation of that material to the stockpile across the road, and the eventual removal of the material from the stockpile to some remote location to be determined in the future. (The applicant has not shared the details of this operation with county staff.) The impacts of site preparation and operation must be weighed and considered when the process will be as extensive as is the case here.

V. CONDITIONAL USE CRITERIA UNDER BCC 60.220

BCC 60.220 applies in this case and provides in material part:

60.220 Conditional Use Criteria.

(1) A use allowed under BCC 60.205 or 60.215 may be approved only upon findings that the use:

(a) Will not force a significant change in, or significantly increase the cost of, accepted farming or forest practices on agriculture or forest lands; * * *

This is essentially the language of ORS 215.296(1), which sets out the "significant impacts" test and was interpreted by the Oregon Supreme Court in SDC. Again, the Supreme Court interpreted "significant" in this context as follows:

> Because the term "significant" is undefined, and of common usage, it is permissible to consult dictionary definitions. The most pertinent definition of "significant" in *Webster's Third New International Dictionary* (2002), 2116, appears to be "3 a : **having or likely to have influence or effect : deserving to be considered[.]**" Because ORS 215.296(1) is framed in the negative (the applicant must demonstrate that the proposed use "will not" force a significant change, etc.), it seems appropriate to consider related antonyms such as the term **"insignificant," which *Webster's* defines in relevant part as "e : of little size or importance[.]**" *Id.* at 1169.

(Emphasis added.) This provides the definition and interpretation which are binding upon the county here.

The staff report concurs with the applicant's characterization:

> The new or relocated elements that are proposed on the FC-zoned lands are an 1,800-square-foot employee building and parking, access road modifications, the relocation of leachate ponds, leachate loadout, leachate sump, an outbound scale, portions of the perimeter landfill road, cut activities for landfill, and a shop/maintenance area to support the landfill. These elements will slightly reduce the amount of land that is available for farm and forest uses * * *.

Staff Report, 52-53.

Staff then concludes:

> Staff concurs with the applicant that farm and forest uses have operated on and adjacent to an active landfill use on this site for decades. In the absence of contradictory information, as of the writing of this staff report staff sees no evidence the proposal will force a significant change in, or significantly increase the cost of, accepted farm and forest practices.

Id. at 53.

This conclusion fails to take into account the movement of the applicant's operation toward the south, and the farm impacts which will occur there. In fairness, staff did not have "contradictory information" at the time the staff report was prepared. However, farmers will submit contradictory evidence into this record. That evidence is also likely to be highly relevant to your consideration under the general Conditional Use criteria of BCC 53.215. As we have discussed, this would be a new landfill. While it will be closer to some farms than is the fill north of Coffin Butte Road, the Commission must also take into account impacts on other affected farms in light of the fact that the existing northerly site will shrink and then close, which would otherwise eliminate its impacts but for the opening of this new, proposed fill.

VI. BCC 99.225-DEVELOPMENT ACTIVITIES IN WETLANDS

With respect to these criteria, staff states:

> On-site are a Freshwater Emergent Wetland, a Freshwater Pond, and Freshwater Forested/Shrub Wetland. Benton County notified DSL of the complete application on March 20, 2025, following the 58-day extension requested by the applicant (Exhibit BC4). The County did not receive a response from DSL.

Staff Report at 66.

DSL's failure to respond is not the fault of the applicant or staff. Nonetheless, receipt of a response should be required before this application can be approved. Then, if there is somehow an otherwise approvable application, it may (or may not) be possible to craft appropriate conditions based upon DSL's comments.

VI. CONCLUSION

For all the reasons set out above and in the staff report, and adduced in the written and oral testimony before you, the applicant has not met its burden of proof to show compliance with Benton County's approval standards. Accordingly, this application must be denied.

Respectfully submitted,

Jeffrey L. Kleinman

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Attorney for Valley Neighbors for
Environmental Quality and Safety

Waste Control Systems
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CORVALLIS, OREGON 97330
(503) 928-1241

March 16, 1977

Benton County Planning Commission
Benton County Courthouse
Corvallis, OR 97330

Dear Commissioners:

Enclosed is a Solid Waste Management Plan for Benton County.

This report presents a program for developing a systematic, feasible approach to solid waste utilization. We believe the approach presented in this report allows flexibility that will benefit the residents of Benton County now and in the future. Our active participation in solid waste management allows us to keep abreast of new technology and implement them as they become economically worthwhile.

Very truly yours,

Robert E. Bunn
Vice-President

cc: Benton County Commissioners
Ron Minor, Chairman, Benton County Solid Waste Advisory Committee
Grace Phinney, Environmental Quality Commission, DEQ
Elizabeth Frenkle, Benton County League of Women Voters
Ernest Schmidt, Solid Waste Director, DEQ
Russell Fetrow, DEQ
Verner Adkinson, DEQ
Linn County Commissioners
Polk County Commissioners
Marion County Commissioners

SOLID WASTE MANAGEMENT PLAN
BENTON COUNTY, OREGON

Prepared for:

BENTON COUNTY PLANNING COMMISSION

Per Sjogren, Chairman
Jack Gates
Herbert Frolander
Mark McNabb
Jean Nath
Rosetta Venell
John Beardsley
James Park

By

WASTE CONTROL SYSTEMS, INC.
CORVALLIS, OREGON

March 1977

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INTRODUCTION

The purpose of this report is to familiarize the Planning Commission members of Benton County and its residents with our plans, objectives and goals to achieve an efficient and economical total resource recovery program.

The recent awareness of need for the conservation of energy, raw materials and natural resources has led to the conclusion that total resource recovery will soon become an American way of life. To achieve such a goal, an understanding of the solid waste streams involved must be explored. The volumes, densities, compositions and potential market values are of tremendous importance. The areas of collection, transportation, disposal of the putrescible materials, and the processing of the recoverable wastes into a form that is marketable requires a professional understanding of solid waste management.

Therefore, it is hoped the following report will demonstrate Waste Control Systems, Inc.'s program and interest and expertise for better serving Benton County and the surrounding communities in the Willamette Valley.

GOAL

Our long-range organizational goal is to achieve total resource recovery. It is hoped this can be accomplished by expanding our present activities to a comprehensive, flexible, economic program that meets the solid waste needs of Benton County and is consistent with Regional and State plans.

THE PLAN ABSTRACT

As part of the goal, Waste Control Systems, Inc. has completed an engineering feasibility study for a Benton County solid waste resource recovery plant.

Unlike other parts of our country which have been faced with higher cost of fuels, the Benton County area presently has an over-abundant supply of wood wastes. Therefore, the economics of a solid waste processing facility for the recovery of a refuse derived fuel (RDF) is not presently feasible. However, a plan has been developed, based on the present "state of the art" in solid waste management technology. This plan can be adapted quickly to a change in fuel market conditions.

PROGRAMS

Our objective is to implement a resource recovery program in accordance with Local, State and Federal legislation. It will be done within the framework developed by the Chemeketa Region and the new Federal Resource Conservation and Recovery Act of 1976. The following are activities now being accomplished by Waste Control Systems, Inc. (WCSI) in Benton County.

1. Recycling of cardboard, newsprint, paper, glass, tin cans, aluminum, iron scrap, wire and appliances is presently being accomplished. As experience is gained with methods of source separation, collection, transportation and markets, we expect this recycled volume to increase.

2. Landfill operations in Benton County, as well as other WCSI landfills, are considered to be among the better facilities in the entire Northwest region, both environmentally and operationally.

3. Discarded liquid waste for energy recovery is now under study. This waste material will be used as a potential fuel supplement to industrial customers. It will also help solve a serious disposal problem both locally and regionally.

4. The utilization of discarded scrap tires as an additive to 'hog' fuel is now in its final development stages. This is a joint effort between WCSI and the Georgia Pacific Corporation. The project, when fully operational, will save many barrels of valuable fuel oil and solve a serious tire disposal problem for the residents of Benton County and the State.

5. Evaluation of different types of energy conversion systems are also under study. These will utilize various types of wastes which can be economically processed to serve as a fuel supplement to industry. One current study is with the Oregon Field Sanitation Committee to combine waste straw grass with local and regional municipal solid wastes to produce a fuel gas which may replace the dependency on natural gas.

DISCUSSION

To help in understanding how our goal of total resource recovery is to be achieved through the activities presented, the major areas of recycling, landfill management, present projects and services will be discussed in more detail.

RECYCLING in the solid waste industry is not a new phenomenon. It has been occurring for many years. WCSI has been a leader locally, regionally and even nationally in pursuing this goal. WCSI also formed a new subsidiary corporation to pursue the collection of recyclable materials in all areas of WCSI operations. The cardboard baling at our Corvallis facility was the first one in Oregon established by a garbage company. This facility daily bales cardboard that is reprocessed in Oregon into paper products. Eco-Alliance shares part of the Corvallis Disposal facility. This arrangement offers a continuously manned, clean and efficient recycling center for the Corvallis area. Corvallis Disposal provides transportation to markets without duplication of capital costs or overhead. At the present time, approximately 100 tons of cardboard, 45 tons of newspapers, 2 tons of other paper goods, 11 tons of glass, 4 tons of tin and 10 tons of white goods are recycled monthly from Benton County.

At other WCSI operations, including the Lebanon landfill, Woodburn landfill and the Macleay transfer station east of Salem, recycling is taking place. Soon, we will be doing the same at the Polk County transfer station. Presently, WCSI recycles appliances, wire, aluminum, scrap iron, batteries, copper, brass, radiators, electric motors and generators in addition to glass, cardboard and newspaper recovery. This is done not only because of available markets, but also to minimize the waste volume which would be

buried. WCSI operations incorporate recycling not only in Benton County but throughout the Chemeketa Region. This widespread network will greatly affect the economics of transporting these recyclable materials, thus making the project more worthwhile.

A second critical area now receiving a great deal of attention is LANDFILL MANAGEMENT. Presently there is a need for environmentally sound solid waste disposal operations. The majority of the waste stream is now, unfortunately, being buried. There are some items in this stream which most probably will always require landfilling. These landfill items include: stumps, brush, construction waste, demolition, concrete, waste asphalt, broken furniture, mattresses, plastics, rubber, leather, non-returnable containers and other inert materials. Even when a total resource recovery program is implemented, landfills will continue to play a role in that system. In the case of a major market "turn down" or the failure of resource recovery processing equipment, landfills would temporarily be used for disposal.

The Coffin Butte sanitary landfill site in Benton County has a projected life through the year 2000. This projection includes the present growth rate and the addition of Polk County. As resource recovery gains momentum through increased recycling efforts and market availability, the life of the site could be extended almost indefinitely.

WCSI, in accordance with the Chemeketa Plan, is regionalizing its solid waste disposal system. All Benton County residential and putrescible waste goes to Coffin Butte. Waste from the Monroe transfer station also is buried at Coffin Butte. Two years ago, the Albany dump was closed by order of the Department of Environmental Quality and now putrescible waste from Albany is transported to Coffin Butte. Near Corvallis and in

Linn County, WCSI operates a disposal site solely for commercial and industrial waste. This site serves both Linn and Benton Counties. This has become a logical trade-off for both counties.

Two years ago in east Linn County, the Sweet Home dump was closed. Waste is now transferred to the WCSI site in Lebanon. This site is also a regional one serving the entire east Linn County area.

In the north Marion County area, the old Woodburn dump was closed, and now we operate the sanitary landfill facility serving the area. We also operate the Macleay transfer station east of Salem and that waste is transported to our Woodburn site. In October of this year, the landfill site serving most of Polk County will close. WCSI is planning to construct and operate a transfer station to serve the communities of Dallas, Monmouth and Independence.

Normal landfill operations are based on volumetric measurement, so the cubic yard is the basis of all charges and planning. In the areas of recycling and resource recovery, weight measurement is used. Unfortunately, today's weight projections are only guesses as there is little valid data on which to base assumptions. To gather accurate data for planning resource recovery, WCSI will begin a program this spring of weighing garbage trucks to determine actual densities and tons/day presently being disposed of. Essentially, a two-man team will move from site to site weighing trucks in full and then weighing them out empty. We anticipate providing this service to all landfill sites in the Mid-Willamette Valley. The results of this study will provide vital information on which to base assumptions for our resource recovery program.

In developing the concept of total resource recovery, the need for SPECIALIZED HANDLING of certain types of wastes also becomes very important. One such waste classification that cannot be handled using normal

methods is liquid wastes. This includes motor oil, paints, paint thinners and similar type compounds. These wastes could be collected locally and under strictly controlled conditions, then blended with other types of industrial fuels to power boilers and generate steam. These power plants could serve local industrial processors. We anticipate that by collecting these wastes and combusting them at one point source, they can be accurately monitored and controlled. This local disposal solution could reduce costs for special disposal elsewhere in the State and also minimize our area's need for oil or natural gas. WCSI is presently evaluating the sources of these liquid wastes and their composition, amounts and density.

Another area of great concern is the disposal of SCRAP TIRES. It is generally recognized that successful burial of tires is impossible. The tires tend to work themselves up to the surface of the fill due to their composition and shape. WCSI has entered into a joint project with Georgia Pacific Corporation to develop a system to grind up the tires for use as a boiler fuel additive. This particular research and development process has not been without its problems. However, to date some 50,000 tires have been ground and burned successfully at the Georgia Pacific mill in Toledo, Oregon. In fact, the infamous tire pile in Peoria, Oregon has been eliminated. We are very encouraged by these results. This recycling represents a major achievement in this county.

In addition to the other waste materials mentioned, there is a serious problem of GRASS STRAW disposal. This plight of the Willamette Valley grass seed growers has been much discussed by the news media. WCSI has made a commitment to work with the Oregon Field Sanitation Commission to look at alternatives of combining waste straw and municipal waste to produce, possibly, a fuel to supplement local industries. Essentially,

we are exploring the manufacture of methane gas as an ammonia derivative. As a greater demand is placed on energy requirements, the economic feasibility of such projects increases, WCSI is willing to work with others to achieve a satisfactory solution to disposal of these wastes.

As WCSI has become more involved both in Benton County and the surrounding communities, its knowledge and expertise has grown. WCSI now provides consulting services in the field of recycling based on its experience in Corvallis. We help others throughout the State as well as in the State of Washington in the areas of landfill supervision, management, design and feasibility studies concerning resource recovery itself. WCSI services also include locating and designing transfer stations, and marketing and management services in the field of municipal, commercial and industrial waste handling. This, in turn, ends up as being a direct benefit to the residents of Benton County. The professional services offerred by WCSI help in determining how Benton County and the Mid-Willamette Valley can initiate a resource recovery system and take advantage of knowledge being gained throughout the country.

WCSI provides information in the community in the form of talks to service organizations, industries, schools and the University as to WCSI's activities and programs. This also gives us an opportunity to receive input from the community. Tours of our operations are provided to familiarize people with how the sanitation industry operates and serves the community.

WCSI personnel belong to and take active part in community activities as well as serving on County and State advisory committees and belonging to professional organizations.

THE PLAN

The PLAN for a resource recovery plant must take into consideration the recycling, landfill management, specialized handling of certain waste streams, new energy conversion technologies, and new processes for recovery of certain waste streams not presently economical. Therefore, the process must be flexible, economical, and operationally feasible.

Before beginning the project, the proposed system was keyed to comply with:

1. Benton County ordinances
2. The Chemeketa Region Guidelines
3. Department of Environmental Quality Guidelines
4. Environmental Protection Agency Guidelines for "Thermal Processing and Land Disposal of Solid Waste"
5. Federal "Resource Conservation and Recovery Act of 1976"
6. Land Conservation and Development Commission Guidelines
7. Present plans and guidelines as they develop locally, regionally and nationally.

The scope of the investigation included a preliminary feasibility evaluation to:

1. Develop capital and production costs for processing solid wastes for recovery of ferrous, non-ferrous and a refuse derived fuel (RDF)
2. Determine the type, extent and costs of modifications to proposed power generating facilities to receive and burn "RDF"
3. Evaluate the overall feasibility of the proposed system.

In the initial stages of the study, an evaluation of the Benton County and Chemeketa Region solid waste generated in tons per day versus time projections into the future was undertaken. This initial evaluation led to certain conclusions. That:

1. Waste loads in Benton County and the Chemeketa Region will increase

2. Landfill sites can have problems such as leachate, potential air pollution, health factors and aesthetics

3. Later, new landfill sites will be scarce, expensive and politically impossible

4. The economics of such a system can support change based on distance, environmental concerns, and value of the waste products.

In order to evaluate the "Resource Recovery Potential", a good understanding of the solid waste stream must be known. Such an understanding means knowing the general refuse composition on a percent-by-weight basis and relating this to its processing potential. Figure 1 illustrates the "Resource Recovery Potential". It should be noted that the geographical area, atmospheric conditions, social and economical community styles, population density and distances between communities and towns within Benton County can vary refuse composition and this, in turn, affects the potential value of the final products. Figure 1 is typical of a refuse composition and is used as a basis for this study. As more specific data is obtained from ongoing work by WCSI personnel, this plan will be refined.

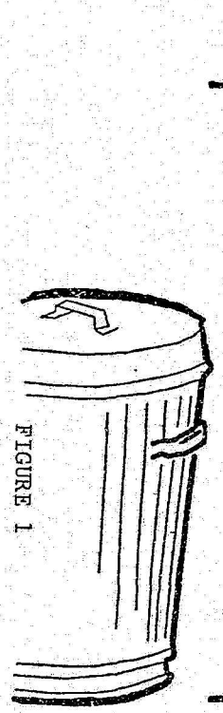
The recent awareness for conservation has brought up evaluation of two important points that affect resource recovery:

1. The correlation of waste generated per person per year, and

2. The affect of recycling on refuse composition.

Interestingly, when the Ames, Iowa Resource Heat Recovery Project began full operation, the size of the plant was based on a generation design factor of 1.0 tons of waste generated per person per year based on careful solid waste evaluation studies of the area. After one year of operation, 0.85 tons of waste generated per person per year was found to be true. This indicated that less refuse was being received, possibly

"RESOURCE RECOVERY POTENTIAL"



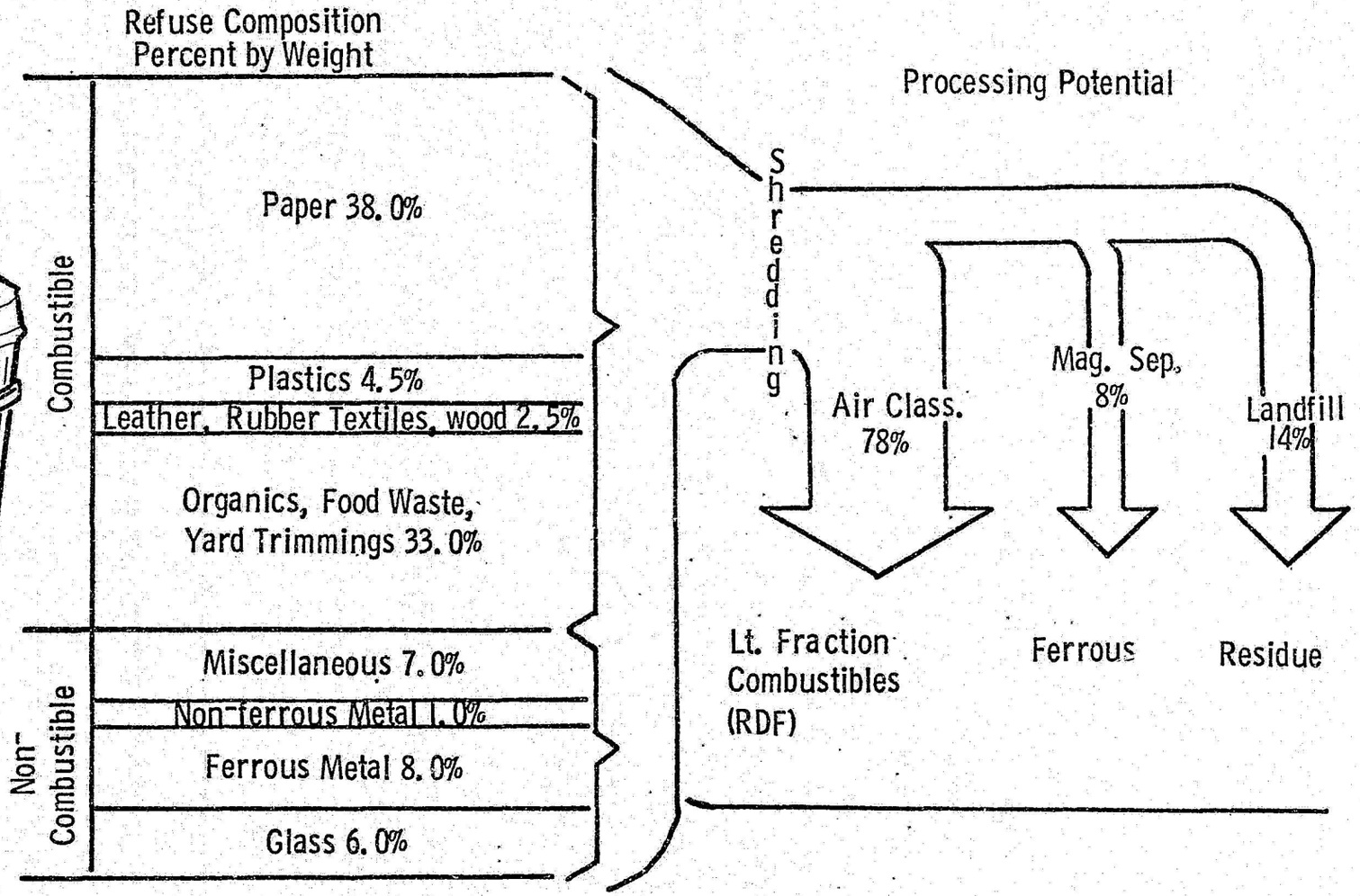


FIGURE 1

due to the effect of recycling. If a certain amount of RDF must be processed to be economical, then more refuse must be available based on the generation rate. Therefore, in this study, WCSI not only had to look at refuse composition but also consider the final fuel characteristics as the volumes and compositions change.

Evaluating the "Resource Recovery Potential", the system must be so designed to be highly flexible in order to produce products that can be used in many types of processes presently available or as they develop in the future. Figure 2 represents an overview of solid waste conversion functions broken down into "front end" and "back end" processing steps. WCSI's plan is to build a "front end" system that meets the criteria of the "back end" requirement for input materials in the most economical and systematic way, whether these input materials go to energy recovery, materials recovery, or both.

Benton County residents may ask: "Why front end processing for ferrous, non-ferrous and RDF?". This question can be answered based on the following:

1. The successes of the pilot plant work done by the City of St. Louis, Union Electric Company, and the Environmental Protection Agency
2. Success of the Ames, Iowa project of processing and converting refuse into kilowatts
3. Many intermediate shredding and ferrous removal facilities now operating across the nation which no longer have landfills available as an economic option
4. Potential energy need markets do exist for RDF, ferrous and non-ferrous materials
5. As these refuse streams are now being utilized, the capital costs and risks are being minimized
6. Growing public acceptance due to energy cost savings, good public relations and proven technology

7. RDF is acceptable to most utility and industrial boilers while meeting the environmental considerations.

This plan's development was based on trip observations to:

1. City of St. Louis facility project
2. City of Ames, Iowa facility
3. Baltimore County facility
4. Great Falls, Montana
5. Union Carbide's process at South Charleston, West Virginia
6. Hamilton, Ontario facility
7. City of Baltimore by Monsanto
8. Navy facility, Norfolk, Virginia
9. Garrett Research's San Diego project
10. National Center for Resource Recovery test facility in Washington, D. C.
11. Bureau of Mines test facility in Washington, D. C.
12. Saugus, Massachusetts
13. Franklin, Ohio

To evaluate and develop a total processing concept for Benton County, the Union Electric-St. Louis front end processing concept had to be understood. This work, in turn, was, and is, the basis for the present success of the Ames, Iowa project. However, unlike the Benton County area, the economics for Story County (where the Ames facility is located) were based on coal which sells for $40 per ton compared to abundant wood wastes selling for virtually transportation cost only. However, as the demand for energy increases in the Northwest, so will the demand for the wood wastes.

A proposed process schematic was developed based on existing operating facilities. Figure 3 is a front end processing schematic plan for preparing a marketable refuse derived fuel and ferrous and non-ferrous by-products.

FRONT END PROCESSING SCHEMATIC

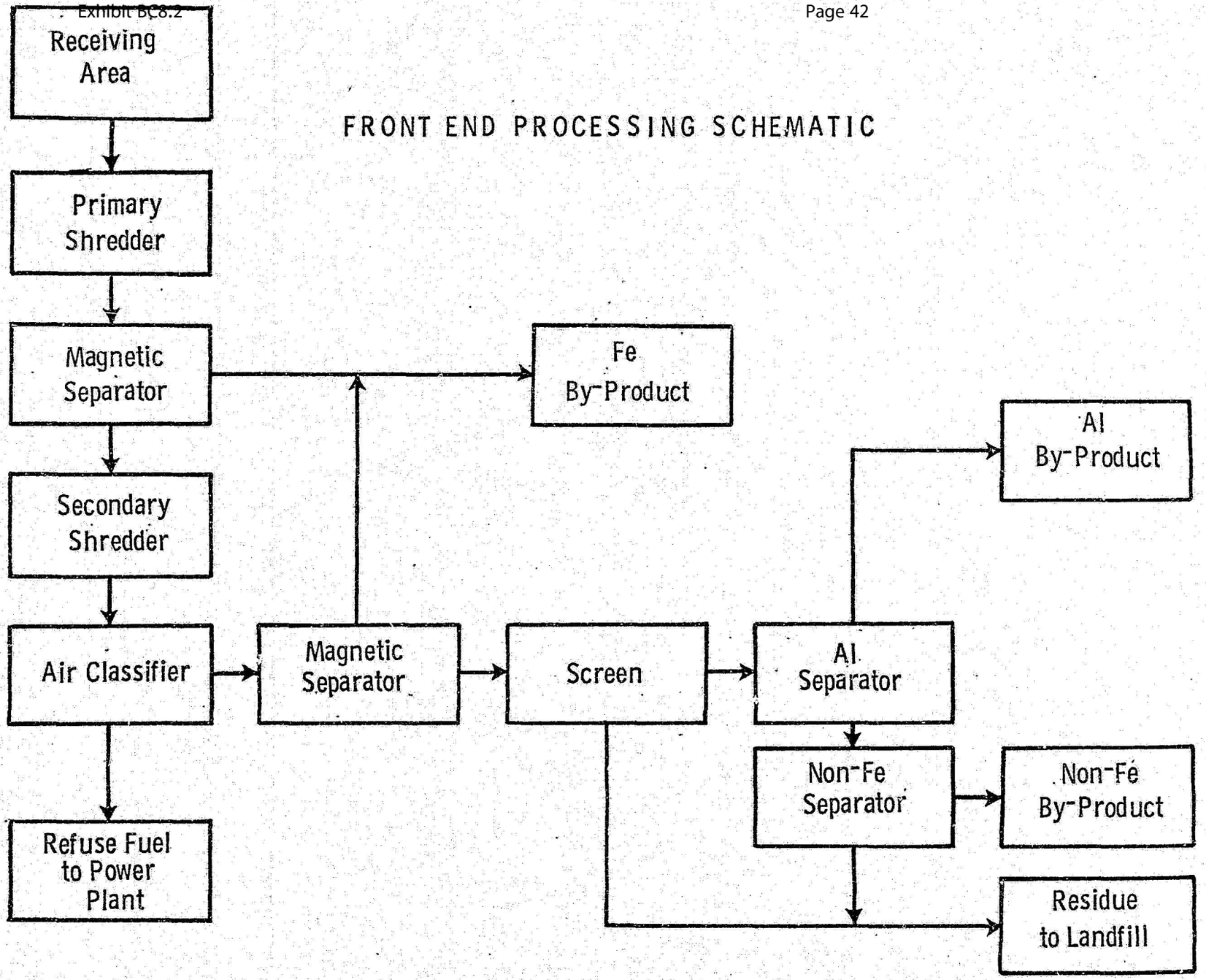


FIGURE 3

In all cases, it should be noted that a properly managed landfill site is a must in case of non-marketable items.

From a processing schematic, a total processing flow diagram has been arrived at (see Figure 4). Here, the raw refuse will be blended and processed in such a manner to produce a fuel that can easily be transported, unloaded, stored and metered as a supplementary fuel along with wood wastes to produce energy while meeting environmental considerations.

RDF is a fuel, and being a fuel it must have certain characteristics. Figure 5 relates to a set of fuel criteria set down in WCSI's feasibility study. The small particle size requirement allows for optimum handling, metering and combustion. The ash content, which is totally inert due to being combusted at very high temperatures, is very safe when disposed of in a landfill.

Thus, looking at the effect of recycling, refuse composition at the processing facility, processing costs, market needs, product worth in relation to distance and amounts transported, appreciation for the fuel user needs and the amounts of refuse available allows for making certain conclusions based on these inputs:

1. Such a proposed system is not now technically and economically feasible due to abundant available wood wastes that, in themselves, pose a serious disposal problem

2. Refuse quantities will be required from sources outside Benton County to make such a project feasible

3. Alternate methods and markets are being actively pursued in the interim.

When markets make implementation feasible for a resource recovery plant, the approach will be:

1. Review the entire Resource Recovery Plan with the Benton County Planning Commission, State and Federal agencies, the public and other concerned individuals or groups to get their ideas and concurrence with the preliminary plan.

Total Processing Concept

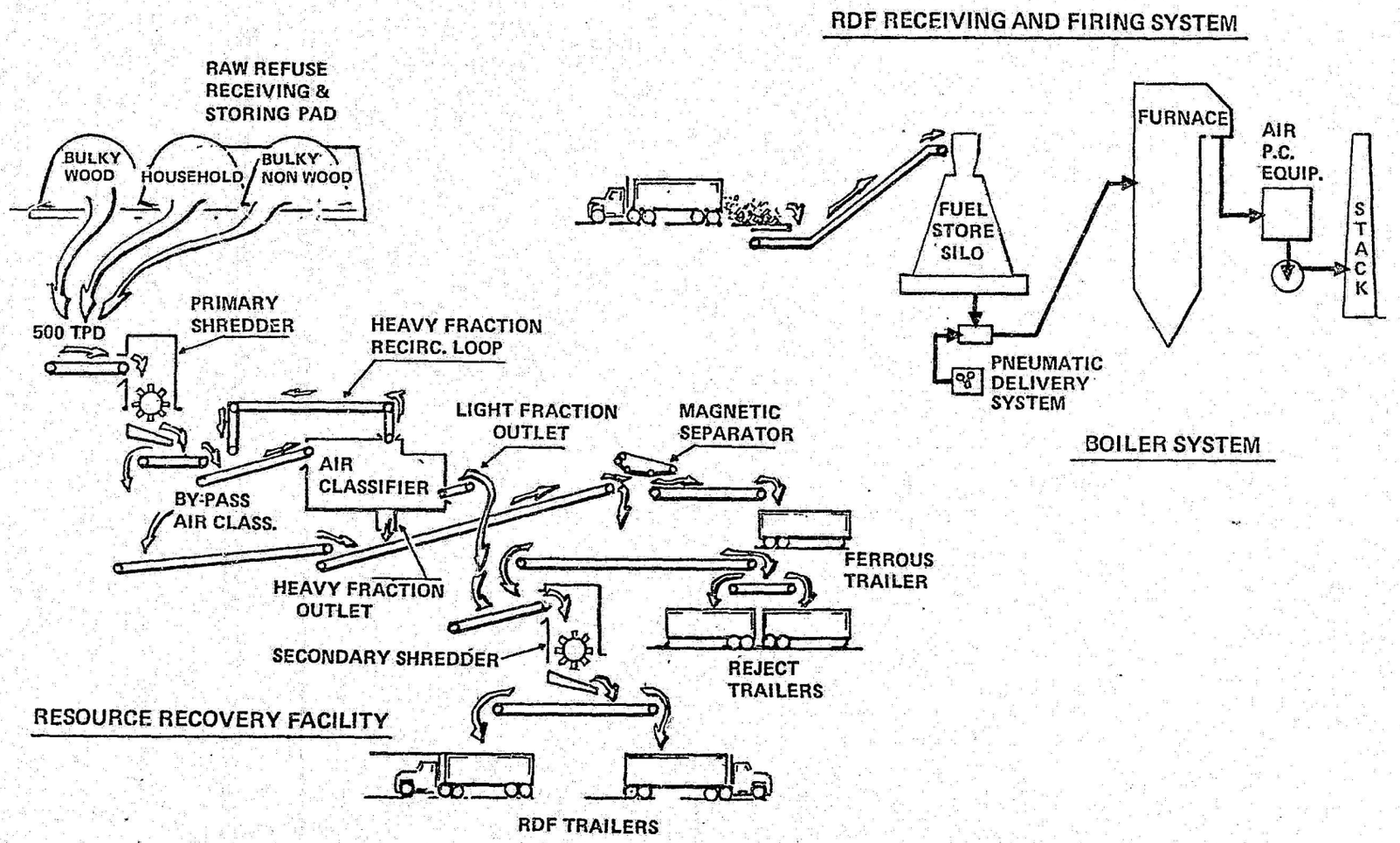


FIGURE 4

C. RACTERISTICS OF RDF SYSTEM

Fuel Criteria	Specification
Particle Size	- 98% less than 2", 90% less than 1"
Ash Content	- Range 8-15%, Average 12%
Moisture Content	- Range 15 - 30%, Average 25%
Sulphur Content	- 0.2% Average
Chlorine Content	- 0.3% Average
Higher Heating Value of Fuel	- 6500 BTU/Lb.
Lower Heating Value of Fuel	- 4875 BTU/Lb.
Peutrescible Content/Odor Characteristics	- Negligible
Delivery	- 20 Ton loads by standard bulk trailers
Residue Disposal	- Negligible

FIGURE 5

2. Refine the engineering analyses and system approach to arrive at a firm base decision to proceed with the implementation

3. Recommend implementation of a final system for a long-term solid waste disposal and resource recovery facility.

TIME SCHEDULE

An update on WCSI's resource recovery plans will be submitted annually to the Benton County Planning Commissioners, or sooner if any significant development occurs with the overall total resource recovery plan herein submitted or any one of its programs.

CONCLUSION

The total resource recovery success depends on economic recovery of each waste material. The economics of each depends on the volumes of waste, its composition, handling and transportation costs, as well as demand for final product. Equipment failures, market changes, and the disposal of the resource recovery residue will always demand the need for landfills. Markets must exist to make recovery of these waste materials economical. WCSI is an organization that has the flexibility to respond to market changes. We possess technical knowledge, management capability, marketing expertise and ability for capitalization. To achieve total resource recovery requires enthusiasm, study, evaluation and active participation in projects which will lead WCSI to this goal.

The EPA investigation of Coffin Butte Landfill has moved into its next phase

EPA Enforcement: a timeline and explainer

Ken Eklund
April 15, 2025

What's happening?

The public has known for a while that the EPA was investigating Coffin Butte Landfill: neighborhood groups brought up concerns about the landfill to Senators Merkley and Wyden in the years 2021 – 2023, and their staffs took the matter to the EPA. In May 2024 Senator Merkley asked Michael Regan, then Head of the EPA, about Coffin Butte Landfill in hearings. Regan confirmed that the EPA had opened a case and was actively pursuing it against the landfill.[1]

That investigation has now progressed to EPA enforcement action against the landfill. On January 16, 2025, the Enforcement Manager for EPA Region 10 served a process on Republic Services, in the form of a Section 114 Information Request.[2] [3]

This process document came to light when Bailey Payne, the Solid Waste Coordinator for Benton County, filed a Freedom Of Information Act request on behalf of the county's Disposal Site Advisory Committee, which was seeking more information about the EPA investigation. Republic Services did not disclose to you, the Planning Commissioners, that the landfill had been served a Section 114 Information Request in their final update to their Application to expand the landfill, which they filed with the County on March 14, almost two months after the EPA served the Request on them.

What does it mean to be served a Section 114 Information Request by EPA Enforcement?

- Technically, it's a "Clean Air Act (CAA) Section 114 Information Request," which is functionally a government subpoena.

- This Section 114 Information Request requires the landfill's Environmental Manager to turn over a comprehensive list of environmental records to the EPA. Air quality regulations require the landfill keep these records of their self-testing and monitoring.

- There are two kinds of Section 114 Information Requests: "rulemaking" ones and "enforcement" ones. This is an enforcement IR: it was filed by by the Manager of the Air and Land Enforcement Branch of Region 10 of the EPA, and the document states it is requiring records so that it can determine "whether any violations of the Clean Air Act have occurred."

- The document requires someone at Republic to certify that the information provided is "true, accurate and complete" under threat of fines or prison.

- The EPA investigation has moved into its next phase: assessing compliance.

What is the implication of the Section 114 Information Request by EPA Enforcement?

It implies that the EPA intends to initiate enforcement action as warranted. The Section 114 Information Request is a crucial tool in the EPA's arsenal for gathering data and ensuring accountability in matters related to air pollution. It's often the first step in enforcing compliance.

It may be useful to think of the Section 114 Information Request as the environmental equivalent of an audit by the Internal Revenue Service. In both cases it's an effective litigation tactic to query the underlying data in a defendant's possession, because that can naturally lead to findings that the defendant (1) is not maintaining data properly, or (2) has altered or destroyed data, or (3) has not been complying with regulations, all of which are offenses. With both the IRS audit and the Section 114 Information Request, the action often represents the initial stage of a process that can end up assessing civil penalties, issuing compliance orders, or initiating legal proceedings.

What are possible reasons EPA Enforcement has taken this step?

The implication is that the EPA has grounds to believe that Republic has committed some infractions and that Coffin Butte Landfill is out of compliance. What's not known at this time is how serious the believed infractions are. Throughout this process the EPA has declined to discuss their investigation, as it is an active legal proceeding.

Here's what we know the EPA knows about the landfill, that may be grounds for or contributing to its Section 114 Information Request:

- The EPA inspected the landfill twice, once in 2022 and again in 2024, and both times found larger numbers of breaches, and breaches much more serious in scale, than what Republic's self-monitoring had reported. The 2024 inspection, for example, found an uncapped landfill gas well leaking at 230 times the actionable amount.[4]
- The EPA required Republic to remediate the 61 breaches identified by the EPA's 2022 inspection, but there seems to be no corresponding remediation log for these breaches in Republic's subsequent reporting to Oregon DEQ. It's possible those leaks were never remediated.
- In September 2024, the EPA widely issued two Enforcement Alerts to municipal landfills such as Coffin Butte. These Enforcement Alerts warned of a series of regulatory infractions that the EPA had noted during recent inspections. This Section 114 Information Request may be a follow-up to these Enforcement Alerts, again because of infractions observed during the EPA's 2022 and 2024 inspections of the landfill.[5]

- Carbon Mapper, a climate science nonprofit, partnered with the EPA to survey hundreds of landfills in 2023, detecting and quantifying their methane leaks from the air. Their survey of Coffin Butte Landfill revealed four super-emitting leaks, all active in different locations on the landfill at the same time, throughout the 10-day survey period.[6]
- Carbon Mapper estimated that during that survey period, Coffin Butte Landfill was leaking methane at a rate of 1.7 metric tons per hour, which is almost twice the average rate for super-emitting landfills as a class. So Coffin Butte Landfill may have been prioritized for enforcement action.[7]
- Oregon DEQ collaborated with the EPA on the 2024 inspection, and may have shared information about its own enforcement action against the landfill happening at that time, regarding Republic's non-compliance with requirements to update its landfill gas collection and control system.
- The EPA has the Community Concerns Annual Reports compiled by Benton County's Disposal Site Advisory Committee for the years 2021-24. These Annual Reports summarize concerns and complaints by members of the public. Each report has hundreds of community concerns, with "odor" and "methane" being the most prevalent issue. The 2024 CCAR summarizes 233 community reports, for example, with odor comprising 59% of total issues raised and methane being an additional 7%.[8]

What effect does the EPA Enforcement action have on Republic's application to expand the landfill?

In my view, EPA Enforcement's action defeats Republic's expansion application, because it causes the application's Burden of Proof to fail. This outcome is apparent when you view this legal landscape from a Planning Commissioner's point of view – your point of view. To approve the expansion application, a Planning Commissioner would have to affirm Republic's proofs as sufficient; they'd have to publicly certify that an expanded dump couldn't pose significant problems – and do so while the EPA is actively investigating the current dump for significant problems. This seems like an impossible position for you as a Planning Commissioner to take.

EPA Enforcement's action can unravel the expansion application so thoroughly because the application's Burden of Proof has been built around a core misdirection all along: it focuses on regulations and regulatory power. The Planning Commission's criteria, however, do not say anything about regulations: they focus on actual harms.

In the world of the applicant's Burden of Proof, it's impossible for these two statements to both be true: (a) "the applicant is complying with environmental regulations" and (b) "the landfill is causing environmental harms." The Burden of Proof attempts to construct a binary world.

In the world of the Planning Commission's criteria, however, it's quite possible for both statements to be true. You regularly make judgments on how land uses will work (or not) in the real world.

Put another way, Republic's Burden of Proof means that their application must show that the landfill expansion won't cause significant harm to nearby properties, character of the area, etc., or it fails. Their proof for this has been "we comply with environmental regulations" – this is said throughout their Burden of Proof. But now that the EPA has said "let's see all your compliance records" explicitly to see if Republic really is complying, the EPA has slapped big red question marks all over Republic's proof. And a proof with big red question marks on it is no proof at all.

What has been Republic's response to the EPA Enforcement action?

- **No disclosure.** Republic did not disclose in their final Burden of Proof that Coffin Butte Landfill had been served by the EPA, nor offer the Planning Commissioners any narrative about it.

- **Misleading statement maintained.** Republic's Burden of Proof includes a letter that states "we have not received notification from the EPA that… Coffin Butte is the subject of any pending enforcement action" dated the day the EPA Enforcement initiated its action.[9]

- **Delay.** You as a Planning Commissioner might reasonably expect Republic to deal with this EPA Enforcement action forthrightly and expeditiously, to "clear the air" for their expansion application. Instead, Republic Services has acted instead to delay the EPA's examination of landfill records by filing two extension requests to date. With these extensions, they have made it impossible for the EPA to take further action until after the public comment period for the application is closed.[10]

Summary.

On January 15 the EPA's investigation of Coffin Butte Landfill moved into a new phase: active enforcement proceedings. The Enforcement Manager for EPA Region 10 served a process on Republic Services, in the form of a Section 114 Information Request. Republic Services did not disclose this development and have no narrative about it for the Planning Commissioners. The EPA Enforcement process would seem to render the applicant's Burden of Proof insufficient, because that Burden of Proof focuses on the lack of enforcement action by regulators as credentials of the applicant. I recommend that the Planning Commissioners deny LU-24-027, the application to expand Coffin Butte Landfill, due to the applicant's failure to make a convincing case for their environmental compliance, and due to the gravity of many questions raised about the accuracy and completeness of its application.

–

#EPAenforcement
#Section114
#explainer

[1]
1:52:32
Senator Merkley: [In my] home state: Coffin Butte Landfill. In June of 2022 the EPA sent out a team to measure the methane coming out of it, because of local concerns. The inspection resulted in recording 61 leaks, including three measurements that maxed out the instrumentation that was being used, at 70,000 parts per million. So: can you give me a short version of what action the EPA is taking? This is now 23 months ago that the field inspection occurred. If we need a longer discussion, I'd like to follow up with you to make sure that there is going to be action regarding landfills like this that are out of compliance.

1:53:10
Mr. Regan: Well, I will say that our enforcement arm has been very aggressive at looking at these methane leaks and opportunities here. This is one that as you said was discovered in 2022. Unfortunately it is an active enforcement situation, so I can't speak to that without betraying the confidence or the legal obligations that I have. But I can tell you that we are coordinating with the State of Oregon – it's an active case, and we are laser-focused on this case.

1:53:43
Senator Merkley: Great, because if you have a landfill which maxes out the instrumentation – which is I think quite rare? – it should probably rise to the top of the list of places to act on. I'll convey to the folks in Corvallis and nearby that you are on the case.

Senate Appropriations Committee Hearings, May 1, 2024 (link)

[2] This Section 114 Information Request has been supplied to the Planning Commission: search testimony for #EPAInfoRequest

[3] The EPA served their Section 114 Information Request upon Republic's registered agent in Oregon, CT Corporation. CT Corporation's legal arm relayed the EPA process on to Republic's legal department with a cover letter that identified the nature of the process as "Subpoena – Business Records" and the Action involved as "United States Environmental Protection Agency vs. Republic Services"

[4] These EPA Inspection Reports have been supplied to the Planning Commission: search testimony for "Heinz" (2022 Inspection) and "Conley" (2024 Inspection)

[5] "EPA Issues Two Enforcement Alerts to Highlight Compliance and Monitoring Obligations for Municipal Solid Waste Landfills," September 25, 2024 (link)

[6] Data publicly available at CarbonMapper.org. See also: Carbon Mapper explainer at #methaneplumes

[7] Data publicly available at CarbonMapper.org. See also: Carbon Mapper explainer at #methaneplumes

[8] These Community Concerns Annual Reports have been supplied to the Planning Commission: search testimony for #CCAR

[9] See Republic's January 15, 2025 update to its Burden of Proof

[10] Emails between Paul Koster, Environmental Manager at Coffin Butte Landfill, and Sara Conley, EPA Air Enforcement Officer, Region 10, obtained through FOIA. At Paul's request, the original deadline for the Section 114 Information was extended 180 days, to May 12.

Benton County Exhibit 8 (BC8)

BC8.3	VNEQS



Valley Neighbors for Environmental Quality and Safety (VNEQS)

To: **Chair Fowler** and Benton County **Planning Commission members**

CC: Anne Thwaits, Benton County Public Information Officer
Petra Schuetz, Benton County Community Development Department
Winterbrook Planning (incl. Maul Foster Alongi, Kellar Engineering)

From: Valley Neighbors for Environmental Quality and Safety (VNEQS)
https:coffinbuttefacts.org
North Benton County
Oregon, 97330

Date: June 10, 2025

Re: LU-24-027 CUP application - document to help facilitate planning commissioner deliberations and assist County staff in preparation of supplemental staff report

Chair Fowler, Planning Commissioners,

The attached comprehensive document was compiled by Valley Neighbors for Environmental Quality and Safety (VNEQS) for your benefit, to help facilitate and streamline your access to the LU-24-027 public comments submitted through May 8, 2025. We also encourage its use by County staff and their consultants in preparation of the supplemental staff report.
In it we have addressed issues raised by subject-matter experts in hydrogeology, public works, wastewater treatment, landfill emissions, architecture, construction site development and land use planning.

Contributors are licensed professional engineers, scientists, academics, and other professionals.

Facts are footnoted and cross-referenced. This document is a product of our collaborative review of the Applicant's proposal, Benton County staff report, reports by Benton County consultants, plus oral and written public testimony and Benton County Code.

It begins with a SUMMARY of the problems we have discovered in the Applicant's submittals, followed by DETAILED COMMENTS in support of our assertions, including code citations and suggested findings for denial, should that be the decision of Commissioners.

Separate comment sections are provided for each issue raised by Applicant: noise, odor, traffic impacts, groundwater, PFAS, visual blight, fire and wildlife.

We offer this to you for reference in your deliberations and hereby submit it as testimony to be included in the public record.

Thank you so much, Chair Fowler, Commissioners, Ms. Schuetz, Ms. Thwaits, Benton County Planning staff, consultants, for your hard work on this monumental task. It is appreciated.

Sincerely,



Nancy Whitcombe, LEED AP Architect
on behalf of VNEQS

VNEQS, Valley Neighbors for Environmental Quality and Safety
North Benton County
Oregon, 97330
https://www.coffinbuttefacts.org

SUMMARY: LU-24-027 CUP GENERAL CRITICISM OF APPLICANT SUBMITTALS

There are three basic criticisms of the Applicant's consultants' submittals:

- The first is that to a large extent the Applicant's consultants have assumed that future impacts will be identical with current impacts. This assumption is contradicted by the Applicant's own submissions; future impacts are likely to **double** current impacts.
- The second is that certain of the Applicant's Consultants (traffic & fire), seem unfamiliar with actual operations at Coffin Butte landfill.
- The third is that the Applicant's consultants ignore the disruptive impacts involved in blasting out the side of Tampico Ridge, removing 3,500,000 CUYD of material, moving that material across the road, and then relocating that material to some undisclosed location at some future time, as well as "long tail" of impacts after the period of use.

FIRST CRITICISM: THE APPLICANT GENERALLY ASSUMES THAT THE LEVEL OF FUTURE IMPACTS WILL BE IDENTICAL TO CURRENT IMPACTS. IN FACT, FUTURE IMPACTS WILL BE ROUGHLY TWICE CURRENT IMPACTS: The Applicant's consultants have for the most part based their analysis of the proposal on the assumption that future impacts will be identical to current impacts.

This is a mistake.

One, the existing quarry expansion: It doesn't account for impacts from the unpermitted expansion of the landfill into the west quarry, which Applicant has just begun to fill with waste. When full, the quarry will add 50 more acres of landfill footprint and 14,000,000 more CUYD (cubic yards) of waste-in-place.

Two, the old landfill won't disappear: It doesn't consider cumulative Impacts – a landfill is not a food cart; when you build a new landfill across the road from an old landfill, the old landfill doesn't disappear; it continues to adversely impact its surroundings (produce methane, leachate, add to visual blight, etc.).

Three, increases in waste volume: The consultants apparently do not account for increases in yearly waste volume indicated on the Applicant's construction document set. There is an increase from current maximum levels of roughly 1,100,000 CUYD/yr to 1,500,000 CUYD/yr in years 1-4 of the expansion, and a further increase to 1,860,000 CUYD/year in

years 5-6[1]. The projected increase in yearly waste volume is also consistent with the boosted operating hours specified by the Applicant in the expansion proposal, which expand garbage intake to seven days a week and landfill operations to twenty-four hours a day.

Four, TIME: Applicant proposes to add an additional 5-7 years of environmental degradation to the area. This means disruptive noise, traffic, increased cancer risk, property owners being unable to sell their properties, wildfire danger, and so on, continuing for an additional half to three-quarters of a decade, which could, for example, mean the difference between lifelong health and lifelong illness if PFAS are causing documented human health impacts.

Three metrics determine the impacts of a landfill; they are:

1. Surface area: Surface area impacts visual blight, fire, odor, groundwater and aerial emissions of landfill gas – a complex toxic aerial stew of methane and tag-along chemicals including odor-producing compounds, aerial PFAS, and other toxic substances. The more surface area, the more visible the objectionable view, the greater the burden on emergency response who might be called to fight a fire over a greater area, the more opportunity for water incursion and hence greater leachate production and the more landfill gas emissions. By the time the quarry is full of waste, these impacts could easily be DOUBLE THE LEVEL of current impacts (see below for details).

2. Waste-in-place: Waste-in-place is related to surface area, but impacts visual blight, fire, odor, groundwater and PFAS emissions somewhat differently; the more waste-in-place, the more landfill gas and hence methane/odor/aerial PFAS, and other toxic substances, the more leachate production, the longer time that leachate will be expected to be produced, greater danger to firefighters from a subsurface fire (because of sinkhole formation), etc. Again, considering the old landfill, the new landfill, and the quarry expansion, adverse impacts could easily be DOUBLE THE LEVEL of current impacts (see below for details).

3. Volume of waste accepted per day/year: Daily volume impacts traffic, noise, visual blight, wildlife, fire, and odor. Again, DOUBLE current impacts (see below for details).

DETAILS OF INCREASES, PER APPLICANT'S SUBMITTALS: Included in the Applicant's Burden of Proof are documents that show that proposed impacts will **increase significantly** above current impacts. In fact, when the projected quarry expansion is taken into account, projected impacts are likely to be DOUBLE CURRENT IMPACTS.

[1] Applicant prepares annual reports & drawings with airspace in CUYD (cubic yards). Benton County limits are in tons; per the 2023 Coffin Butte Annual report, there are .98 tons/CY, for the purposes of these comments, we are calling one ton roughly equivalent to one CUYD of airspace (over time, a ton of waste reduces in volume)

Here are the increases in each of these metrics, extracted primarily from the Applicant's own drawings:

a. Surface Area, increases of 45-84% MATERIAL AND SIGNIFICANT:
   i. Increase area of proposal (new landfill) over existing landfill: 145%[2]
   ii. Increase area of quarry plus proposal over existing landfill: 184%[3]
b. Waste-in-place, increases of 40-96% MATERIAL AND SIGNIFICANT:
   i. Increase WIP of proposal (new landfill) over existing landfill: 140%[4]
   ii. Increase WIP of quarry plus proposal over existing landfill: 196%[5]
c. Daily (yearly) volume, increases of 69-100% MATERIAL AND SIGNIFICANT
   i. Increase of yearly volume @ 1,860,000 CUYD/yr:[6] 169%
   ii. Volumes could double as they did from 2017-2019, if so: 200%

CRITICISM TWO: SLOPPY BOILERPLATE BY APPLICANT'S CONSULTANTS

Please see the attached detailed comments (beginning on page 7) for additional criticisms of the formulaic work product of Applicant's consultants, from the odor consultant's assertion that 1% of odor complaints are "likely" caused by the landfill, to the fire consultant's many factually incorrect assertions about landfill operations (including "robust waste approval checks"), to the hydrogeologist conflating movement of water on the surface of the earth with below-grade domestic well impacts. Some of the consultants' reports were, frankly, embarrassing, and we appreciate County and the County's consultants' efforts to flag obvious errors and/or misstatements (kudos to MFA for pointing out that the staging area for the 3,500,000 CUYD of material extracted from Tampico Ridge in no way would have been contained in the area designated in earlier drawing versions).

CRITICISM THREE: ENORMOUS SCOPE OF PROPOSED EXCAVATION OF TAMPICO RIDGE, AND DECADES-LONG POST CLOSURE IMPACTS For a normal land use project, the period of site preparation and construction is relatively short compared to the period of time that the completed project is used. Not so in Applicant's proposal. The sheer scope of required site preparation is mind boggling (perhaps why the Applicant refuses to produce any detail or a timeline). But if the Applicant proposes to extract 3,500,000 CUYD of material from the side of the mountain, that will involve an enormous amount of disruption. Just to move that material across the road to the temporary staging area in the quarry (where they can't leave it for long

[2] Existing landfill: about 130 acres (footprint); proposed new landfill across the road: about 59 acres (footprint)
MATH: 130 + 59 = 189 (existing landfill acreage + proposed new acreage); 189/130 = 145%
[3] Existing landfill: about 130 acres; unpermitted quarry expansion: about 50 acres; proposed new landfill: 59 acres
MATH: 130 + 50 + 59 = 239 (total existing plus quarry plus proposed new acreage) 239/130 = 184%
[4] Existing landfill: about 25,000,000 CUYD WIP; proposed new landfill across the road about 10,000,000 CUYD
MATH: 25,000,000 + 10,000,000 = 35,000,000 (total existing plus proposed); 35/25 = 140%
[5] Existing landfill: 25,000,000 tons, quarry expansion: 14,000,000 CUYD, proposed new landfill: 10,000,000 CUYD
MATH: 25,000,000 + 14,000,000 + 10,000,000 = 49,000,000; 49/25 = 196%
[6] See Applicant's drawings for volumes in years 5 & 6

because the Applicant will be putting garbage there) would require 269,230 one-way trips in a standard dump truck across to the quarry & return across the road. THEN they would have to pick the material up in the quarry to move it to an unidentified location at some undescribed time in the future & return. That's more than ONE MILLION ONE HUNDRED THOUSAND TRIPS by dump trucks, back and forth across Coffin Butte Road. 3,500,000 CUYD is the volume of THREE Empire State Buildings.

Landfills have a "long tail" – they continue to adversely impact the environment, public improvements, and public health for DECADES after closure, as they continue to emit toxic substances and burden public infrastructure. For this landfill project, site preparation time is likely to outlast the period of use, and the period of post-closure impacts will be many multiples of the period of use.

Let's step back and look at this holistically for a few moments – Applicant is proposing an unknown amount of SEVERE site preparation disruption that will take an undisclosed amount of time, proposing to remove a significant portion of Tampico Ridge, a geological feature, proposing to relocate the material so removed at least twice, proposing a relatively short period of actual use, and then proposing DECADES of continuing environmental harms, adverse public infrastructure impacts, and harms to human health. And for what? So that for a few years other counties' residents can save a couple of dollars a month on garbage bills?

In many ways, Applicant's 2024 proposal is identical to Applicant's 2021 proposal. The Applicant has not eliminated odor generation from its new proposed pile of waste; it has just produced a study saying that there are no odors. Similarly, the noise that Applicant could not mitigate in the previous proposal remains unmitigated in this proposal. Even Applicant's great concession of not placing garbage on property they did not own -- generously allowing the public to retain use of the public's own property, Coffin Butte Road -- is impaired by Applicant proposing to route so much landfill traffic on that road that even the Applicant's own traffic consultant acknowledges that functionality will be degraded.

Therefore, where appropriate, potential Findings have been reproduced from the Commission's prior unanimous decision to deny Applicant's previous submission, LU 21-047, in December 2021. The Notice of Decision for LU 21-047 is appended, highlighted, to the end of this document.

On the following pages please find detailed comments describing the ways in which the Applicant's consultant's submittals understate various adverse impacts. We have included citations to assist Commissioners and staff in preparing Findings to support denial of the Application based on our analysis of adverse impacts, if that is the conclusion of the Commissioners.

DETAILED COMMENTS

LU 24-027 APPLICANT SUBMITTALS ON: **NOISE** IMPACTS, **ODOR** IMPACTS, **TRAFFIC** IMPACTS, **GROUNDWATER** IMPACTS, **PFAS, VISUAL BLIGHT, FIRE** DANGER**, AND WILDLIFE** IMPACTS AND, WHERE APPROPRIATE, **FINDINGS** TO **SUPPORT DENIAL OF THE APPLICATION**

-- NOISE --

Applicant's slide presentation on noise begins on page 10 of the Applicant's presentation dated May 29, 2025

APPLICANT: Noise "does not constitute an off-site impact that will 'seriously interfere' with the uses of adjacent and nearby properties"

BENTON COUNTY: "The study is flawed, for the following reason(s): *The proposal appears to exceed the DEQ regulatory noise threshold proposed for use by the applicant (Staff Report, page 26)*

COMMUNITY ADDRESSES FLAWS IN THE APPLICANT'S CONSULTANT'S STUDY: Community members draw the attention of Commissioners, Benton County CDD, and Benton County consultants to the following:

FLAW #1 IN CONSULTANT'S STUDY – REMOVAL OF VOLUME CAP – NOISE ANALYSIS NOT ADJUSTED FOR NOISE IMPACTS INCREASING IN TANDEM WITH WASTE VOLUME INCREASES

Applicant's consultant's submittal does not take into account removal of the intake cap, which will have the effect of increasing noise impacts 1:1 in tandem with waste volume increases (69%/100%/100%+)[7]. Applicant's own drawings show an increase over current volumes of 69%, but Applicant has shown capacity to double volumes in the past (as from 2017 to 2019). With no constraint in the intake cap, any analysis of potential future impacts should not perform noise analysis using current noise volume, but at least 169% of current noise volume (using Applicant's own volume estimates for years 5&6 of the proposal), or 200% of current noise volume if Applicant exceeds estimates and conforms to historical increases.

FLAW #2 IN CONSULTANT'S STUDY – NO CONSIDERATION OF SITE PREPARATION IMPACTS

Applicant's consultant's submittal does not take into account site preparation noise (unknown impacts), applicant has not provided a timeline or plan, but removal of enough material (mostly basalt) to equal the volume of THREE EMPIRE STATE BUILDINGS (3,500,000 CUYD) will not be accomplished quietly or swiftly.

[7] Applicant's drawing #17, submitted March 14, 2025, Note: "Top of Waste Phase 4 (Year 6-7) 1. FILL VOLUME = 1,860,000 CY; CURRENT ALLOWABLE CY, APPROXIMATELY 1,100,000 MATH: 186/110 = 169%

POTENTIAL CODE CITATIONS – POTENTIAL FINDINGS FOR DENIAL, NOISE, PART I

53.215 (1) NOISE SERIOUSLY INTERFERE – INCREASED WASTE DISPOSAL VOLUME = INCREASED NOISE

Applicant's consultant's analysis considers only current noise impacts, not future noise impacts that would result from increased activity resulting from increased volumes of waste accepted. Noise could increase 69%/100%/100%+ over current noise recorded (not including site preparation, see below).

53.215 (1) NOISE SERIOUSLY INTERFERE -- SITE PREPARATION = INCREASED NOISE

Applicant's consultant's analysis considers CURRENT NOISE IMPACTS, NOT FUTURE NOISE IMPACTS THAT WILL RESULT FROM EXTENSIVE SITE PREPARATION "before and after" operating hours, i.e. all the time. This noise will be extremely disruptive, consisting of blasting – YEARS of blasting, scraping, beeping, loading dump trucks, unloading dump trucks, truck travel, etc.

COMMUNITY ADDRESSES DEQ REGULATIONS: Community members do not concur with the Applicant and with Benton County Planning that DEQ regulations are an adequate metric to capture land use impacts, for the following reasons:

DEQ REGULATIONS ARE NOT LAND USE CRITERIA

DEQ Regulations protect PUBLIC HEALTH; Land Use protections protect one land use from potentially incompatible uses; such protections do not necessitate a health component. A one-time 49-decibel noise would have an entirely different impact on an "adjacent" (however defined) property than a 49-decibel noise that continued 24/7. Either would be allowed by DEQ; the latter situation, however, might properly result in land use application denial. In LU 21-047, The Planning Commission addressed this squarely, and succinctly summarized the disconnect as follows: *"…There is no ability for the Planning Commission to review the situation after DEQ's approval to ensure that DEQ's standards were adequate to prevent the proposed use from seriously interfering with uses on adjacent property."*[8]

DEQ REGULATIONS ARE NOT CURRENTLY ENFORCED AND COMMUNITY BELIEVES THEY ARE CURRENTLY EXCEEDED

DEQ regulations are not enforced; and Benton County does not have a noise ordinance to enforce. An unenforced regulation relies on voluntary compliance, and there has been considerable public testimony to the effect that the Applicant frequently does not comply with unenforced regulations (i.e. EPA emissions, OSHA, DEQ, etc.)

[8] FINDINGS, LU 21-047, p. 2

POTENTIAL CODE CITATIONS – FINDINGS FOR DENIAL, NOISE, PART II

53.215 (1) NOISE ALL THE TIME

The Applicant proposes to engage in landfill operations from 5 am to 5 pm and to engage in site preparation "after and before" operating hours. "After and before" is equivalent to "all the time". The Applicant's proposal, by subjecting adjacent properties to the constant noise – at approximately double current volumes -- of an operation which Benton County Public Works testified was already the "most intensive" industrial operation in Benton County would constitute significant adverse impact.

53.215 (1) APPLICANT CURRENTLY OUT OF COMPLIANCE WITH DEQ NOISE REGULATIONS

The Applicant has been promising neighbors for years that it will replace the existing backup alarms that awaken them before dawn, but to date has yet to do so. Backup alarms produce a noise that ranges from 87 to 102 dB (twice the DEQ regulatory limit for night-time noises), and by OSHA standards must be audible above the surrounding ambient noise level (which is why they are so loud). Applicant currently starts landfill operations at 5:00 a.m., TWO HOURS BEFORE DEQ ALLOWS, awakening residents in surrounding homes at that time with the loud beeping of backup alarms (see testimony, Grant Carlin). Consequently, it is probable that landfill operations are already out of compliance with DEQ noise regulations mandating noises no louder than 50 dB at night from 10 p.m. to 7 a.m. It is reasonable to assume that if the Applicant is currently out of compliance with regulations, non-compliance will continue if this application is not denied.

-- ODOR –

Applicant's slide presentation on odor begins on page 20 of the Applicant's presentation dated May 29, 2025

APPLICANT: "Odor modeling shows that the proposed landfill expansion [sic, actually a new landfill] would not 'seriously interfere' with uses on adjacent properties…"

BENTON COUNTY: Recommends denial because there are minor flaws in the Applicant's technical analysis, but states: *"staff places high value on technical analysis in relation to the odor produced by the proposed expansion."* (Staff Report, page 33)

COMMUNITY ADDRESSES FLAWS IN THE APPLICANT'S CONSULTANT'S STUDY: Community members believe that Benton County staff has cited only the tip of the garbage iceberg (the "trashberg"?) regarding flaws in Applicant's odor submission. The Applicant's consultants state with a straight face that only 84 odor complaints have been lodged in five years, which is demonstrably false, per Benton County's own DEQ submittals. Applicant's consultants then conclude that only 1% "likely" originate from the landfill. So, per Applicant, ONLY ONE ODOR COMPLAINT IN FIVE YEARS HAS ACTUALLY ORIGINATED FROM THE LANDFILL (!). Is Benton County familiar with the expression, "garbage in, garbage out"; flawed, inaccurate, or low-quality input data will inevitably result in equally flawed, inaccurate, or low-quality output conclusions? Below please find criticisms of Applicant's odor study:

FLAW #1 IN CONSULTANT'S STUDY – INCORRECT AMOUNT OF WASTE IN PLACE

Applicants based their studies on 41,110,068 tons of waste in place. But current CUYD of the landfill (from the 2023 Coffin Butte Annual report) is approximately 39,000,000 CUYD in the existing landfill plus the quarry expansion. If the new landfill south of Coffin Butte Road is approved, that would add about 10,000,000 CUYD capacity[9]. That is 49,000,000 CUYD – NOT 41,000,000 CUYD -- of garbage[10]. So already there is a major error in the consultant study, a significant underestimation of odor-generating garbage.

FLAW #2 IN CONSULTANT'S STUDY – INCORRECT CLOSURE YEAR

The closure year cited by Applicant's odor consultant (SCS) is 2052. But per the 2023 Annual report, the landfill currently has 11 more years of capacity, and per the current application, the new landfill south of Coffin Butte Road has six years of capacity. That takes us to 2042, not 2052 (MATH: 2025 + 11 years + 6 years = 2042, not 2052). More stinky waste in less time equals more odor.

[9] Per Applicant's drawings, 1,500,000 CUYD/y years 1-4, 1,860,000 CUYD/y years 5-6

[10] Initially, .98 tons of waste fills approximately one cubic yard of airspace, but over time a cubic yard of airspace will contain more than one ton, because over time waste volume reduces as waste decomposes into the air as landfill gas and leachate, allowing the landfill operator to place more waste tonnage in the same airspace later

FLAW #3 IN CONSULTANT'S STUDY – LANDFILL GAS COLLECTION EFFICIENCY OVERESTIMATED
Applicant has already admitted to less than EPA models for collection efficiency. In January 2025, the landfill's Environmental Manager, Paul Koster, informed DSAC that Republic estimated its gas collection system operated at 70% efficiency in 2024. Therefore, Applicant has already conceded that 30% (not the 25% of the EPA models) of emissions, and thus odors, escape capture. Community members point to recent EPA exceedance reports and Carbon Mapper data to demonstrate that even 70% is a significant overestimation, and actual uncaptured gas, termed 'fugitive emissions', is probably in the mid-50% range, corresponding to the EPA's estimation of 57% (2019). So, 40% to 50% (not 25%) of emissions, and thus odors, escape capture (this range is corroborated by new evidence that will be presented in later testimony). Consequently, this odor study is using fugitive emission amounts of landfill gas that are only 50-65% of actual emissions. Add in that they are underestimating waste in place, and overestimating closure year: garbage in/garbage out.

FLAW #4 -- INCREASED SURFACE AREA WILL INCREASE FUGITIVE EMISSIONS; odor correlates to surface area (more surface area = more fugitive emissions). The Applicant is proposing what is essentially an entirely new landfill south of Coffin Butte Road, not an expansion where a portion of the new fill abuts old fill. The Applicant's analysis does not account for the additional surface area that will contribute to fugitive emissions.

FLAW #5 – CHERRY-PICKED ODOR COMPLAINTS. The Applicant has excluded from its consideration the hundreds of complaints filed by residents with Benton County itself; these are compiled in the Community Concerns Annual Reports which the County's Disposal Site Advisory Committee (which includes a representative of the Applicant) files with DEQ. For comparison with applicant's citation of 84 complaints in five years, there were TWO HUNDRED AND THIRTY-THREE complaints about landfill odor in 2024 ALONE.

FLAW #6 – APPLICANT'S CONCLUSIONS ARE CONTRARY TO REALITY AND TO COMMON SENSE
This study's model and findings are contradicted by direct evidence from Carbon Mapper which shows landfill gas plumes at super-emissions levels stretching for up to two miles from origin points on the landfill's surface. Benton County has been presented with Carbon Mapper's plume images and data (testimony, Ken Eklund). Applicant's study values the conclusions of out-of-state consultants over the lived experience of community members. Benton County itself has submitted literally hundreds of odor complaints per year to DEQ in mandated annual reports to that agency. The sale of a winery four miles distant from the landfill fell through because the potential buyer became ill after experiencing landfill odors.

Yet Benton County and Benton County's consultants accept without comment the Applicant's consultant's conclusion that there have been only 84 odor complaints in five years, and that of those 84 complaints, only one complaint "likely" originated from the landfill? Does that pass the smell test?

POTENTIAL CODE CITATIONS – FINDINGS FOR DENIAL, ODOR:

53.215 (1) ODORS WILL SERIOUSLY INTERFERE WITH USES ON ADJACENT PROPERTY – CAN NOT ENJOY BEING OUTSIDE

On days when odor from the landfill is strong, community members have testified that they cannot enjoy being outside on their own property. This is due both to the unpleasantness of the odor, and to the reasonable fear that breathing it is unhealthy. This is a particularly adverse impact in rural residential zones, where valued outside activities include tending livestock, agriculture, and silviculture. If this application is approved, current odor-related adverse impacts are almost certain to become exacerbated. *"People living in areas with poor air quality does pose serious interference with livability."*[11] (**FINDING** OF **LU 21-047 DENIAL**, UNCHANGED IN CURRENT APPLICATION)

53.215 (1) ODORS WILL SERIOUSLY INTERFERE WITH USES ON ADJACENT PROPERTY -- RESPIRATORY AILMENTS, HEADACHES, DIZZINESS

Residents have submitted testimony that landfill odor exacerbates health conditions in persons on properties up to four miles distant from the landfill. This finding is supported by scientific research, which has likewise been submitted into testimony. If approved, current adverse impacts are likely to be exacerbated. *"Risk of health concerns is likely with the landfill expansion…"*[12] (**FINDING** OF **LU 21-047 DENIAL**, UNCHANGED IN CURRENT APPLICATION)

53.215 (1) ODORS WILL SERIOUSLY INTERFERE WITH USES ON ADJACENT PROPERTY -- AIRBORNE PFAS & OTHER CHEMICALS (HYDROGEN SULFIDE, VOC's, ETC)

Recent studies have come out showing that landfills "belch"[13] PFAS along with fugitive landfill gas and recent guidance is for people who live near landfills to be tested for PFAS. Exposure to PFAS have been cited by the EPA as potentially linked to decreased fertility, developmental delays in children, increased risk of some cancers, reduced vaccine response, and increased cholesterol levels and obesity risks. Residents have submitted testimony that residents of the area surrounding the landfill worry about increased cancer risk. If approved, current adverse impacts are likely to be exacerbated. (**FINDING** OF LU 21-047 **DENIAL**, UNCHANGED IN CURRENT APPLICATION)

[11] FINDINGS, LU 21-047, p. 2
[12] FINDINGS, LU 21-047, p. 2
[13] Science News: "Landfills belch 'forever chemicals' into the air"

53.215 (1) ODORS WILL SERIOUSLY INTERFERE WITH USES ON ADJACENT PROPERTY -- FARMERS CAN'T RETAIN EMPLOYEES

Small lot farmers on nearby agricultural parcels have difficulty retaining farm employees because of offensive odors (Testimony, LU-21-047 Priya Thakkar). If approved, current adverse impacts are likely to be exacerbated. *"Some farmers have testified that getting workers to work in the stench has been an issue."*[14] (**FINDING** OF LU 21-047 **DENIAL**, UNCHANGED IN CURRENT APPLICATION)

53.215 (1) ODORS WILL SERIOUSLY INTERFERE WITH USES ON ADJACENT PROPERTY -- VINEYARD SALE FALLS THROUGH AS A RESULT OF LANDFILL ODOR

Sale of a vineyard four miles north of the landfill fell through after the buyer was sickened by landfill odor. This resulted in significant financial damage to the buyer, who lost his down payment, a significant adverse impact for both buyer and seller. Not being able to sell your property is a current adverse impact. If approved, current adverse impacts are likely to continue and worsen significantly.

53.215 (1) ODORS WILL SERIOUSLY INTERFERE WITH CHARACTER OF THE AREA -- HOMES, FORESTS, AND FARMS SHOULDN'T SMELL LIKE ROTTING GARBAGE

Smelling garbage in any of the non-landfill-zoned areas abutting, adjacent, or near to the landfill seriously interferes with the character of those areas. People who live, work and recreate in forests and farms up to seven miles away, and in the village of Adair should not be subjected to the nauseating and potentially harmful effects of landfill stench. If approved, current adverse impacts are likely to be exacerbated. *"Many residents of the area testified that the odor and noise has continually gotten worse over the years. Some testified that they have to seek shelter inside to avoid the noise and smell. They warn that the levels expected in the future will affect their rural residential uses."*[15] (**FINDING** OF **LU 21-047 DENIAL**, UNCHANGED IN CURRENT APPLICATION)

53.215 (1) CURRENT ODOR MITIGATION DOES NOT WORK, APPLICANT DOES NOT PROPOSE ANY CHANGE IN ODOR MITIGATION

The same mitigation is proposed for odor reduction as is currently used (tarps). If it currently does not mitigate odor then it cannot be expected to mitigate odor in the future. *"The same mitigation is proposed for the expansion and if it currently does not mitigate the odor then it cannot be used as a mitigation for the future and be expected to minimize the concern."*[16] (**FINDING** OF **LU 21-047 DENIAL**, UNCHANGED IN CURRENT APPLICATION)

[14] FINDINGS, LU 21-047, p. 2
[15] FINDINGS, LU 21-047, p. 2
[16] FINDINGS, LU 21-047, p. 2

53.215 (1) NO ABILITY FOR THE PLANNING COMMISSION TO ENSURE THAT DEQ STANDARDS ARE ADEQUATE TO PREVENT THE PROPOSED USE FROM SERIOUSLY INTERFERING WITH USES ON ADJACENT PROPERTY

"*Much of the applicant's response to these issues is to rely on subsequent review and approval by Oregon Dept. of Environmental Quality (DEQ); however, there is no ability for the Planning Commission to review the situation after DEQ's approval to ensure that DEQ's standards were adequate to prevent the proposed use from seriously interfering with uses on adjacent property.*"[17] (**FINDING** OF **LU 21-047 DENIAL**, UNCHANGED IN CURRENT APPLICATION)

53.215 (1) ODOR IMPOSES UNDUE BURDEN ON ADJACENT PROPERTY -- PHILLIPS HOME

The Phillips' home at 38691 Soap Creek Road is less than 200 yards from the face of the new proposed landfill south of Coffin Butte Road. So less than 200 yards away from the Phillips home and business (Cheryl's Garden, listed on Dun & Bradstreet) the Applicant proposes to locate a 150' wall of garbage, 10,000,000 cubic yards of waste that will include sewage sludge, industrial waste, and rotting animal carcasses. It is easy to imagine that this may render the Phillips property uninhabitable as a result of odor.

[17] FINDINGS, LU 21-047, p. 2

-- TRAFFIC IMPACTS –

Applicant's slide presentation on traffic begins on page 25 of Applicant's presentation dated May 29, 2025

APPLICANT: "Our previous application proposed the closure of Coffin Butte Road. We've kept it intact in response to Community concerns. We're also improving it."

BENTON COUNTY: Concurs with Applicant, *"Transportation impacts from the proposed expansion are minimal and are not expected to 'seriously interfere' with adjacent land uses" (Staff Report, page 34)*

COMMUNITY ADDRESSES FLAWS IN THE APPLICANT'S CONSULTANT'S STUDY: Community members do not concur with Benton County's conclusions. They point out the following flaws in the Applicant's consultant's report:

FLAW #1 IN CONSULTANT'S STUDY – NO STANDARD I.T.E. TRIP GENERATION DATA FOR LANDFILLS, TRAFFIC ENGINEER HAS PROPOSED A FLAWED METRIC

There is no accepted methodology for estimating landfill traffic volume. The ITE (Institute of Transportation Engineers) does not include "landfill" as a use for trip generation estimates. The traffic engineer therefore has to come up with a non-approved methodology for estimated projected landfill traffic volume, and states that "trips…will correlate to area population growth". Community members strenuously disagree that tonnage increases will correlate with population growth. Since this is an import landfill, an accurate metric would be the correlation with increases in import area, reflected in the 69% waste volume increases that the Applicant itself projects. The Applicant's consultant's report also does not take into account the demonstrated historic capacity of the Applicant to increase year-over-year tonnage (100% from 2017-2019) far beyond natural population growth in the County.

FLAW #2 IN CONSULTANT'S STUDY – DOES NOT ACCOUNT FOR CROSS TRAFFIC ON COFFIN BUTTE ROAD RESULTING FROM SITE PREPARATION ACTIVITIES

The study does not adequately account for cross traffic on Coffin Butte Road resulting in the movement of 3,500,000 CUYD of material from Tampico Ridge, and the subsequent relocation of that material which will increase traffic impacts by an unknown but enormous amount. An estimate of more than 1,100,000 trips would result just from the number of dump trucks it would take to relocate 3,500,000 CUYD of material temporarily into the quarry across the road and then to some more permanent location as the quarry area fills with garbage.

FLAW #3 – DOES NOT ADEQUATELY ACCOUNT FOR CROSS TRAFFIC ON COFFIN BUTTE ROAD RESULTING FROM THE APPLICANT'S TRAFFIC DESIGN & SITE PREPARATION

Republic Services reports over 127,000 commercial vehicles per year entering the landfill. If volumes of waste increase from roughly 1,100,000 CUYD to Applicant's estimate of 1,860,000 CUYD, a concomitant traffic increase would be to 214,630 vehicle trips. Under the proposed expansion, trash haulers will enter the existing scales on the North side, turn right onto an 850 ft. extended left turn lane and cross Coffin Butte Road to the new working face on the South side. Applicant's baroque traffic plan will effectively double the existing heavy truck use of Coffin Butte Road by landfill operations. Add leachate trucks carrying away leachate and cross traffic of almost 1,100,000 dump-truck-loads carrying Tampico Ridge away. When added to the site preparation cross traffic, landfill operations will effectively privatize the road, the same outcome as LU 21-047. In emergencies, such as wildfire, landfill fire, earthquake, or other disaster, the steady influx of trash haulers will impede evacuation, block emergency vehicles and cause trucks to stack up along major evacuation routes, threatening public safety.

POTENTIAL CODE CITATIONS – – FINDINGS FOR DENIAL, TRAFFIC:

53.215 (1) TRAFFIC SERIOUSLY INTERFERE -- EMERGENCY EGRESS/INGRESS

Traffic increases due to increases in projected landfill tonnage increases will seriously interfere with uses on adjacent property, through impeding traffic flow as a result of increases from 69%/100%/100%-plus on Coffin Butte Road, which valley residents depend on for emergency egress & EMT ingress.

53.215 (2) TRAFFIC UNDUE BURDEN -- DEGRADATION OF LEVEL OF SERVICE

Increases of only 50% (less than the 69% increase in volumes projected by the applicant) will, per the Applicant's consultant, result in degradation of the level of service from "A" to "B" (traffic report, page 15). **Degradation of service is an undue burden.**

53.215 (2) TRAFFIC UNDUE BURDEN -- PUBLIC IMPROVEMENTS, ROADBEDS

The Applicant does not consider the increased damage that heavy vehicles impose on public improvements by damaging road surfaces and roadbeds of County- and State-maintained roads (Yeager testimony, one loaded semi-truck does the same damage as 9,500 passenger vehicles), causing pavement deformation, cracks, and potholes. ODOT already faces a maintenance and operations shortfall of $205,000,000; increasing heavy truck traffic to Coffin Butte by 69%/100%/100%+ will be an undue burden on both State and local transportation infrastructure.

53.215 (2) TRAFFIC UNDUE BURDEN -- PUBLIC SERVICES EMS RESPONSE ACCIDENTS

The proposal will impose an undue burden on public services (Adair Fire -- EMS traffic accident response) due to Coffin Butte Road congestion as well as EMS response to traffic accidents caused by increases (69%/100%/100%+) in semi-truck traffic, not including increased leachate transportation and site preparation heavy truck traffic.

-- GROUNDWATER –

Applicant's slide presentation on groundwater begins on page 28 of Applicant's presentation dated May 29, 2025

APPLICANT: "Production at private wells on adjoining properties will not be affected"

BENTON COUNTY: Declines to comment, *" ...the county is limited in its ability to evaluate and regulate groundwater impacts beyond the multiple levels of state and federal regulation applicable to the proposed landfill expansion" (*Staff Report, page 36)

COMMUNITY ADDRESSES FLAWS IN THE APPLICANT'S CONSULTANT'S STUDY -- DEWATERING: The applicant provides no support for the conclusion that domestic wells will not be affected aside from a diagram of water flows on the ground surface. But the concern expressed is for the potential disturbance of water flows and collection points below grade. It is undisputed that quarrying can negatively impact domestic well production in the vicinity. This is known as "dewatering" and the term is fairly self-explanatory.

FLAW #1 IN CONSULTANT'S STUDY – DEWATERING AND DEWATERING MECHANISM

Neither the Applicant nor the County has even considered, let alone evaluated, the impacts on domestic wells of DEWATERING the north end of Tampico Ridge by drainage to the very large excavations that are planned for the site preparation phase. The Applicant has only considered the comparatively minor impacts to their own existing wells. The mechanism by which dewatering occurs is that, when soils and bedrock are excavated below the natural groundwater level ("water table"), water drains out of those soils and bedrock and into the excavations. This lowers the water table adjacent to the excavation, which in turn causes groundwater to flow toward the excavation from farther distances. As the effect propagates outward, there is a widening of the area within which the water table will be lowered.

FLAW #2 IN CONSULTANT'S STUDY – DEWATERING IS A FEATURE OF THE PROPOSAL

The proposed excavations include holes up to 50 ft deep for the proposed new leachate ponds, and a much larger excavation -- what amounts to a new quarry -- in the footprint of the proposed new landfill. Applicant's engineers have explicitly recommended that the slope above the proposed new leachate ponds should be dewatered in order to make those excavations more stable. Applicant's engineers have also provided a drainage plan for draining water away from the new quarry-like excavation. Thus, dewatering of Tampico Ridge is a feature of the design, but impacts to domestic wells on adjacent properties are unaddressed.

FLAW #3 IN CONSULTANT'S STUDY – DEWATERING IMPACTS

Dewatering has the potential to adversely impact domestic wells, if the wells are within the area within which the water table has been impacted by excavations. The severity of impacts can range from a decrease in the sustainable pumping rate, to seasonal or even permanent loss of productive capacity for the well, by eliminating flow to those wells. In actuality both of these potential adverse impacts could severely limit the functionality of existing wells. The degree to which the water table is lowered, at a given distance from the excavations, depends on the properties of the soils and bedrock.

FLAW #4 IN CONSULTANT'S STUDY – UNPREDICTABILITY OF DEWATERING IMPACTS

The bedrock below Tampico Ridge is understood to be mainly fractured basalt, through which groundwater flows mainly within fractures or fractured zones. The Applicant's consultants have acknowledged that groundwater flow in this type of bedrock is difficult to predict, because it depends on how these fractures are connected. Despite recognizing this difficulty, the Applicant has not made any investigation of the groundwater flow system to the south of the planned excavations. Without conducting any such investigations, they lack a credible basis for predicting the extent of the impacts from dewatering the rock around the proposed excavations.

FLAW #5 IN CONSULTANT'S STUDY – DEWATERING HAS ALREADY OCCURRED

Dewatering has already happened on the northwest side of Coffin Butte as a result of the quarrying operation (see testimony, William Briskey) where quarrying has resulted in cracked concrete slabs in the outbuildings of nearby property owners, and the draining of a pond that formerly served as a livestock watering pond.

FLAW #6 IN CONSULTANT'S STUDY -- MISPLACED RELIANCE ON STATE AGENCIES

The County, in declining to evaluate whether the Applicant has addressed groundwater, suggests that this might be covered by state and federal regulation. However, the County has not identified any stage in the permitting process in which potential impacts of dewatering on nearby domestic wells would be addressed either by state or federal agencies. The Oregon Water Resources Department is responsible for managing groundwater and surface water supplies across the state, but they do not appear in the list of external agencies for which the County has sought comment on LU-24-027.

<u>POTENTIAL CODE CITATIONS – DOMESTIC WELLS, DEWATERING:</u>

53.215 (1) THREAT TO DOMESTIC WELLS -- DEWATERING

Not having access to water is a significant adverse impact. Requiring owners of properties on Tampico Ridge to redrill wells is a significant adverse impact, especially considering the possibility for salinity in deeper wells.

53.215 (1) THREAT TO DOMESTIC WATER SUPPLY -- WATER FOR LIVESTOCK AND ANIMALS
Impacting the supply of water used for animals is a significant adverse impact in a Rural Residential district where owners typically have large lots and room for livestock, including cattle, horses, and/or goats

53.215 (1) THREAT TO DOMESTIC WATER SUPPLY -- WATER FOR AGRICULTURE
Impacting the supply of water used for agriculture is a significant adverse impact in a Rural Residential district where owners typically have large gardens or even small commercial farming operations

53.215 (1) THREAT TO DOMESTIC WELLS – NOT ABLE TO SELL PROPERTY
Sale of any adjacent properties would have to disclose the potential threat to domestic water supply, resulting in the possibility that properties so impacted would not be salable. Not being able to sell your home is a significant adverse impact.

COMMUNITY ADDRESSES FLAWS IN THE APPLICANT'S CONSULTANT'S STUDY -- CONTAMINATION: Domestic wells and aquifers could be contaminated by landfill activities. All landfill liners will eventually leak, per the EPA, even double liner systems. That is why there are double liners (leachate is already leaking through the upper liner North of Coffin Butte Road, and is being collected in the secondary system; there is no tertiary collection system). That is also why there are perimeter wells. If landfill liners were perfect, there would be no need for a double system, and there would be no need for frequently testing of perimeter wells. Research in US landfills shows that the primary collection system collects 98% of leachate, but in a 'wet' landfill like Coffin Butte, where 40,000,000 gallons per year are disposed of, even 2% is an enormous amount – 800,000 gallons per year.

FLAW #1 HISTORY OF DOMESTIC WELL CONTAMINATION
In the past, at least one domestic well on properties adjacent to the landfill has been contaminated (the Helm well), and DEQ has required that the landfill operator buy that property and has required that that well be decommissioned

FLAW #2 PERIMETER WELL ARSENIC
High arsenic levels as well as upward trends in iron and manganese in landfill perimeter wells are an indication that contaminants found in landfill leachate may already be escaping the landfill property perimeter.

FLAW #3 PERIMETER WELL PFAS
Perimeter wells are not currently tested for PFAS.

FLAW #4 DOMESTIC WELL POTENTIAL FOR ADVERSE IMPACTS ALREADY A FINDING IN LU 21-047
The potential for contamination of domestic wells was noted in denial of LU 21-047, and no circumstances have changed since the Planning Commission made that finding. *"The*

protection of groundwater water quality is a high priority and the risk of contamination from the landfill expansion is too great to allow and too difficult to remediate if it happens."[18]

FLAW #5 AQUIFERS AT RISK OF CONTAMINATION

Even before contaminants might be detected in existing domestic wells, there is a risk of contaminating the Willamette basin-fill aquifer. The Applicant acknowledges that the most likely direction of groundwater flow away from the proposed new landfill is toward the east, where state-owned land (E.E. Wilson Wildlife Area) lies atop the basin-fill sediments. The Willamette basin-fill aquifer is a REGIONAL PUBLIC RESOURCE relied upon for agricultural irrigation wells (including irrigation wells used for food crops including mint and hazelnuts just east of the state-owned land) and municipal water-supply wells (including for the Luckiamute Domestic Water Cooperative located just 2.8 miles from the landfill, in the unincorporated town of Suver).

<u>POTENTIAL CODE CITATIONS – DOMESTIC WELLS, CONTAMINATION:</u>

53.215 (1) THREAT TO DOMESTIC WELLS -- CONTAMINATION

If a domestic water well becomes contaminated that is a significant adverse impact

53.215 (1) THREAT TO DOMESTIC WATER SUPPLY -- WATER FOR LIVESTOCK AND ANIMALS

Contaminating the supply of water used for animals is a significant adverse impact in a Rural Residential district where owners typically have large lots and room for cattle, horses, and/or goats

53.215 (1) THREAT TO DOMESTIC WATER SUPPLY -- WATER FOR AGRICULTURE

Contaminating the supply of water used for agriculture is a significant adverse impact in a Rural Residential district where owners typically have large gardens or even small commercial farming operations

53.215 (1) THREAT TO DOMESTIC WELLS – NOT ABLE TO SELL PROPERTY

Sale of any adjacent properties would have to disclose the potential threat of contamination to domestic water supply, resulting in the potential that properties would not be salable. Not being able to sell your home is a significant adverse impact.

53.215 (1) CONTAMINATION OF DOMESTIC WELLS HAS ALREADY OCCURRED

Contamination of the Helms well resulted in purchase of that property (required by DEQ) and decommissioning of that well

[18] Ken Kenaston, notes, page 1

-- PFAS & LEACHATE –

Applicant's slide presentation on PFAS begins on page 34 of Applicant's presentation dated May 29, 2025

APPLICANT: "Coffin Butte landfill is not a producer of [PFAS in leachate]; it is a receiver"

BENTON COUNTY: Declines to comment

COMMUNITY ADDRESSES FLAWS IN THE APPLICANT'S CONSULTANT'S STUDY -- PFAS: Benton County produces approximately 75,000 tons of MSW each year. But the amount of waste landfilled in Benton County is 1,100,000 tons/year. That means that CURRENTLY FIFTEEN (15) bags of PFAS-containing material are imported and landfilled for every ONE (1) bag of PFAS-containing material generated within Benton County. If the new landfill south of Coffin Butte Road is approved, and the landfill ramps up to 1,860,000 CUYD/yr (as shown on Applicant's drawings), that will go up to almost 25 bags of PFAS-containing material for every 1 bag of PFAS-containing material generated within Benton County. The Applicant is **IMPORTING PFAS** into Benton County and **CONCENTRATING PFAS** at the landfill, and then **RELEASING PFAS** into the air, water, and soil of Benton County. The EPA has concluded that there is no safe level of PFOA or PFOS exposure.

WATER: MECHANISM OF CONTAMINATION

Coffin Butte landfill is a concentrator of PFAS produced in all of Western Oregon. PFAS-containing leachate is released untreated for leachate into the Willamette River. PFAS are also released into local streams and creeks as runoff from biosolid-treated agricultural lands.

WATER: TIME ELEMENT OF PFAS CONCENTRATION ON HUMAN HEALTH, ESPECIALLY CHILDREN

This proposal would add another 10,000,000 CUYD of PFAS-generating waste, originating outside of Benton County, into Benton County, for an additional 5-7 years of bioaccumulation of PFAS in human and animal tissues. 5-7 years of additional exposure to PFAS could adversely impact human health, especially in children, where exposure has been correlated with dire health effects.

WATER: PROPOSAL INCREASES YEARLY PFAS INTAKE BY AT LEAST 69%

The Applicant proposes to increase yearly waste, and therefore PFAS, from current cap of 1,100,000 CUYD/year to 1,860,000 CUYD/year, and the Applicant could increase yearly intakes by even more, since approval of the proposal will eliminate the current cap on yearly intake. Since there is already no safe level of PFAS in terms of human consumption, increasing the amount of PFAS discharged into waterways, from which drinking water is drawn, is also not safe. Municipal drinking water treatment plants do not remove PFAS.

SOIL: PROPOSAL INCREASES PFAS ON AGRICULTURAL LANDS

See above, for the mechanism by which the Applicant proposes to IMPORT 69% MORE PFAS yearly for MORE YEARS. Prior to being applied to agricultural lands, leachate that settles out in municipal wastewater treatment plants actually increases PFAS concentration when precursor PFAS molecules in leachate recombine to make even more PFAS in the settling tanks. The resulting super-PFAS-charged sewage sludge, instead of being deposited back in the landfill, is then spread on agricultural lands in Benton County.

AIR: PROPOSAL INCREASES PFAS RELEASED INTO THE AIR

See above, for the mechanism by which the Applicant proposes to IMPORT 69% MORE PFAS yearly for MORE YEARS. Recent research out of Florida finds that equivalent amounts of PFAS as are found in leachate are released directly into the atmosphere with fugitive landfill gas emissions (Science News: *"Landfills belch 'forever chemicals' into the air"*). PFAS are not destroyed by the combustion temperatures reached in either the generation facility or the enclosed flare, so these facilities also generate airborne PFAS.

POTENTIAL CODE CITATIONS – PFAS & LEACHATE:

53.215 (2) PUBLIC BURDEN – PFAS GENERALLY

Benton County should not have to bear the brunt of contaminating Benton County air, soil, and water with 1/3 of the PFAS generated in all of Oregon. Applicant privatizes the profits from disposing of a disproportionate amount of PFAS generated in greater Oregon (those 25 bags of PFAS-containing waste to Benton County's single bag), but socializes the cost onto Benton County alone, which must either shoulder the cost of removing PFAS from air, soil, and water, or displace the ill effects of PFAS onto Benton County residents. Either of those outcomes is a public burden.

53.215 (1) PFAS IN WATER – AGRICULTURAL IMPACTS

Concentrating into Benton County the PFAS from all of Western Oregon could adversely impact the safety of food and beverages produced in Benton County

53.215 (1) PFAS IN WATER -- PER EPA THERE ARE NO "SAFE" LEVELS OF PFAS

PFAS bioaccumulate in the human body, concentrating especially in breast milk. There is no way to remove PFAS from the human body; current research focuses on preventing exposure. Having PFAS bioaccumulate in Benton County residents is a significant adverse impact of the Applicant's proposal.

53.215 (1) PFAS IN WATER -- TOXICITY OF PFAS

"The carcinogenic effect, acute toxicity, and genotoxicity are just a few of the adverse effects of groundwater contaminated by leachate," "A review of the biological treatment of

leachate", Biochemical Engineering Journal, November 2022. Carcinogenic effects, acute toxicity, and genotoxicity are significant adverse impacts

53.215 (2) PUBLIC BURDEN -- PFAS TESTING

The Committee on the Guidance on PFAS Testing and Health Outcomes has recommended biomonitoring for communities that obtain their water from sources near landfills and PFAS testing to patients likely to have a history of elevated exposure, including communities living near landfills. Biomonitoring the community and testing domestic wells would be an undue burden for Benton County or Benton County residents so affected.

53.215 (2) PUBLIC BURDEN -- ELIMINATE PFAS FROM LEACHATE

There is no economical method to treat leachate to eliminate PFAS. Construction of such a system at the Corvallis Wastewater Treatment Plant would be extremely costly and an undue burden

53.215 (1) ADVERSE IMPACT TO FARMERS WHO APPLY BIOSOLIDS PFAS IN LIVESTOCK

In Maine, entire herds of dairy cows that had foraged on land upon which biosolids had been spread had to be culled when their milk was tested and found to contain dangerous levels of PFAS. PFAS concentrates in milk in both cattle and in humans, which is especially concerning with regard to human breast milk. If farmers have to cull dairy cows as happened in Maine, that would be a significant adverse impact.

53.215 (1) PUBLIC BURDEN FROM INCREASED LEACHATE

Currently, Corvallis Public Works treats approximately half of leachate generated. With the quarry expansion and this proposed new south landfill, leachate generated is expected to double current amounts. Already there is more leachate treated in Corvallis than the facility can accommodate, and if leachate generation doubles in the next 18 years, the increased volume of leachate hauled will impose an undue burden on public improvements. *"The increased volume of leachate hauled will increase tanker truck loads to Corvallis and burden the transportation corridor and create an undue burden on the CWTF [Corvallis Water Treatment Facility]. The treated leachate from CWTF is released into the Willamette River and poses water quality concerns. The applicant has presented no leachate plan to account for this increased volume and continued maintenance and disposal for the future."*[19]
(**FINDING** OF **LU 21-047** DENIAL, UNCHANGED IN CURRENT APPLICATION)

[19] FINDINGS LU 21-047, p. 4 Applicant claims that leachate will in the future be diverted from the CWTF, but has not identified alternate treatment facilities

-- VISUAL BLIGHT –

Applicant's slide presentation on Visual impacts begins on page 37 of Applicant's presentation dated May 29, 2025

APPLICANT: Applicant's consultants made a 3-d model and took a single screenshot from four points of view; the screenshots from those points of view do not show the new landfill.

BENTON COUNTY: "*Staff concurs with the applicant's findings in relation to adjacent properties. While some elements of the project may be visible, as of the writing of this staff report, staff has seen no evidence or reason to conclude that the visibility of some elements of the proposed landfill expansion from adjacent roadways will "seriously interfere" with uses on adjacent properties." (Staff Report, p. 37)*

COMMUNITY ADDRESSES FLAWS IN THE APPLICANT'S CONSULTANT'S STUDY – VISUAL BLIGHT: The new landfill will create visual blight which will significantly and adversely impact uses on the many non-landfill- zoned properties with the landfill in their viewsheds. This will constrain property owners as to how they can develop their properties, will impact salability of properties, and will render some parcels impossible to develop as zoning allows. It will significantly exacerbate existing incongruities with the pastoral and rural character of the area. The Community directs Benton County staff and Benton County consultants to the history of the establishment of the LS zone, prior conditional use permits for landfill operations, and to the 1965 Highway Beautification Act, which establish clearly that the standard for visual impact on surrounding roadways and properties was whether landfill operations "COULD BE SEEN" from roadways and adjacent properties. Per the 1965 Highway Beautification Act, a landfill is a "junkyard" and the Act requires that it be screened from Highway 99 (documentation of this requirement can be found in Benton County files from 1983); in terms of screening, the Applicant is currently operating the landfill illegally. The Applicant should not be rewarded for flouting conditions of development for the zone, its own Site Development Plan from 1983, prior conditional use permits, and federal law. The community forcefully rejects the conclusion offered by Benton County, for the following reasons:

REASON 1: VISUAL IMPACTS CANNOT BE CAPTURED IN FOUR STATIC SNAPSHOTS

The visual impact of the new landfill on the landscape cannot be adequately captured with four static screenshots.

REASON 2: VISUAL IMPACT -- SLEIGHT OF HAND BY THE APPLICANT IN RENDERING THE PROPOSAL & CHOICE OF THE FOUR STATIC SCREENSHOTS.

The proposed new landfill is rendered as a green object, minimizing the proposal's visibility (it will not be green). Trees are rendered as solid objects, minimizing the proposal's visibility. Points of view chosen likewise minimize the proposal's visibility.

Additionally, the existing landfill north of Coffin Butte Road is "cut away" at the base of the landfill slope north of Coffin Butte Road. In actuality, what will result from the proposal will be a malodorous, tarp-covered garbage valley, rising unrelieved to either side of Coffin Butte Road. All of these sleights-of-hand in the model result in minimizing the visual impact of the proposal on the existing landscape, counter to the reality that anyone can perceive, viewing the landfill mass currently, which is REQUIRED BY FEDERAL LAW to be screened.

REASON 3: VISUAL IMPACT -- HUMAN EYE

The human eye is drawn by motion and by noise. Heavy, noisy traffic onto and off the landfill will draw the eye and render landfill operations more obtrusive.

REASON 4: VISUAL IMPACT -- UNNATURAL AND FREAKISH SHAPE OF THE NEW LANDFILL

The shape of the new landfill is an unnatural geometric truncated pyramid which does not at all conform to the existing topography of the area. It will stand out overwhelmingly as an aberrant in the surrounding pastoral natural landscape of gentle valleys and rolling, forested hillsides.

REASON 5: VISUAL IMPACT -- NO TERRACING

The shape of the new landfill does not conform with the terracing required by the 1983 Conditions of Development. Whether or not those 1983 Conditions of Development are legally enforceable for the LS zoned landfill north of Coffin Butte Road, those standards were a 1983 Condition of Development and thus should be considered when permitting any new landfill in Benton County. Those standards required terracing and conformity of any new landfill with existing topography.

REASON 6: VISUAL IMPACT -- CAN BE SEEN

The new landfill can be seen from adjacent properties and county roads. It therefore does not conform to 1983 Conditions of Development. Whether or not those 1983 Conditions of Development are legally enforceable for the LS zoned landfill north of Coffin Butte Road, those standards should be considered when permitting any new landfill in Benton County. Those standards required that landfill operations NOT BE SEEN from roadways or adjacent property.

REASON 7: VISUAL IMPACT -- VIOLATION OF FEDERAL LAW

The requirement that landfill operations not be seen from roadways IS A REQUIREMENT OF THE 1965 HIGHWAY BEAUTIFICATION ACT. CURRENT VISIBLE LANDFILL OPERATIONS ARE IN VIOLATION OF FEDERAL LAW.

POTENTIAL CODE CITATIONS – VISUAL BLIGHT:

53.215 (1) VISUAL BLIGHT SERIOUSLY INTERFERE -- 45+ NORTH TAMPICO PROPERTIES WITH NEW LANDFILL IN VIEWSHED WILL BE SIGNIFICANTLY ADVERSELY IMPACTED

Properties on North Tampico (45+ parcels) will have the new landfill in the viewsheds of those parcels. This will have a significant impact on what property owners can do on their own property, constraining them from cutting down screening trees or making property improvements that would open up views of the new landfill (Whitcombe testimony).

53.215 (1) VISUAL BLIGHT SERIOUSLY INTERFERE -- 35+ SOUTH TAMPICO PROPERTIES MAY BE UNABLE TO SELL THEIR PROPERTIES

A home purchase on South Tampico fell through when a buyer learned of potential landfill expansion in 1994. Visual blight will adversely affect property salability. If properties near the landfill are made more difficult to sell, that is a significant adverse impact.

53.215 (1) VISUAL BLIGHT SERIOUSLY INTERFERE -- 15+ POTENTIAL SMALL-LOT PROPERTIES WILL NOT BE DEVELOPABLE AS ZONING ALLOWS

Views of the landfill from the undeveloped RR-10 parcels on Tampico Ridge not owned by the Applicant (15+ potential small-lot homesteads) will render them permanently undevelopable because of property value impacts and liquidity impacts of large, visible landfills on nearby properties (Whitcombe testimony).

53.215 (1) VISUAL BLIGHT SERIOUSLY INTERFERE – 12+ PROPERTIES VISUAL BLIGHT WILL RENDER DEVELOPMENT OF SOME PARCELS IMPOSSIBLE

Views of a 100' tall wall of garbage will render IMPOSSIBLE development of the 83.7-acre RR-10 parcel and four Soap Creek FC parcels (12 parcels) south and west.

53.215 (1) VISUAL BLIGHT CHARACTER OF THE AREA -- FREAKISH UNNATURAL SHAPE

The freakish geometric shape of the proposed new landfill -- a strange truncated pyramid, with unrelieved, steeply-sloping sides, terminating in an oddly-shaped artificial triangular plateau -- would stand out as an unnatural artifact in the existing forested pastoral milieu.

53.215 (1) VISUAL BLIGHT SCREENING

Screening the existing landfill is both a Condition of Development of the Site Development Plan and a requirement of Federal Law. The Applicant currently complies with neither, and there is no reason to suppose that this most recent commitment will have any different result. *"Proposed condition of approval…are not adequate to address screening of the site from public roads or adjacent property…since no mitigation is possible, we must deny the application for non-compliance to the criteria."*[20] (**FINDING** OF **LU 21-047 DENIAL** RELEVANT)

[20] FINDINGS LU 21-047, p. 5 The "mountain of garbage" will be seen from many points of view from which the Applicant has failed to take screenshots, including: Coffin Butte Road, Soap Creek Road, & EE Wilson, etc. etc.

-- FIRE DANGER –

Applicant's slide presentation on Visual impacts begins on page 39 of Applicant's presentation dated May 29, 2025

APPLICANT: "Our consultant, says 'there is no significant risk to the public or the environment from landfill fires.' "

BENTON COUNTY: *"The applicant provided a fire risk assessment (Exhibit E20); this was reviewed by 3rd party fire experts (Exhibit BC1). Both confirmed that the proposed Fire Mitigation Plan is sufficient to minimize fire risk for the proposed development. This criterion is met." (Staff Report, p. 60)*

COMMUNITY ADDRESSES FLAWS IN THE APPLICANT'S CONSULTANT'S STUDY – FIRE:
Community strenuously disagrees with the Applicant's fire consultant and with Benton County's concurrence. Every single statement in the "About Coffin Butte Landfill" on page 39 of the slide presentation Applicant made to Planning Commission on May 1 is factually incorrect, as follows:

#1: FACTUALLY INCORRECT STATEMENT BY CONSULTANT JAMES WALSH:
"The landfill accepts only MSW (Municipal Solid Waste)"
IN FACT, the facility also accepts "special waste," industrial waste, and C&D (Construction & Demolition) waste. C&D waste is known to be more likely to spontaneously combust.

#2. FACTUALLY INCORRECT STATEMENT BY CONSULTANT WALSH:
"The landfill does not accept hazardous waste."
IN FACT, there are no audits of waste, and no penalties for landfilling hazardous waste.

#3. FACTUALLY INCORRECT STATEMENT BY CONSULTANT WALSH:
"Robust waste approval checks are in place."
IN FACT, there is no oversight of any kind, and when alerted to the presence of hazardous waste in a load, the landfill operator permits disposal of hazardous waste (see Doug Pollock testimony). Any "robust" oversight of disposal would presumably preclude human corpses from being disposed of at the landfill (corpse of Kaylee Birdzell, 2022; remains of Kara Tayler, 2023)

#4. FACTUALLY INCORRECT STATEMENT BY CONSULTANT WALSH:
"Waste disposal is limited to a 1/2 acre working face."
IN FACT, the landfill working face shown on GIS is typically 1.5-2.5 acres (see testimony, Mason Leavitt). More working face = higher fire risk

#5. FACTUALLY INCORRECT STATEMENT BY CONSULTANT WALSH:
"Daily cover is applied at the close of each business day."

IN FACT, see testimony and photographs, Mark Yeager, and testimony, Roger Orton: daily cover is **not** consistently applied at the close of each business day. When applied, "alternate daily cover" is often poorly-applied tarps with large gaps that allow for combustion air infiltration.

#6. FACTUALLY INCORRECT STATEMENT BY CONSULTANT WALSH:
"There are three plausible fire scenarios (working face/grassed area/gas well fire."
IN FACT, there are many, many more plausible fire scenarios, including many that would endanger lives and property well beyond the area of the landfill itself:

- PLAUSIBLE SCENARIO 1: a dumped "hot load" (fire burning in the garbage truck, so to minimize truck damage the driver dumps the entire load by the side of the road...a recent "hot load" dump caused the deadly Sandalwood fire in California that destroyed 70+ structures and resulted in two fatalities);
- PLAUSIBLE SCENARIO 2: Lightning strike (see testimony, Virginia Scott);
- PLAUSIBLE SCENARIO 3: Burning embers from a fire burning elsewhere rain down upon the landfill, igniting it. Fire experts tell area residents that this is THE MOST LIKELY scenario for a fire emergency: that a wildfire elsewhere lofts airborne embers into the area, starting fires there;
- PLAUSIBLE SCENARIO 4: Exploding lithium batteries (see testimony, Virginia Scott, & OPB article, "*Exploding lithium batteries are causing fires in Oregon's landfills*");
- PLAUSIBLE SCENARIO 5: Electrical short ignites fire in garbage truck in the compressed natural gas fueling area (see "Corvallis Fire Instagram account");
- PLAUSIBLE SCENARIO 6: "Subsurface Reaction" (the term of art used by the Applicant's fire consultant, Mr. James Walsh to describe spontaneous combustion deep in the landfill mass). In his 2015 expert testimony on the Bridgeton, Missouri fire (we will use the term "fire" rather than "SSR"), the Applicant's fire expert, Mr. Walsh, stated: "**There is no known way to prevent the SSR from developing or to stop it.**" That SSR (or "fire") has now been burning in the Bridgeton landfill for 15 years. There are known risk factors, however, and one of them is having incinerator ash in the landfill; Coffin Butte has been accepting ash from the incinerator in Marion County for years. Another is accepting construction and demolition debris.

POTENTIAL CODE CITATIONS – FIRE:

53.215 (1) FIRE SERIOUSLY INTERFERE WITH USES ON ADJACENT PROPERTY

There has been testimony (Erin Bradley & Joel Geier) regarding the threat fire on the landfill posed in 2024 to nearby properties

53.215 (1) FIRE SERIOUSLY INTERFERE WITH CHARACTER OF THE AREA
A fire that destroyed structures and forests would result in a significant impact in the character of the area, as can be seen from before/after photographs taken in the aftermath of various Oregon fires in 2020

53.215 (2) FIRE UNDUE BURDEN ON PUBLIC IMPROVEMENTS
A fire that started at the landfill could damage public improvements, including power and water infrastructure.

53.215 (2) FIRE UNDUE BURDEN ON PUBLIC IMPROVEMENTS, EGRESS
If there is an artificial canyon made out of methane-generating garbage on either side of Coffin Butte Road, a fire that started elsewhere and spread to the landfill (via burning embers) could prevent Coffin Butte Road from being a safe egress route for Valley residents

53.215 (1) FIRE UNDUE BURDEN ADAIR FIRE: DANGEROUSLY STEEP SLOPES
The Applicant has told the EPA that the surface of the existing landfill is too steep, and dangerous for EPA personnel to walk over with hand-held air quality monitoring devices. But fire personnel will have to access these same surfaces. Steep and dangerous surfaces are a threat to the life and safety of firefighting personnel and an undue burden.

53.215 (1) FIRE UNDUE BURDEN ADAIR FIRE: ADDITIONAL 59 ACRES OF SURFACE ON WHICH FIRES MIGHT IGNITE
The increase in the landfill surface area is 145% of existing landfill footprint, without taking slopes into account (like the roof of a building, the surface area of the landfill is greater than its footprint). An increased surface area of 45% is a material amount and poses a threat to the life and safety of firefighting personnel and an undue burden.

53.215 (1) FIRE UNDUE BURDEN ADAIR FIRE: ADDITIONAL 10,000,000 CUYD OF METHANE-GENERATING WASTE IN PLACE
The proposal will increase waste in place by 140% over existing waste-in-place. More waste-in-place means more methane. Methane is currently being released as fugitive emissions from the landfill in explosive concentrations. An increased amount of 40% is a material amount of explosive methane and is a threat to the life and safety of firefighting personnel and an undue burden

53.215 (1) FIRE UNDUE BURDEN ADAIR FIRE: GEOMETRY OF THE PROPOSAL
The proposal will create an artificial canyon made of garbage on either side of Coffin Butte Road, each side of which will producing methane at explosive levels. The new topography will intensify fires moving uphill and increase wind speed if a fire ignites on either side of the artificial canyon. Fighting fires in an artificial canyon made of methane-producing garbage is a threat to the life and safety of firefighting personnel and an undue burden.

53.215 (1) FIRE UNDUE BURDEN CORVALLIS & BENTON COUNTY RFD's

Hot loads could be dumped by the side of any road in Benton County where there is garbage truck traffic to the landfill. Therefore, a fire like the deadly Sandalwood fire could ignite anywhere and could pose an undue burden to firefighting personnel.

53.215 (1) LANDFILL NOT CONSIDERED IN COMMUNITY WILDFIRE PROTECTION PLAN – UNDUE BURDEN ON BENTON COUNTY COMMUNITY DEVELOPMENT STAFF

Benton County staff did not incorporate the landfill in the CWPP. The reason given was inadequate experience and that it was "a task too large to undertake" by Benton County staff.[21]

53.215 (1) FIRE UNDUE BURDEN – PROPERTIES IN THE LANDFILL AREA

Hot loads are most likely to be dumped on roadsides in the landfill area. In fact, in the early 2000's a "hot load" was dumped north of the landfill. Therefore, a fire like the deadly Sandalwood fire could ignite in that area and pose an undue burden of fire risk to residents and their properties.

53.215 (1) FEMA DOCUMENT ON LANDFILL FIRES

The FEMA document "LANDFILL FIRES THEIR MAGNITUDE, CHARACTERISTICS, AND MITIGATION" states:

> *"Landfill fires are particularly challenging to the fire service. A large landfill fire normally requires numerous personnel and a significant period of time before it is contained. Both of these circumstances can strain a jurisdiction, particularly one dependent on volunteer staffing."*

So, per FEMA, a large landfill fire would particularly strain Adair RFD. This document continues, regarding Mr. Walsh's recommendation of water tanker mitigation:

> *"The use of water to suppress landfill fires is controversial. The application of large volumes of water may actually exacerbate a fire by contributing to the process of aerobic decomposition*."

It goes on in some detail about underground fires that can begin via spontaneous combustion. Applicant's consultant, Mr. James Walsh, failed to mention such fires as a 'plausible fire scenario' for Coffin Butte. However, regarding the Bridgeton landfill fire, Mr. Walsh opined that there was 'no known way' to prevent that type of landfill fire or to stop it. Per FEMA:

> *"Fires, particularly those underground, can undermine the integrity of the landfill, which could cause a collapse under the weight of landfill employees, firefighters, or equipment."*[22]

[21] Email, Inga Williams to Nancy Whitcombe, 3/18/2022 "I don't see how I can include this in CWPP as I have no experience in the topic and it would be a task too large to undertake for what is in the final draft stages. It may be that it could be included as a task to be worked on in future year updates."

[22] FEMA, all quotes from "LANDFILL FIRES [etc]" pages 1, 15, 16

-- WILDLIFE –

Applicant's slide presentation on wildlife begins on page 44 of Applicant's presentation dated May 29, 2025

APPLICANT: BLUE HERON "Our consultants say the rookery is abandoned (or it will be soon);" BALD EAGLE "Our consultants say that bald eagles do not nest in this area" OTHER WILDLIFE "Our consultants say that the habitat provided by the forest lands that will be deforested, blasted, excavated, and covered with garbage are important habitat"

BENTON COUNTY: Benton County has no comment

COMMUNITY ADDRESSES FLAWS IN THE APPLICANT'S CONSULTANT'S STUDY – WILDLIFE:
The Applicant's proposal relies on moving current landfill accessory uses that are accommodated on the 59-acre LS-zoned parcel onto parcels zoned FC. The reason that the LS zone was created in 1983 was to prevent FC parcels from being used for landfill operations. Forest Conservation is for conserving forests, not destroying them, which is what the Applicant proposes to do. The language of the FC zone is that its purpose is to "…conserve forest lands…and protect the…wildlife resources in the zone." With regard to the impact of blasting away the mountainside, filling it with garbage, and displacing current landfill operations equipment onto non-LS-zoned parcels, the proposal would have the following impacts:

BLUE HERONS 1: EXPANDED DISTURBANCE FROM EXPANDED OPERATIONS WOULD PUT THE HERON COLONY AT RISK Blue Herons have been observed continuing to use trees on the Forest Conservation parcel as perches, while nesting immediately across the highway from the proposed new leachate ponds. Herons have been known to recolonize temporarily abandoned nesting trees, and might do so here if the source of disturbance goes away. But if human activity, large-scale removal of forestlands, earth-moving, and location of leachate ponds and haul roads cause continued disruption, including on the Forest Conservation parcel closer to the currently active nests, collapse of the colony and permanent abandonment could result.

BLUE HERONS 2: EXPOSING BLUE HERONS TO DISEASE An active landfill adjacent to their continuing rookery will increase the number and diverse bird species that can result in the spread of various avian diseases. The bird flu virus can survive up to two years in a landfill, so carcasses of infected birds disposed of in landfills can disseminate avian flu, endangering the surviving population of Blue Herons.

BALD EAGLES 1: DESTRUCTION OF HABITAT The applicant's wildlife consultant has observed bald eagles foraging and soaring on the 59-acre parcel. An active landfill on this parcel will provide scavenging opportunities that can induce them to ingest harmful garbage.

BALD EAGLES 2: EXPOSING BALD EAGLES TO DISEASE An active landfill damages bald eagles by concentrating great numbers of invasive bird species such as starlings as well as providing infected bird carcasses (culled domestic birds) that can result in the spread of avian disease.

OTHER WILDLIFE: DEER, ELK, BOBCAT, COUGAR, RACOON, STRIPED SKUNK Community members agree with the applicant's consultants; the parcels are important habitat. Per the purpose of the zone, this habitat should be conserved, not destroyed.

POTENTIAL CODE CITATIONS – WILDLIFE:

53.215 (1) WILDLIFE HABITAT SERIOUSLY INTERFERE: BLUE HERON WILL NOT RECOLONIZE
This location is very advantageous to nesting Blue Herons, with close access both to wetlands to the east and farm fields to the west. Removing the west rookery conifers in the perhaps abandoned west rookery will prevent the Blue Herons that are currently nesting adjacent to the site from ever recolonizing them. Disturbance near the east rookery poplars will also prevent the herons from recolonizing those trees.

53.215 (1) WILDLIFE HABITAT SERIOUSLY INTERFERE: BLUE HERONS INCOMPATIBLE WITH LANDFILL ACTIVITIES
The Applicant since LU 21-047, has demonstrated that landfill operations are not compatible with Blue Heron habitat by causing rookery abandonment. Moving landfill operations even closer to the Blue Heron's new habitat is likely to drive them away from that as well.

53.215 (1) WILDLIFE HABITAT USES ON ADJACENT PROPERTY: DISEASE
Placing municipal solid waste on the 59-acre parcel will expose BLUE HERONS, BALD EAGLES and RED-TAILED HAWKS to avian disease, both via the ingestion of infected bird carcasses and through mingling with large numbers of diverse bird species that congregate at a landfill

53.215 (2) THE LANDFILL IS "SPOT ZONING" IN A FORESTED AREA OVERWHELMINGLY DEDICATED TO THE PROTECTION OF WILDLIFE. REPLACING THE FOREST WITH A PILE OF GARBAGE WOULD SERIOUSLY INTERFERE WITH THE OVERALL CHARACTER OF THE AREA
The current landfill area is less than 180 acres. Directly across Highway 99 is an 1800-acre wildlife preserve. The character of the area south of Coffin Butte Road – forested gentle slopes that **Applicant acknowledges is an important wildlife habitat** -- has more in common with the larger wildlife preserve to the east than the relatively small landfill to the north. *"Purpose of Conservation Zone The applicant has not met the burden of proof that the proposal will not interfere with the purpose of the Forest Conservation zone for protection of the wildlife resources."*[23] *(**FINDING** OF **LU 21-047 DENIAL**, UNCHANGED)*

[23] FINDINGS LU 21-047, p. 3 Applicant's consultant has actually acknowledged that the parcel is important habitat

Benton County
COMMUNITY DEVELOPMENT DEPARTMENT

Planning Division

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PLANNING COMMISSION FINDINGS

NATURE OF REQUEST:	**Conditional Use Permit to expand Coffin Butte Landfill**. Republic Services is proposing: to create a new disposal cell for the Coffin Butte Landfill which will extend from the current cell south of Coffin Butte Road; close Coffin Butte Road to public traffic (vacate the right-of-way) so the new cell can cover the road; relocate a replacement roadway (for landfill and quarry traffic only) around the area of the new disposal cell; relocate the leachate ponds south of Coffin Butte Road, and move some other structures.
APPLICABLE CODE CRITERIA:	Benton County Code (BCC) Section 51.505, Sections 51.705 through 51.840, Sections 53.205 through 53.235, Section 60.215, Section 60.220, Chapter 77, Chapter 99. The Benton County Code can be found at this link: **https://www.co.benton.or.us/planning/page/development-code**
PROJECT LOCATION:	• 29000 Coffin Butte Road; Township 10 S, Range 4 W, Section 18, Tax Lot 1107 • 29160 Coffin Butte Road; Township 10 S, Range 4 W, Section 18, Tax Lot 1200 • 28972 Coffin Butte Road; Township 10 S, Range 4 W, Section 18, Tax Lot 1101 • Township 10 S, Range 4 W, Section 18, Tax Lot 1104 • Township 10 S, Range 4 W, Section 18, Tax Lot 1108 • 29175 Coffin Butte Road; Township 10 S, Range 4 W, Section 18, Tax Lot 801
APPLICANT:	**Republic Services**
PROPERTY OWNER:	**Valley Landfills Inc.**
ZONE DESIGNATION:	Landfill Site (LS), and Forest Conservation (FC)
COMPREHENSIVE PLAN DESIGNATION:	Landfill Site, Forestry
CAC PLANNING AREA:	North Benton (not active)
STAFF CONTACT:	Inga Williams, inga.williams@co.benton.or.us
FILE NUMBER:	LU-21-047

This matter came before the Planning Commission in public hearings held November 2 and November 16, 2021. At the November 16 meeting:

- the applicant was provided the opportunity to submit additional written evidence up to 5 PM on November 19th;
- per statute, the record was held open so that the public could to submit further written testimony until 5 PM on the 29th; and
- per statute, the applicant was allowed one additional week, until 5 PM on December 6, to submit final written argument.

On December 7, 2021, the Planning Commission returned to deliberate on the application. At the meeting on the 7th, the Planning Commission considered the record as a whole, then deliberated and reached a decision. The decision of the Planning Commission is to **DENY** the Applicant's request for a Conditional Use authorization to expand Coffin Butte Landfill based upon the following findings of fact.

FINDINGS

General Conditional Use Criteria - Chapter 53

53.215 Criteria. The decision to approve a conditional use permit shall be based on findings that:

(1) The proposed use does not seriously interfere with uses on adjacent property, with the character of the area, or with the purpose of the zone;

Uses on adjacent property:

Many residents of the area testified that the odor and noise has continually gotten worse over the years. Some testified that they have to seek shelter inside to avoid the noise and smell. They warn that the levels expected in the future will affect their rural residential uses. Some farmers have testified that getting workers to work in the stench has been an issue.

Odor: Methane emission rules do not capture the impacts to the character and use of the area because many people testified that the smell inhibits them from going outside and enjoying the use of their property. Property owners within miles of the site stated they could smell the landfill. The current mitigation of an earthen cap over cells does not mitigate smell and smell reflects emissions of other gases such as Volatile Organic Compounds (VOCs) and hydrogen sulfide. The same mitigation is proposed for the expansion and if it currently does not mitigate the odor then it cannot be used as a mitigation for the future and be expected to minimize the concern.

Bad air quality: People living in areas with poor air quality does pose serious interference with livability. Risk of health concerns is likely with the landfill expansion; enough so nearby residents speak out about it. Some residents point to increasing cancer clusters in their neighborhood and suggest that poor air quality may be responsible. One nearby resident pointed to studies in Europe that tied poor air quality in the proximity of landfills to bad health issues. The applicant noted they cannot control all of the releases of VOCs or hydrogen sulfide and these gases are understood to be potent carcinogens. The applicant did not address the long-term effects of those gases in varying concentrations in different weather situations but the Planning Commission certainly heard from people that they can smell these.

Noise: The noise study contracted by the applicant has been criticized as faulty and inadequate. Proposed mitigations do not seem feasible and such conditions couched as "whenever feasible" or "if permitted by safety conditions" are not stringent enough. Further concern of noise from banging truck gates, loud noises from unloading, was not addressed. Point noises are often the most debilitating and background noise is easier to live with. The proposed Condition of Approval PA-7 (A) is inadequate to address this concern. To base approval on the applicant's assurance that future studies will ensure compliance would be inappropriate.

Much of the applicant's response to these issues is to rely on subsequent review and approval by Oregon Dept. of Environmental Quality (DEQ); however, there is no ability for the Planning Commission to review the situation after DEQ's approval to ensure that DEQ's standards were adequate to prevent the proposed use from seriously interfering with uses on adjacent property.

Conclusion: The proposed use <u>does seriously interfere</u> with uses on adjacent property.

The character of the area:

<u>Increase in landfill area</u>

Residents of the area point to the change in the character of the area. The minimal footprint of the landfill in previous years has and will be changed to a dominant footprint. The proposed expansion

will increase that interference in a number of ways. A whole valley will be filled with garbage. Modification of the fundamental topography at this scale, turning a valley into a ridgeline and burying the valley under 100 feet of garbage seriously interferes with the character of the area. This level of impact could not have been reasonably anticipated by any existing resident or past prospective purchaser. No condition could mitigate this level of change to the character of the area; therefore, the application fails to meet this criterion.

Open space and views of the cascades will disappear. The agricultural production from fields have gone away. The livability of the area because of noise, odors, and the visibility of the garbage pile will continue to degrade. One resident testified that their view of the dump has steadily increased to the point that it is now noticed and commented on by her children, and it is expected to increase more if the expansion is allowed.

Closure of Coffin Butte Road

The closure of Coffin Butte Road seriously affects those that use this road and the proposed Conditions of Approval do not lower the impact below the level of serious. The proposed mitigations for a closure may not be feasible or, if implemented, may seriously interfere with uses on adjacent property or seriously interfere with the character of the area. Improvement to Tampico Road would drastically alter the character of the area. Traffic will increase on Tampico Rd, and no amount of leveling and grading will be sufficient to make Tampico Road a better egress route without substantially altering the character of the area. These improvements will also increase certain dangers on Tampico Road by enabling traffic to travel it faster and increase risks to non-motorized users.

Staff and the applicant conclude that the Tampico Rd corridor would be heavily impacted by the increased passenger traffic and changes to the nature of every day traffic to include freight, agriculture, and forestry heavy equipment. Increasing truck traffic on Tampico will negatively affect the area. It may be widened, but sight issues will remain. This will increase risks to non-motorized users of the road from increased traffic. No amount of widening will change the underlying topography and hazards inherent in it; yet widening would further damage the local community character with no guarantee of success.

Conclusion: The proposed use does seriously interfere with the character of the area.

The purpose of the zone:

Purpose of Conservation Zone

The applicant has not met the burden of proof that the proposal will not interfere with the purpose of the Forest Conservation zone for protection of the wildlife resources. The Conditions of Approval requiring further study of Great Blue Heron (GBH) rookeries do not provide us with timely information to determine if the criteria is met nor if mitigation is possible. Further, testimony regarding threatened Streaked Horn Lark populations, Oregon Vesper Sparrow populations, and wildlife movements in the area of the landfill expansion point to the need for more wildlife investigations before action is taken in this area.

Proposed Condition of Approval PA-4 only addresses GBH concerns. Either that condition should be expanded to include other wildlife or additional conditions should be added. There is also concern that the applicant has limited ability to hire qualified consultants. The inventory of GBH nesting activity by their hired consultant has been challenged by residents with compelling photographic evidence.

Buffering and Zoning

The proposed landfill expansion relies heavily on the buffering of noise, odor, sight, and other nuisances by adjacent property owned by the applicant. Some of this buffering is provided by properly zoned land. However, some of the adjacent land is zoned Rural Residential (tax lots 10419001600 and 104180001200). Rural Residential zoning has no provisions for landfill buffering or for the extension of the landfill's grading footprint. The buffering of the landfill site and proposed grading plan for the new haul road under this CUP shows the new haul road positioned on the lot boundary of tax lot 104180001107 (zoned LS) and tax lot 10419001600 (zoned RR-10) and the land graded in the RR-10 zone. If the landfill requires a buffer to operate and extend grading, that buffer becomes part of the landfill use. As such, it should require appropriate zoning; a zone change or Conditional Use Permit if necessary. If the landfill cannot operate without establishing an illegal use on residentially-zoned lands, then reconsideration of this expansion location is necessary.

Conclusion: The proposed use does seriously interfere with the purpose of the zone.

(2) The proposed use does not impose an undue burden on any public improvements, facilities, utilities, or services available to the area;

Closure of Coffin Butte Road

This is an undue burden because Coffin Butte Road is used as a bicycle and walking route, log truck and freight haul road, an emergency egress by the neighborhoods to the south and west, and is used by Adair Rural Fire Protection District for public safety and fire access. The closure of Coffin Butte Road seriously affects facilities and services.

Closure of Coffin Butte Road results in the loss of the most direct, safe evacuation route in case of inclement weather or wildfire; it eliminates the best (paved, flat, one curve) and shortest egress from the Soap Creek Valley. Closure of Coffin Butte Road results in the permanent loss of one of only three routes out of the Valley. In addition, the Coffin Butte Road closure results in the loss of the only locally available, direct east/west crossing of Hwy 99W, creating additional traffic conflicts on Hwy 99W at Camp Adair Road, Tampico Road, and Robison Road.

Based on community testimony, during the February 2021 ice storm Coffin Butte road was the only egress for several days. There is testimony dated November 23, 2021, from Chief Aaron Harris to Joe Bessmen and email from County Emergency Manager Bryan Lee dated Nov. 23, 2021, to Julie Jackson, and later that day forwarded to County staff, indicating that they both felt that the loss of Coffin Butte Road would be an impact on public safety.

The Adair Rural Fire Protection District Board advises, "this route should not be closed" and "closure of Coffin Butte Road would be detrimental to public safety". Proposed Conditions of Approval to mitigate this road's loss through improvement to the northern route will not be "superior to Coffin Butte Road with regards to evacuation routes and public safety".

Closing Coffin Butte Road for this conditional use would remove an important route, replacing it with a lesser, compromised route or routes.

Leachate

Leachate from the proposed expansion is planned to be hauled off-site and disposed at the Corvallis Wastewater Treatment Facility (CWTF). The increased volume of leachate hauled will increase tanker truck loads to Corvallis and burden the transportation corridor and create an undue burden on the CWTF. The treated leachate from CWTF is released into the Willamette River and poses water quality concerns. The applicant has presented no leachate plan to account for this increased volume and continued maintenance and disposal for the future.

Conclusion: The proposed use does impose an undue burden on public improvements, facilities, or services available to the area:

Conditional Use Criteria for the Forest Conservation Zone - Chapter 60

60.220 Conditional Use Criteria. (1) A use allowed under BCC 60.205 or 60.215 may be approved only upon findings that the use: (a) Will not force a significant change in, or significantly increase the cost of, accepted farming or forest practices on agriculture or forest lands; (b) Will not significantly increase fire hazard or significantly increase fire suppression costs or significantly increase risks to fire suppression personnel; and (c) Complies with criteria set forth in BCC 53.215 and 53.220.

There will be increased transportation costs to local farm and forestry operations from the closure of Coffin Butte Road. One commercial forester commented that their harvesting operations use Coffin Butte Road as a major haul route and that closure of the road would affect their forestry operation. "Closing Coffin Butte Road and replacing it with an alternative will add time and cost." Another commercial forester commented that closing Coffin Butte Road would create problems for them in increased costs and safety issues.

Adair Rural Fire and Rescue uses Coffin Butte Road for public safety and fire access. Alternative routes take more time for fire response and are narrower. "The closure of Coffin Butte Road will negatively impact the response time from the Substation to the northern/northeastern areas of our fire district and North Albany automatic aid response areas." It will also create an increase in fire suppression costs and increase risk to fire suppression personnel because of the increase in transportation time to reach a fire.

Conclusion: The proposed use will force a significant change in, or significantly increase the cost of, accepted farming or forest practices on agriculture or forest lands, and will significantly increase fire hazard or significantly increase fire suppression costs or significantly increase risks to fire suppression personnel.

Conditional Use Criteria for the Landfill Site Zone - Chapter 77

77.310 Conditional Use Review. (1) The applicant for a conditional use permit shall provide a narrative which describes:

*****

(c) Provisions for screening of the site from public roads and adjacent property;

The staff discussion in the staff memorandum of November 29, 2021, concluded that screening is appropriate for this application. Pages 2-5 propose screening mitigation activities (tree planting), but even those would not be sufficient. Proposed condition of approval OA-6 and OA-7 for screening are not adequate to address screening of the site from public roads or adjacent property. It will be impossible to adequately screen the view of this mountain of garbage. Since no mitigation is possible, we must deny the application for non-compliance to the criteria.

Conclusion: Provisions for screening of the site from public roads and adjacent property is inadequate.

PLANNING OFFICIAL: _____ Date of Decision: December 7, 2021

Benton County Exhibit 8 (BC8)

BC8.4	M. Leavitt representing Beyond Toxics

From: Mason Leavitt
To: Benton Public Comment
Subject: Public Comment Opposing LU-24-027
Date: Tuesday, May 6, 2025 2:59:02 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Please find the attached testimony and supporting documents for the record.

--



Mason Leavitt
GIS Analyst and Programs Coordinator
Beyond Toxics
mleavitt@beyondtoxics.org
(541) 645-5972

BEYOND TOXICS

DATE RECEIVED: 05-06-25
FROM: Mason Leavitt
PHONE OR EMAIL: M

MLeavitt@BeyondToxics.org

LU-24-027
Mason Leavitt GIS Analyst
120 Shelton McMurphy Blvd
Suite 280, Eugene OR, 97401

Becky Merja, speaker 67 and Todd Rowland, Speaker 69 have ceded their time to me. I am speaking for 9 minutes today.

My name is Mason Leavitt, and I am testifying on behalf of Beyond Toxics, a decades old Oregon Based environmental organization that fights for all Oregonians to have access to clean, safe air, water, and land. Our organization has worked with Soap Creek Valley and Adair Village Residents for three years to find solutions to many of the challenges posed by this facility, and I have been there through that journey.

My background is based in Geographic Information Systems or GIS, and I have been trained to map and analyze spatial data.

Today I want to draw attention to the odor study, which the county has determined as grounds for denial. This is due to the fact the applicant used an outdated software version and did not adequately take elevational differences into account. I wish to elaborate on why this odor study is neither **comprehensive nor objective**. But, first, I want to add some related details to the record.

One, the applicant highlighted the newly installed enclosed flare as an important piece of infrastructure to manage landfill gas. I want to note for the record that DEQ announced the requirement of enclosing all landfill gas flares in 2022. The applicant received multiple notices and extensions to comply with this requirement, and failed to do so resulting in an enforcement notice from DEQ. It's installed now, but this process is illustrative of how laborious it is to get the applicant to respond to required operating conditions.

Two, the applicant has waited until last week's hearing to announce their intentions to install fenceline monitoring for odorous pollutants. Beyond Toxics and residents have been pressing for this for years now, and that technology has been available the entire time. I want to note that the applicant's odor study chase not to incorporate any real time air monitoring despite the availability of that technology

Third, I want to problematize the applicants claim they found 99% of odor complaints to be "impossible" despite acknowledging they were working with an incomplete data set that does not have the time or location of odor detection. It's worth elaborating on this. How can we know someone didn't smell the landfill because the wind was blowing the opposite direction of their location, if we do now know their location or the wind direction at the time of their complaint? Additionally, when we find a model invalidates 99% of human experiences, we typically conclude the model is wrong. I teach GIS part time at the UO, and I would fail any student who would make a similar claim to the applicant without additional explanation.

Next, I want to turn to some additional assumptions of the applicant's odor study that need more explanation. The applicant has chosen to go with an atmospheric modeling system

using weather data from Coffin Butte, Salem Airport, and Corvallis airport. Using this data, they have made an educated guess on how air has moved around in the nearby area of the landfill.

As the famous saying goes: "All models are wrong, but some are useful." Models have fundamental limitations and they cannot and do not reflect all the complexities of the real world. Modeling is a great tool but it is not the entire picture and there are many other tools in the toolbox the applicant has chosen not to deploy including the air monitoring I mentioned above.

Models are a series of mathematical equations- if you change the numerical inputs or the parameters, you get different results. Choosing those inputs is not an objective decision- it is subjective to the applicants preferences.

One of the most important assumptions made by the applicant is that the facility has a 25% fugitive emissions rate - mind you, I want to note that they used to claim it was 10%- the best in Oregon before quietly revising those numbers last year. Recall, fugitive emissions are landfill gas emissions that are not captured by gas extraction wells and other gas controls. I want to complicate that 25% assumption made by the applicant. Planning Commissioners brought up two important questions last session I would like to answer:

1. What about all the photos of holes in Coffin Butte's covers and tarps meticulously documented by residents? Recall, the applicant stated they do regular surface emissions monitoring to repair these holes. This prompted the second question.

2. Do we have results of the surface emissions monitoring done by the applicant?

First, let's look at the EPA: Coffin Butte has been inspected twice by the US EPA inspections which uncovered over 100 violations, some of them 200 times the regulatory limit. The first time EPA inspected the landfill in 2022, Coffin Butte had done their own SEM monitoring 10 days prior where they found 6 leaks between 500ppm and 1,500 Ppm. The EPA found 71 leaks between 500 ppm and over 70,000 ppm and they only monitored a small portion of the landfill. They also found that the applicant had been not complying with several standard testing procedures required by Oregon Law. A similar story occurred in 2024 with 41 leaks between 500 and 118,000 ppm. the applicant is currently under investigation for failing to meet Clean Air Act standards.

Second, I have analyzed surface emissions monitoring reports submitted to DEQ by all Oregon Landfills legally required to do so. I found records that show that Coffin Butte is choosing not to monitor 56% percent of their landfill surface area in SEM using a legal loophole (**Exhibit A**). This is above average for privately operated landfills in Oregon which omit 50% on average. Publicly operated landfills omit about 10%. Coffin Butte claims that some of their slopes are too steep or too covered in vegetation meaning they can't monitor them. These are slopes operators designed and vegetation they chose not to maintain, and the legality of these exemptions are ambiguous at best or illegal at worst.

Additionally, Third party satellite flyovers have found massive plumes of landfill gas that can be observed from space. They have flown over Coffin Butte 6 times over the last two years, and found leaks 100% of the time.

The working face, where garbage is currently being deposited, is a site of significant fugitive emissions. Coffin Butte claims they limit their working face to a half acre at any time. I have submitted nearly a dozen random satellite images showing otherwise (**Exhibit B**). They also claim they cover it with daily cover at the end of each working day. Photographs show otherwise.

Additionally, I have used air monitoring equipment to document hydrogen sulfide levels at residential households. This is the classic rotten-eggy smell we have all smelled in our garbage. Through monitoring, we have found Hydrogen sulfide levels between 250 and 500 ppb. This is well over the human detection threshold of 30 ppb (**Exhibit C**)

I also worked with Linfield University students to conduct a door to door survey of all 500 homes in Adair Village. Of 126 households that spoke to us, we found 60% of residents reported regularly smelling the landfill, and many were specific that the smell is distinct from the compost facility. 20% of residents reported having modified their daily activities to avoid going outside due to the smell being unbearable or concerns over exposure to toxics.

Remember, all models are wrong, but some are useful. The applicant's model is serving a purpose to cast doubt on hundreds of people's lived experiences. The applicant has offered no explanation for the discrepancy between their odor study results and the experience of residents. They have offered no explanation of why their gas collection system is failing and how they plan to fix it. I urge the planning committee to believe the residents' experiences, and to acknowledge the applicants reliable record of bad behaviour.

Exhibit A

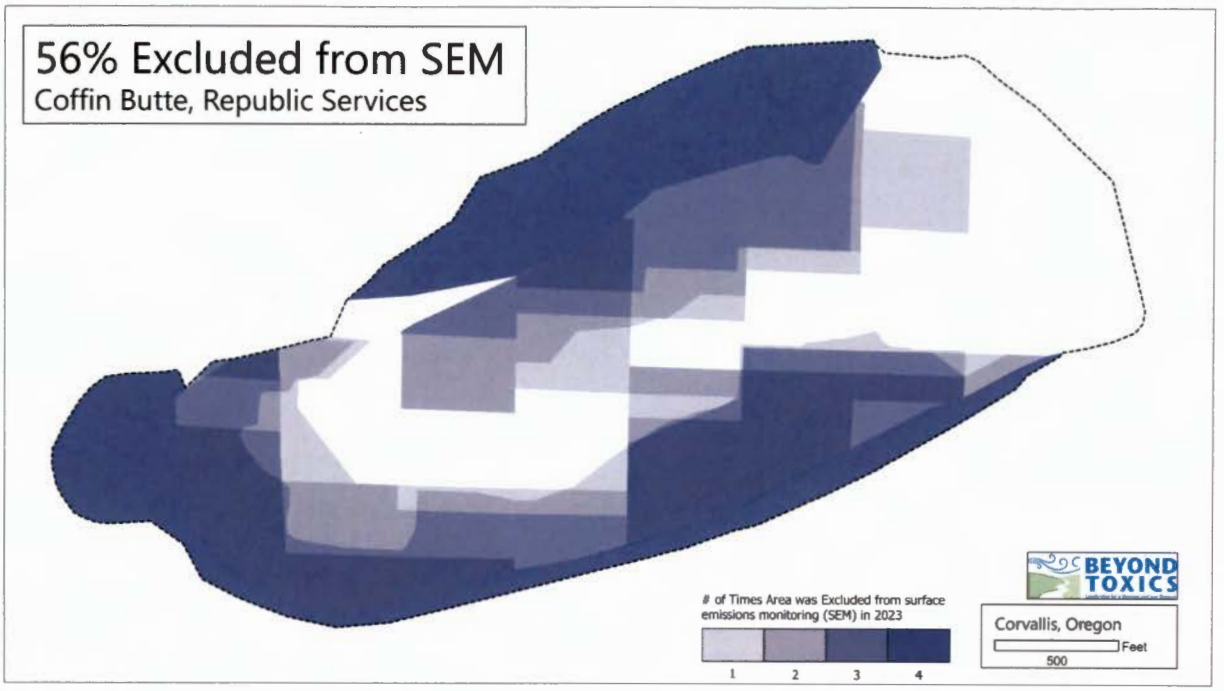


Exhibit B




June 22, 2022
1.23 acre exposed
Google Earth
700 ft
N


July 14, 2022
2.1 acre exposed
Google Earth
700 ft
N

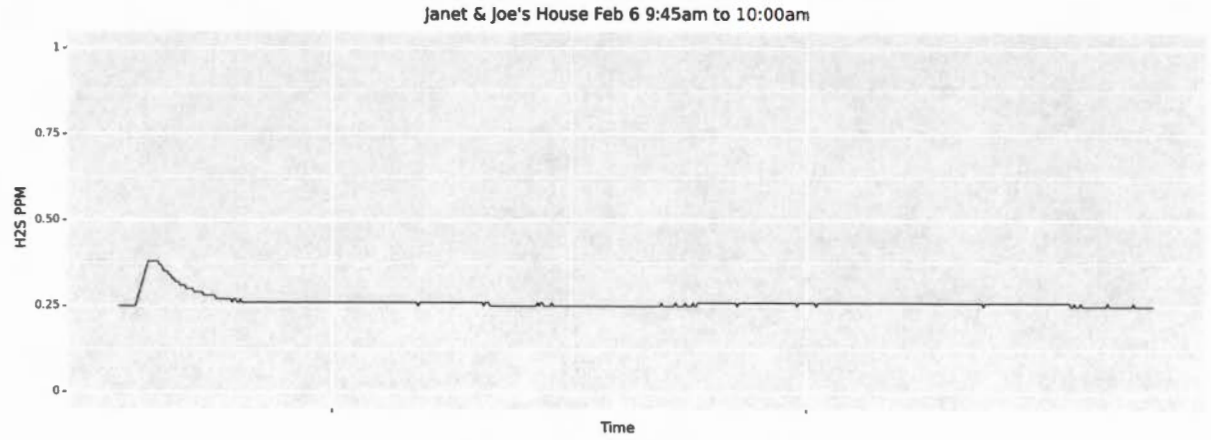

April 29, 2023
1.00 acre exposed
Google Earth
700 ft
N

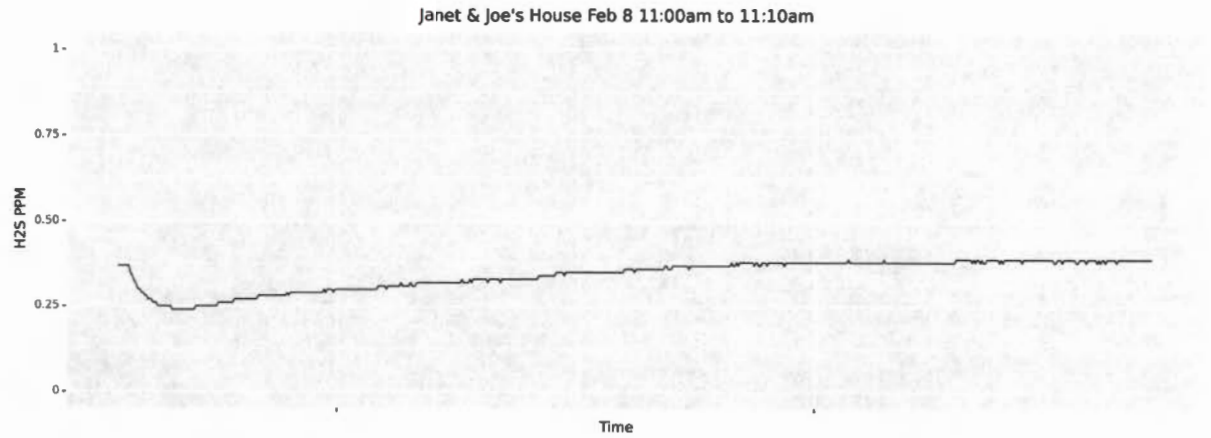

April 19, 2024
2.59 acres exposed
Google Earth
700 ft
N

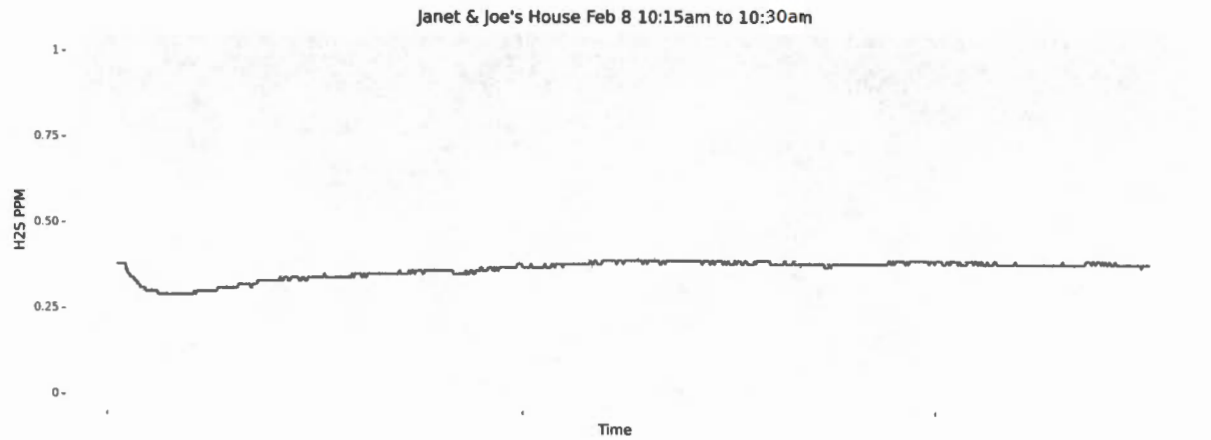

July 2, 2024
1.04 acres exposed
Google Earth
700 ft
N

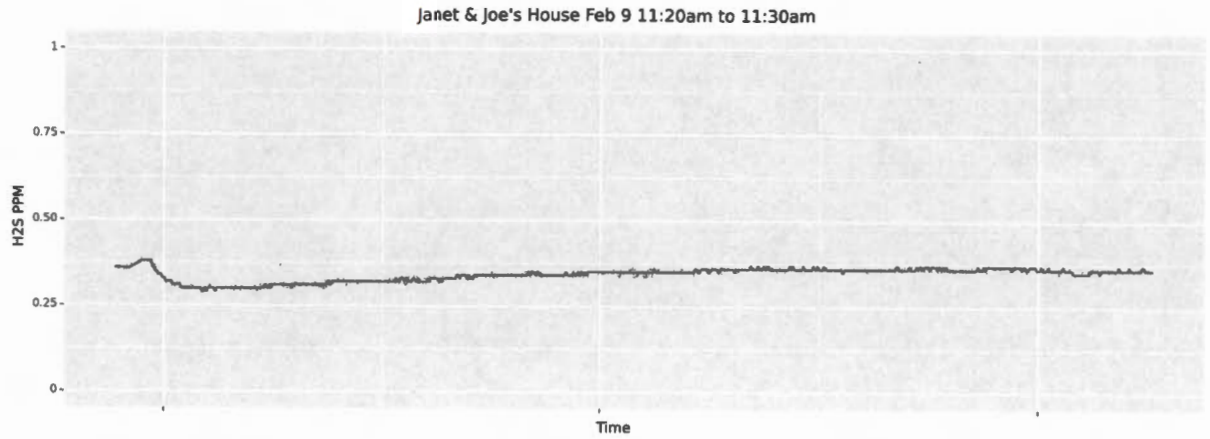

March 26, 2025
2.26 acres exposed
Google Earth
700 ft
N

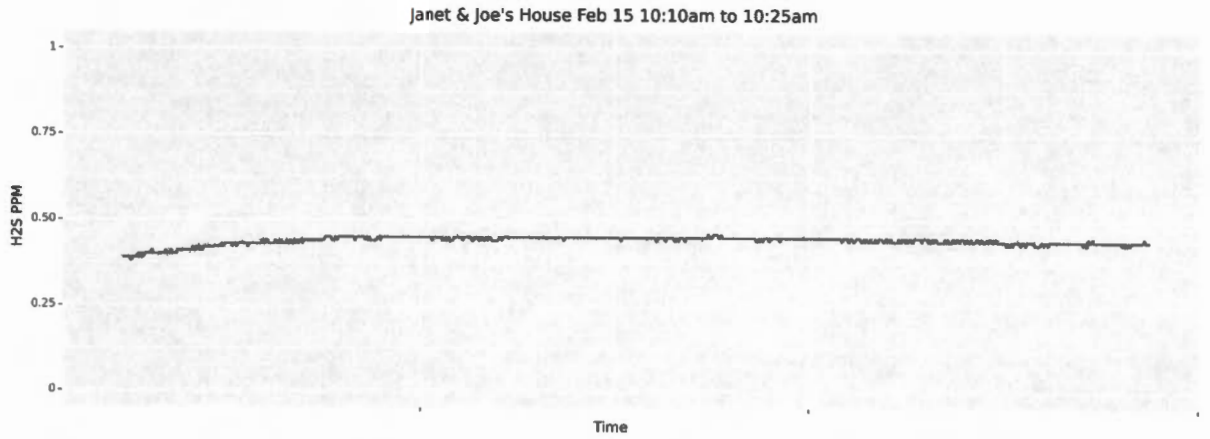
Exhibit C (Note graphics are in PPM. Convert to PPB= PPM x 1,000)

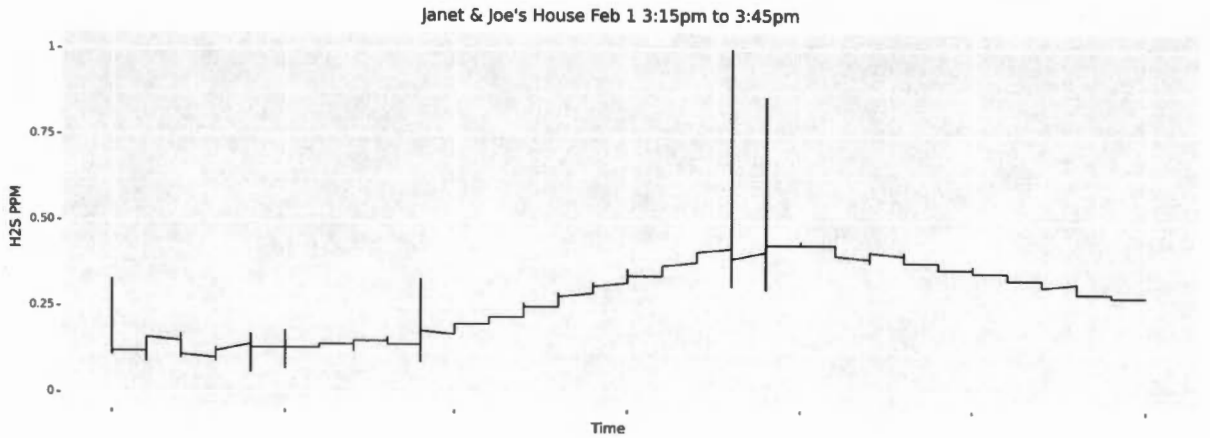







Janet & Joe's House Feb 9 11:20am to 11:30am
H2S PPM
1
0.75
0.50
0.25
0
Time


Janet & Joe's House Feb 15 10:10am to 10:25am
H2S PPM
1
0.75
0.50
0.25
0
Time


Janet & Joe's House Feb 1 3:15pm to 3:45pm
H2S PPM
1
0.75
0.50
0.25
0
Time

BEYOND TOXICS



OREGON'S SECRET CLIMATE KILLERS

PULLING BACK THE CURTAIN ON HIDDEN LANDFILL METHANE EMISSIONS

March 2025

MASON LEAVITT
LISA ARKIN

BRIEF PURPOSE STATEMENT

In 2022, the Oregon Department of Environmental Quality implemented new rules which regulate landfill gas emissions. The rules require Oregon landfills with greater than 200,000 tons of waste-in-place to obtain an Air Contaminant Discharge Permit to submit data on the landfill characteristics and potentially monitor, collect and/or control landfill gas emissions. The DEQ's purpose was to reduce methane emissions to meet former Governor Kate Brown's directive provided in Executive Order No. 20-04 to give state agencies the authority to establish science-based greenhouse gas emissions reduction goals. Typically, landfill gas is made up of around 50% methane. Methane is a very strong greenhouse gas, more than 80 times as potent as carbon dioxide in the short-term.

In 2024, Beyond Toxics conducted an analysis of landfill operator compliance with Oregon's new landfill methane regulations which went into effect in October 2022. We examined 32 Surface Emissions Monitoring (SEM) reports submitted by eight Municipal Solid Waste (MSW) landfills out of a total of 11 MSW landfills that are required to follow the new rules. Our report is limited to eight landfills because three of the 11 large landfills received exemptions from the Department of Environmental Quality or did not comply with the new rules. Our investigation resulted in the following findings.

KEY FINDINGS

Three out of 11 of Oregon's large, currently operating landfills did not follow the state's surface emissions monitoring rules in 2023, one year after the rules went into effect in 2022. As a result, three of Oregon's largest landfills are completely unmonitored for potent methane emissions. This is important because 90% of the methane emissions produced by industries in Oregon come from its largest landfills.[1]

[1] Industrious Labs (2025). Don't Waste Our Future. Based on U.S. EPA Greenhouse Gas Reporting Program (GHGRP) 2022, U.S. EPA Landfill Methane Outreach Program (LMOP) (July 2023), and U.S. EPA GHG Equivalency calculator.

Our examination of maps submitted by the remaining eight largest MSW landfills reporting to regulators found that privately owned landfills (five out of eight)– all owned by large corporations– on average, excluded 48.6% of the landfill surface area from monitoring for methane emissions. While minor portions of these exemptions are legally justified, for example the open area of the landfill's working face where trash is being dumped, most of these exemptions are ambiguous. The high rate of exemptions calls into question how compliant landfill owner-operators are with Oregon's laws. Notably, it coincides with the U.S. EPA's recent nationwide enforcement alert noting "widespread" noncompliance with surface emissions monitoring rules including exempting substantial portions of landfills from SEM without sufficient justification.[2]

Compared to privately owned landfills, publicly owned landfills managed by local governments excluded, on average, just 10% of the surface area. The difference demonstrates significant disparities in methane emission data between privately owned landfills that are managed for profit, and publicly owned landfill operations that are managed for the benefit of local taxpayers and businesses.

There are key gaps regarding what surface emissions monitoring data is required to be reported to state regulators, which leaves the Oregon Department of Environmental Quality unable to review results. Most Oregon landfills required to conduct monitoring are not reporting their surface emissions monitoring locations using verifiable GPS tracking, making it impossible to verify that owner-operators are monitoring every 25 feet as required by law. As a result, there could be significant gaps in methane detection. There is also no way for state regulators to verify integrated monitoring results because landfills are not required to report basic information such as their 50,000 square foot grids and the average surface emission reading in each of those grids.[3]

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[2] Environmental Protection Agency. (2024, September 25). Enforcement Alert: EPA Finds MSW Landfills are Violating Monitoring and Maintenance Requirements. EPA Investigations Find Municipal Solid Waste Landfill Operators Are Failing to Properly Conduct Compliant Monitoring and Maintenance of Gas Collection and Control System. https://www.epa.gov/enforcement/enforcement-alert-epa-finds-msw-landfills-are-violating-monitoring-and-maintenance

[3] Integrated monitoring results are derived from the averaging of all surface emissions monitoring measurements in a given 50,000 square foot grid.

RECOMMENDATIONS

The state of Oregon Department of Environmental Quality (DEQ) should immediately move to integrate the mandatory use of remote sensing technologies into Surface Emission Monitoring (SEM) rules to detect and pinpoint methane leaks at landfills.[4] One available technology is deploying methane detection equipment mounted on drones. The State can also require third party satellite methane detection systems, which provide comprehensive and more accurate measurements of the concentration of methane plumes, the direction of methane plumes moving off the landfill property, and the exact location of emission exceedances from landfills. DEQ can also require fixed monitors for real-time methane tracking. Gathering this comprehensive data set will lead to rapid mitigation of super-emitter leaks, improved methane capture for use in local energy generation or methane destruction through enclosed flaring.

DEQ should update their regulations to require SEM on all areas of landfills including steep slopes, closed cells, locations with covering vegetation and unspecified exemptions. Combining actionable emissions data from these areas along with mitigation strategies such as horizontal gas collection is critical for reducing greenhouse gas impacts and associated air toxics such as volatile organic compounds (VOCs), hydrogen sulfide, forever chemicals and fine particulate matter thereby improving air quality for local communities and climate mitigation to follow state climate action mandates.

Close reporting loopholes to ensure landfill owner-operators are adequately monitoring for methane. DEQ should immediately update its regulations to require that any owner or operator who conducts surface emissions monitoring must:

1. Report the areas exempted from monitoring and report the reasons for requesting those exemptions. This would address the current issue of exemptions being granted on a de facto basis.

[4] Throughout this report we emphasize Oregon because these are the arenas at which Beyond Toxics focuses its advocacy. Our findings could be replicable in other states or at the federal level.

2. Report measured concentration of methane in ppm for each SEM reading.

3. Report the SEM path walked by owner-operators.

4. All the above data should be in a spatial data format such as a shapefile, which makes for more efficient analysis of data gathered through surface emissions monitoring.

To prevent future potent methane emissions, governments at all scales can introduce mandatory organics diversion policies requiring consumers and haulers to separate and sort organic waste so that food and yard waste can be sent to facilities other than landfills to make compost and other products thereby preventing future generation of methane in landfills.

EXECUTIVE SUMMARY

Beyond Toxics conducted an analysis of 32 Surface Emissions Monitoring (SEM) reports submitted by eight MSW landfill operators to the Oregon Department of Environmental Quality for the year of 2023.[5] Per state rules, SEM is currently performed at landfills with over 200,000 tons of total lifetime waste and modeled methane emissions greater than 664 tons. We analyzed open landfills currently accepting municipal solid waste (variations of these rules apply to other landfills that are closed and/or accept only industrial waste). According to records from the DEQ, a total of 11 currently operating municipal solid waste landfills in Oregon meet the waste-in-place and methane emissions thresholds for the state's surface emissions monitoring rules. Three of those landfills were not following the new rules; two due to exemptions granted by the DEQ and one did not comply. SEM is performed quarterly by walking portions of the landfill surface with a handheld gas analyzer in a grid pattern to detect methane leaks. Individual leaks detected measuring over 500 parts per million (ppm) require remediation within 10 days. Operators are also required to divide their landfill into 50,000 square foot grids and average their SEM results within each grid, referred to as integrated monitoring. If a grid has an average of 25 ppm or higher, then the operator is required to conduct mitigation efforts to bring it below 25 ppm.

[5] (See OAR 340-239-0100).

These reports were qualitatively and spatially assessed to determine transparency, compliance, completeness and quality of submitted reports and gaps with landfill emissions regulations.

Across eight landfills, five are privately owned and three are publicly owned and managed by a local government. We found that an average of 33.1% of landfill surface area was excluded from surface emissions monitoring. These exemptions include permitted exemptions, such as the working face where garbage is actively being deposited, and exemptions that are more questionable such as final grading (the slopes of landfill sections that are closed and no longer having waste deposited into them).

Although on average 33.1% of landfill surface area was excluded from emissions monitoring, the data revealed that private landfill operators are excluding an average of 48.6% of landfill surface area from SEM. Methane leaks in those areas are going undetected. The result of data omission is accelerated climate damage, dangerous conditions for workers, and air pollution and odors burdening nearby residential neighbors who are exposed to hazardous byproducts escaping along with methane. While some of these areas are too dangerous to be monitored by workers, substantial portions of landfills could have been safely monitored, such as areas with some vegetation or moderately sloped sides. Instead, they were excluded and listed as exempted on the report to the DEQ. Additionally, all of these areas could have been safely monitored with unmanned aerial equipment or fixed sensor systems. For example, owner-operator Waste Connections in Medford argued 69% of Dry Creek Landfill was too steep to monitor despite there being readily available methane detection technology that could fly over these areas.

We observed that, in comparison, public operators excluded only an average of 10% of landfill surface areas from monitoring. The stark difference in the comprehensiveness of surface emissions monitoring calls for further investigation of how landfill operators request exemptions, how transparent they are about their operating procedures, and the frequency and duration of exemption approvals on the part of the DEQ.

Our findings come in tandem with the U.S. Environmental Protection Agency's recent public release of draft white papers that delineate how advanced methane detection technology such as fixed methane sensors and satellites could address serious deficiencies in finding and fixing methane leaks.[6] In fall of 2024, the EPA issued a nationwide enforcement alert, stating, in part, "While the regulations allow MSW landfills to exclude certain areas from the SEM (e.g., areas with steep slopes or other dangerous areas), the EPA observed during recent inspections that areas that are not dangerous are improperly excluded from monitoring. If a MSW landfill excludes areas from the SEM, the facility should document and explain the basis for excluding each area from monitoring in the surface emission design plan and SEM reports. The regular side slopes of the landfill may not be excluded from monitoring per the regulations."[7] Excluding the working face and a few other time-limited activities,[8] state and federal rules require that all areas of landfills should be monitored during SEM. In Oregon, DEQ air pollution permit writers approve or deny exemptions from SEM proposed by operators (referred to as "alternative monitoring plans").[9]

State regulatory agencies need to use their authority to ensure the exceptions they permit are ultimately demonstrated to be necessary. Additionally, requiring operators to use advanced monitoring systems for SEM in difficult to monitor areas could fill this regulatory gap.

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[6] USEPA, Office of Air and Radiation. (2024). White Paper Series: Municipal Solid Waste Landfills – Advancements in Technology and Operating Practices. USEPA, Office of Air and Radiation. https://www.epa.gov/stationary-sources-air-pollution/non-regulatory-public-docket-municipal-solid-waste-landfills

[7] Environmental Protection Agency. (2024, September 25). Enforcement Alert: EPA Finds MSW Landfills are Violating Monitoring and Maintenance Requirements. EPA Investigations Find Municipal Solid Waste Landfill Operators Are Failing to Properly Conduct Compliant Monitoring and Maintenance of Gas Collection and Control System. https://www.epa.gov/enforcement/enforcement-alert-epa-finds-msw-landfills-are-violating-monitoring-and-maintenance

[8] Or. Admin. R. 340-239-0330, "The requirements of OAR 340-239-0200 do not apply to the working face of the landfill or to areas of the landfill surface where the landfill cover material has been removed and solid waste has been exposed for the purpose of installing, expanding, replacing, or repairing components of the landfill gas, leachate, or gas condensate collection and removal system, for conducting a remedial action, or for law enforcement activities requiring excavation; as long as these areas are kept to the minimum size and time duration as possible." [4] Throughout this report we emphasize Oregon because these are the arenas at which Beyond Toxics focuses its advocacy. Our findings could be replicable in other states or at the federal level.

[9] Or. Admin. R. 340-239-500(1)(c) "Alternative walking patterns to address potential safety and other issues, such as: steep or slippery slopes, monitoring instrument obstructions, and physical obstructions;"

We also found that landfill operators are omitting key pieces of data gathered from SEM, which, while legal, is an outcome of weak regulatory requirements and enforcement. For example, Oregon rules require that operators monitor every 25 feet of a landfill's surface area every year. This can be accomplished by monitoring every 25 feet every quarter or by monitoring every 100 feet each quarter but offsetting that path by 25 feet each quarter.[10] However, Oregon rules do not require operators to share their SEM path, so regulators are not able to verify the rule is being followed. Additionally, SEM data that is reported comes in print format, which requires regulatory staff hundreds of hours to translate to a spatial file storage format that provides comprehensive and more accurate data for analysis. This labor to convert the data, despite the existence of accessible Geographic Information Systems (GIS) technology for data analysis, is inefficient and a burden on regulatory agency resources.

Furthermore, landfill operators are only required to report methane leaks over 200 ppm or integrated monitoring exceedances 25 ppm and greater; they do not report all measured SEM values. This is particularly problematic for integrated monitoring results because those results are based on averaging all SEM measurements within a 50,000 square foot section, not just the values over 200 ppm. For example, there could be a series of SEM measurements between 100 ppm and 199 ppm in a concentrated area that would suggest a problem. However, if it were grouped in a 50,000 square foot cell where there were a substantial amount of measurements near 0 ppm, the problem area could be masked through the averaging process. Enhancing the specificity of data reporting and transparency would provide regulatory agencies with a stronger ability to identify problematic areas of methane escaping from landfills and require targeted remediation. Critical to this would be requiring landfill operators to report data in spatial data formats that are usable by widely available GIS software.

Policymakers can act to address data gaps and upgrade methane reporting standards to ensure a healthy climate, protect worker safety and public health and to reduce greenhouse gas emissions and related air pollutants.

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[10] Or. Admin. R. 340-239-0400(2)(a) "The walking grid in OAR 340-239-0800(3)(a)(B) may be reduced to 100-foot spacing so long as the walking grid is offset by 25-feet each quarter so that by the end of one year of monitoring, the entire surface area has been monitored every 25 feet"

BACKGROUND

Mitigating short-term methane emissions, a climate pollutant about 80 times more powerful than CO2,[11] is critical to preventing the world from reaching climate tipping points. Climate tipping points are thresholds at which the climate systems would irrevocably change and upend local weather systems, supply chains, and global food productions. Currently landfills are the third leading cause of methane emissions in Oregon and the United States, and the second leading globally.[12]

Methane emissions are a byproduct of disposing of organic waste into landfills. As organic waste (food scraps, wood, paper, textiles) decomposes in an oxygen deprived environment, methane gas is generated over the course of decades. Most landfills can be thought of as giant plastic bags containing waste (although some landfills have waste in direct contact with the ground). These cells are lined next to and on top of each other in a pyramid-like structure. Pipes line the bottom of cells in horizontal rows to extract liquid byproducts, referred to as leachate. Gas extraction wells are drilled vertically and sometimes horizontally into landfill cells to capture continually generated methane gas before it escapes to the atmosphere.

Currently, federal rules require certain landfills in the United States to implement gas collection and control systems (GCCS), which use gas wells to extract methane from about 600 U.S. landfills, excluding the working face (where waste is deposited on a daily basis).[13] While GCCS are intended to extract and capture methane, several challenges exist regarding their successful and efficient operation.

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[11] United Nations Environmental Programme. (2022, October 18). What's the deal with methane? Climate Action: Chemicals & Pollution Action. https://www.unep.org/news-and-stories/video/whats-deal-methane
[12] Saunois, M., Martinez, A., Poulter, B., Zhang, Z., Raymond, P., Regnier, P., Canadell, J. G., Jackson, R. B., Patra, P. K., Bousquet, P., Ciais, P., Dlugokencky, E. J., Lan, X., Allen, G. H., Bastviken, D., Beerling, D. J., Belikov, D. A., Blake, D. R., Castaldi, S., … Zhuang, Q. (2024). Global Methane Budget 2000–2020. Earth System Science Data Discussions, 2024, 1–147. https://doi.org/10.5194/essd-2024-115
[13] Rocky Mountain Institute, Ebun Ayandele, Tom Frankiewicz, & Ellie Garland. (2024). Deploying Advanced Monitoring Technologies at US Landfills.
https://rmi.org/wp-content/uploads/dlm_uploads/2024/03/wasteMAP_united_states_playbook.pdf

Primary failures include insufficient gas collection coverage, holes in the plastic-lined cells, poorly or non-operating pipe systems, badly calibrated extraction wells, and leachate liquids clogging gas extraction pipelines.[14] Notably, when methane is escaping landfills, other hazardous air pollutants are being released to the air as well. These include hydrogen sulfide, other volatile organic compounds, and airborne PFOAs (aka “forever chemicals”).[15] These chemicals harm quality of life and pose public health risks for nearby residents and landfill workers. It is critical to consider landfill air emissions as a public health threat and a significant environmental justice challenge.

SURFACE EMISSIONS MONITORING (SEM)

Certain landfill operators are required to implement and comply with Surface Emissions Monitoring (SEM) requirements. SEM requirements were first introduced by the federal government and administered by the EPA. Federal regulations require that these landfills perform SEM quarterly and follow the EPA’s Method 21 guidance,[16] to detect and mitigate emissions greater than 500 parts per million.[17] SEM involves technicians walking the surface of the landfill at regular intervals of 30 meters looking for distressed vegetation, holes in tarps, protruding equipment, and other signs of potential methane leaks. Technicians use hand-held methane gas monitoring equipment to measure methane concentrations in the air just above the surface of the landfill. If a leak above 500 ppm is detected, the operator is required to remediate the cause of the leak.[18]

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[14] Preet Brains, Haley Lewis, Keene Kelderman, & Leah Kelly. (2023). Trashing the Climate: Methane from Municipal Landfills. Environmental Integrity Project. https://environmentalintegrity.org/wp-content/uploads/2023/05/Trashing-the-Climate-report-5.18.23-updated.pdf
[15] Ashley M. Lin, Jake T. Thompson, Jeremy P. Koelmel, Yalan Liu, John A.. Bowden, & Timothy G. Townsend. (2024). Landfill Gas: A Major Pathway for Neutral Per- and Polyfluoroalkyl Substance (PFAS) Release. Environmental Science & Technology, 11(7), 730–737. https://doi.org/10.1021/acs.estlett.4c00364
[16]40 C.F.R. §§ 63.1958(d) and 63.1960(c)-(d)
[17] U.S. Environmental Protection Agency, https://www.govinfo.gov/content/pkg/FR-2021-05-21/html/2021-10109.htm
[18] U.S. Environmental Protection Agency, https://www.govinfo.gov/content/pkg/FR-2021-05-21/html/2021-10109.htm

States including California, Oregon, Maryland, and Washington have promulgated state regulations strengthening various aspects of SEM to detect and reduce methane emissions. However, they are still reliant on a quarterly walking survey grid pattern monitoring, which still allows areas of the landfill to be skipped altogether leading to insufficient detection of leaks (see more in our discussion).

Oregon updated its landfill emissions rules, finalized October 2021, as a result of Executive Order 20-04 initiated by Governor Kate Brown in 2020 to direct state agencies to reduce greenhouse gases to at least 80% below 1990 emissions levels by 2050. The state's 2022 rules differ from federal rules in significant ways. The new regulations require landfill operators to conduct SEM following a walking pattern with no more than 25-foot intervals annually across the landfill's surface area, as opposed to the federally mandated 100 foot intervals. It also requires integrated monitoring for landfills, which averages SEM measurements across 50,000 square foot gridded sections. If a section has an average of 25 ppm or higher, then the landfill operator is required to take action to bring methane levels down.[19] The working face of the landfill is excluded from surface emissions monitoring along with areas under construction for gas collection.[20] Regulations also reduced the size and emissions threshold at which landfills are required to install a GCCS and conduct SEM.[21] The DEQ also added additional requirements to boost methane capture, including stronger GCCS leak component monitoring and data reporting requirements for GCCS equipment indicators and down time, which we did not evaluate in this report.

Our research questions were as follows, for those MSW landfill operators that fall subject to Oregon's regulatory parameters:

1. Which currently operating Oregon landfills accepting municipal solid waste are subject to implementing the updated rules?

2. How much landfill surface area is being included and excluded from SEM?

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[19] Oregon Department of Environmental Quality, Heather Kuoppamaki. (2021, October 1). Landfill Gas Emissions Rulemaking DEQ Presentation. Landfill Gas Emissions Rules Advisory Committee. https://www.oregon.gov/deq/EQCdocs/100121_I_Slides.pdf
[20] https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=6533
[21] Ibid.

3. Are the MSW landfill operators monitoring in a walking 25-foot grid pattern over the course of a year, per state regulatory requirements?

4. Are the MSW landfill operators conducting and reporting integrated monitoring results per a 50,000 sq. ft. grid, per state regulatory requirements?

5. Are reports complete, accurate, easy to analyze and useful to ODEQ to help regulators determine compliance and effective methane mitigation?

METHODS

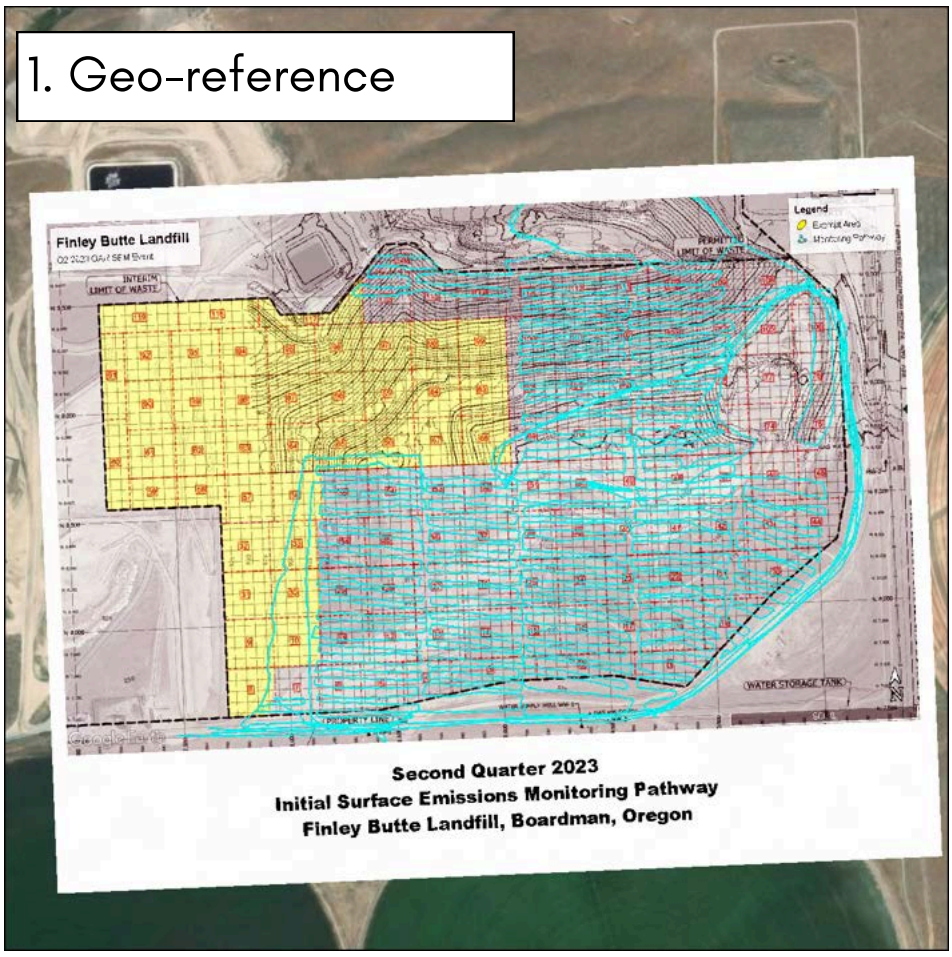
Beyond Toxics procured annual and semiannual reports, which certain landfills are required to file,[22] through a public records request to the Oregon DEQ filed in January 2024. We asked for reports filed by currently operating landfills accepting municipal solid waste that are known to exceed 200,000 tons of waste-in-place and 664 tons of methane a year since those are the thresholds at which Oregon's stricter SEM procedures go into effect.

Records were released in June 2024, and included SEM reports from eight of 11 qualifying Oregon landfills in 2022 and 2023. The other three landfills did not conduct SEM, which we inquired further about and will be discussed later. We analyzed solid waste landfills and we excluded landfills exclusively accepting construction and demolition waste, landfills that take only waste from industrial facilities, and all closed landfills. We performed a records analysis of SEM reports included in semiannual and annual reports to DEQ from 2023 for the eight of 11 currently operating municipal solid landfills required to adhere to stricter SEM requirements. In these reports, we analyzed the reporting of integrated monitoring results, 50,000 square foot grids, SEM exclusions, and SEM walking paths. We did not differentiate between SEM exclusions for the working face, asbestos pits, storage piles, steep slopes, overgrown vegetation, etc. because this information is not consistently available in reports compiled by operators. Operators often listed where they did not monitor without a specific justification.

[22] OAR 340-239-700(3)(c).

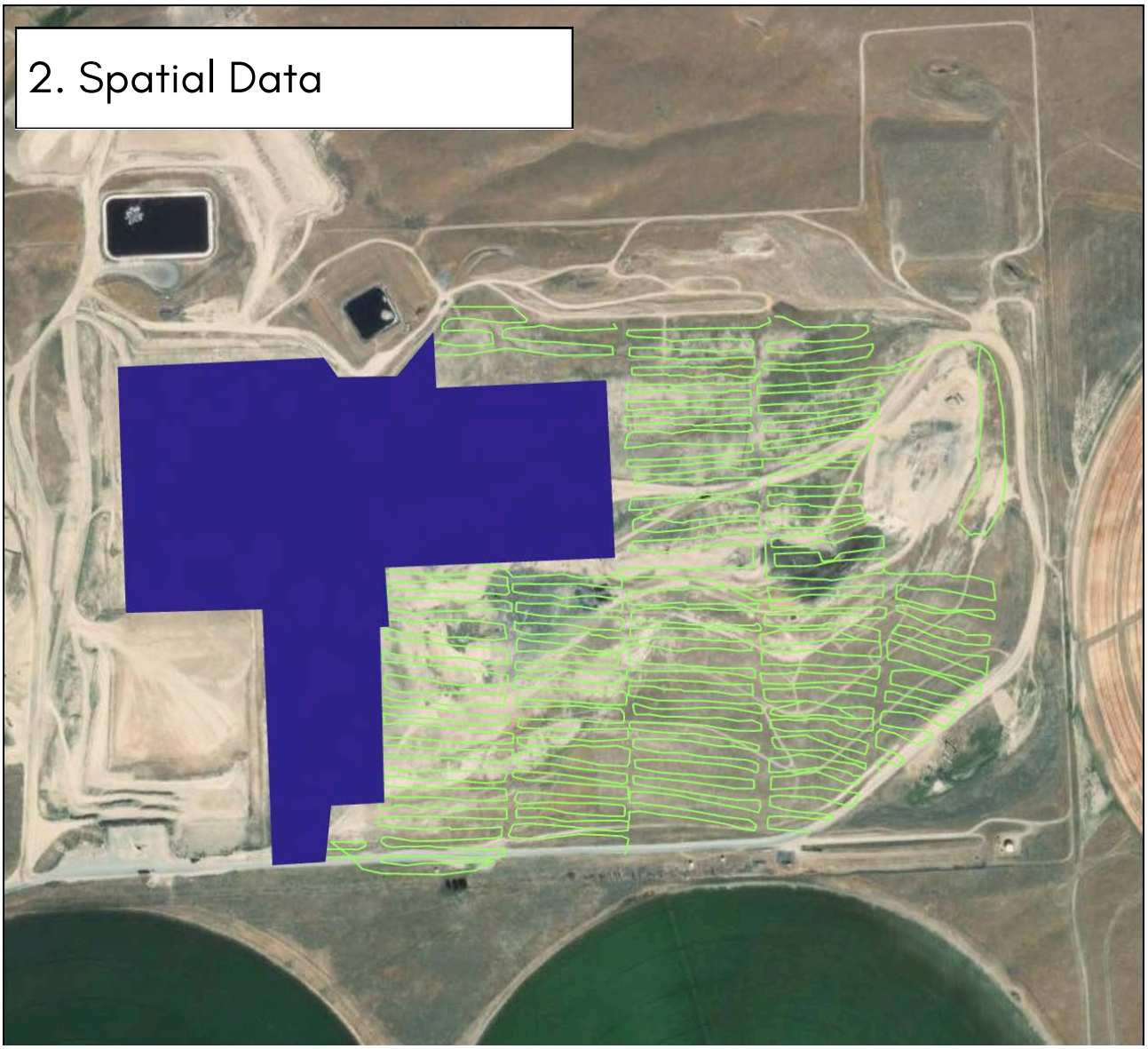
For research questions that required a spatial analysis, we georeferenced SEM report maps using ArcGIS Pro software. We then traced mapped features into vector data, which are GPS synchronized shapes that can be spatially analyzed. This allows us to do a few additional modes of analysis. For example, we can calculate the total area of a landfill and the SEM exempted areas. We can also create buffers around SEM paths to see if operators monitored every 25 feet. For the total area of landfill and areas of landfills excluded from SEM, we calculated their surface area in acres. For SEM paths, we created a 12.5 foot buffer around the walking path so we could visualize where gaps larger than 25 feet occurred between walking paths.

Figure 1: Frame 1, Frame 2, Frame 3, Frame 4

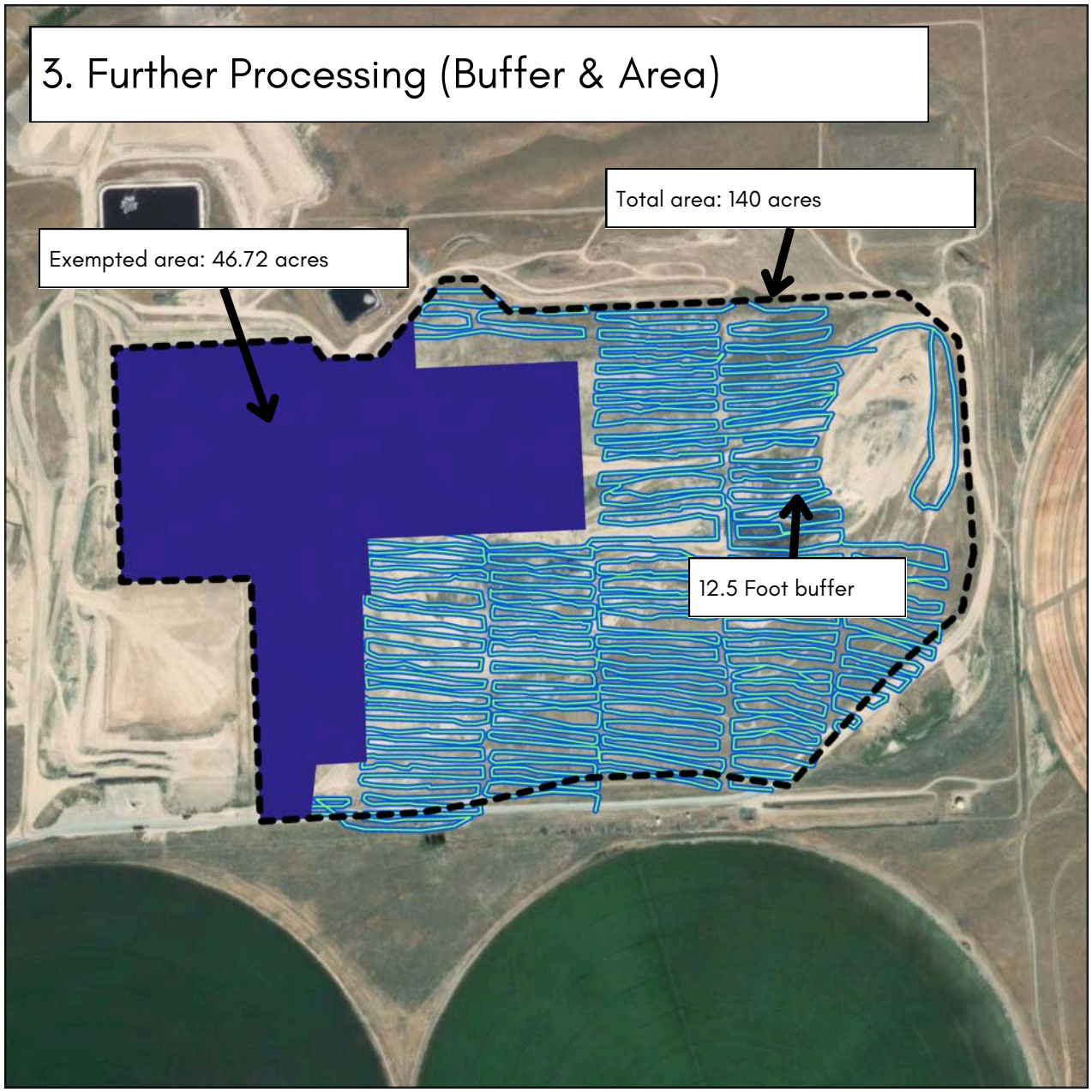


Frame 1: Overall, figure 1 shows our process of spatial data analysis for SEM reports using Finley Butte Landfill managed by Waste Connections in Boardman, Oregon as an example.

First we take the report graphic provided to the DEQ by the operator, which features a yellow polygon showing the area exempt from monitoring and a blue line showing where operators monitored. The first step is attaching the "paper" graphic to its GPS location. This is referred to as georeferencing. Now the graphic is overlaying its current satellite location.

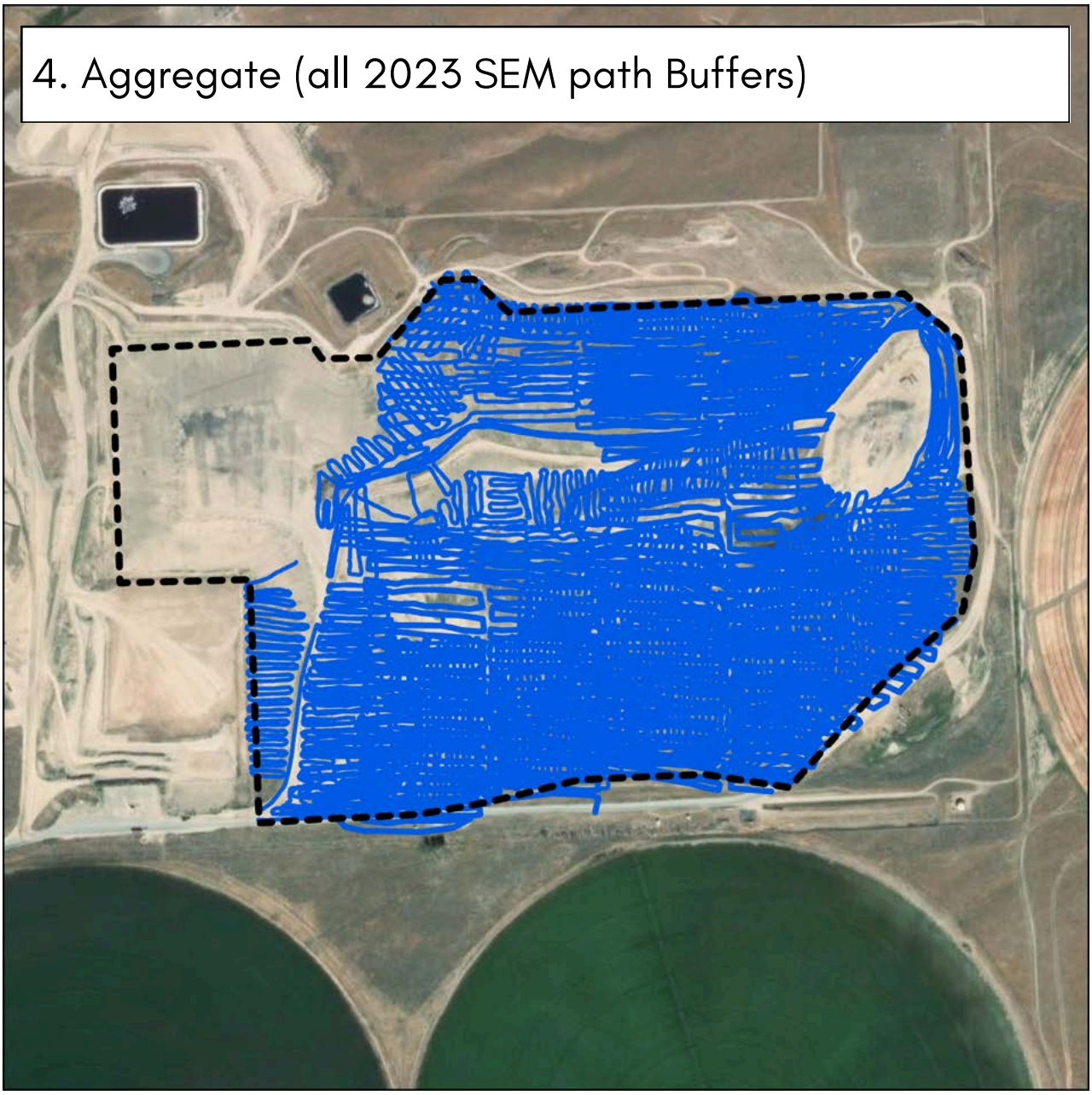


Frame 2: Next we build a shapefile, which is a file storage format used by GIS software. This is accomplished by tracing the exempt area into a polygon and the path into lines. Now, the area the operator exempted from SEM, formerly in yellow, is now in dark blue and the SEM monitoring path, formerly in blue and now depicted in green.



Frame 3: Now that we have a shapefile, we can do further forms of analysis. In this case, we want to know the area of the landfill, which we also traced into a shapefile, and the area of the exempt section. Since the data has been tied to GPS locations, we can calculate those features. The total area of the landfill is 140 acres and 46.72 acres were exempt. We can now calculate that for this quarter, Finley Butte excluded 33.4% of its surface area from monitoring.

We also need to know how well they followed the 25 foot rule. By calculating a 12.5 foot buffer on either side of the path, we can see where the buffers from all paths meet. 12.5 x 2 is 25 feet. We need to put all the paths from the year together to evaluate how well Finley Butte complied with this rule, which we will see in the next graphic.



Frame 4: In this graphic, we have compiled all of the SEM path buffers from each of the four quarters into one graphic. Areas that are in blue are where operators complied with Oregon's 25 foot rule. Areas where we can see the satellite imagery are where paths aren't offset by 25 feet, which means the operator failed to comply with the law. The only way we can evaluate this is through the ability to view all four paths/buffers around paths from each of the quarterly reports. This underscores how GIS analysis makes compliance monitoring more efficient.

WHY THIS METHODOLOGY?

By translating all of this data into a format that is usable in GIS software, we have the ability to look at data from across quarterly reports, or even years, in one environment. This allows us to see if areas have been repeatedly excluded from SEM each quarter, if the landfill operator has indeed monitored every 25 feet of the landfill over the course of a year, or if there are areas that repeatedly have high emissions for integrated monitoring.

Furthermore, we can plug in more spatial data for further exploration. Possibilities we didn't examine in this report, but are possible include: adding data on gas extraction wells, data on landfill cover infrastructure, or pulling in third party methane detection data such as Carbon Mapper, which detects methane plumes from space. The ability to see where landfills are experiencing methane exceedances from different sources of detection alongside their gas collection system infrastructure could generate effective insights on weaknesses in landfill gas systems, areas that need better or more frequent monitoring, or areas that DEQ needs to prioritize inspecting.

RESULTS AND DISCUSSION

Which Oregon landfills accepting municipal solid waste are complying with the DEQ rules adopted in 2021?

Oregon landfills are required to adhere to stricter DEQ requirements for methane management if they exceed 200,000 tons or more of lifetime waste-in-place and if their projected methane generation reaches 664 or more tons a year. Currently 11 Oregon landfills that are open and accepting municipal solid waste meet these metrics based on DEQ provided data (Table 1). Once a landfill reaches these thresholds, they are required to conduct surface emissions monitoring for four consecutive quarterly monitoring periods, with differing requirements thereafter if there is no measured concentration of methane of 200 ppm or greater are discovered during SEM.

Seven of the 11 MSW landfills are privately owned and operated while the other four are owned and operated by a county government. In total, all 11 landfills have a combined modeled methane generation of 169,943 tons in 2023, equivalent to the emissions of 1.6 billion gallons of gasoline burned.[23] The DEQ stated, "In 2017, six of the twenty-five largest stationary sources of GHG emissions in Oregon were landfills."[24] The seven private landfills were typically larger, occupying the top five ranked positions by total waste. On the other hand, the four public landfills held three of the bottom four slots by total waste. All 11 landfills are currently in operation and accepting municipal waste as of 2024.

Based on the numbers in Table 1 from Oregon DEQ, we would expect that all 11 Oregon MSW landfills would be subject to the stricter requirements of the state's current landfill emissions rules pertaining to conducting quarterly surface emissions monitoring. Through analyzing records and conversations with DEQ, we found that three landfills are not held to those higher standards. Each of these three landfills claimed unique circumstances specified below.

Examples of limited or non compliance:

1. Hillsboro Landfill, managed by Waste Management, Inc., was granted an exception to conducting surface emissions monitoring in its Title V operating permit by the DEQ, and does not have to comply with SEM requirements until April 2025. DEQ did not specify why.

2. Roseburg Landfill, managed by Douglas County, has not complied, and, as of May 2024, DEQ has stated they are looking into enforcement. We have not heard any developments since.

3. Baker Sanitary Landfill, managed by a local private company, claimed that its facility is two separate landfills, enabling it to divide its methane emissions between the two facilities and fall below the 664 tons threshold. DEQ has accepted this explanation although its own records present the landfill as one facility.

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[23] [22] OAR 340-239-700(3)(c). We first converted methane to a co2 equivalent of 84.
[24] [22] OAR 340-239-700(3)(c). , page 3

Table 1: Open Oregon MSW Landfills waste-in-place and Annual Methane Generation

Landfill, Owner-Operator	Owner-Operator Type	Total Lifetime Waste In Place (Tons)	Annual Methane Generation (Tons)
Columbia Ridge Landfill, WM	Private	64,358,280	43,497
Coffin Butte Landfill, Republic Services	Private	18,269,157	34,777
Hillsboro Landfill, Waste Management	Private	13,158,408	13,933
Finley Butte Landfill, Waste Connections	Private	13,158,408	13,933
Short Mountain Landfill, Lane County	County Government	11,750,975	13,042
Dry Creek Landfill, Waste Connections	Private	9,075,149	14,090
Wasco County Landfill, Waste Connections	Private	6,006,973	6,138
Knott Landfill, Deschutes County	County Government	4,642,663	3,826
Roseburg Landfill, Douglas County	County Government	3,696,825	35,058
Crook County Landfill, Crook County	County Government	1,116,102	739
Baker Landfill, Baker Sanitary Service	Private	766,113	778

Caption: The table features waste-in-place and methane generation rates for Oregon landfills accepting municipal solid waste while DEQ finalized rulemaking in 2021. Landfills highlighted in green were held to the updated SEM standards in 2023 and included in our analysis.

How much landfill surface area is being excluded from SEM?

We found that Oregon private landfill operators have excluded landfill areas from basic monitoring much more frequently than their publicly operated counterparts. During 2023 private landfills in Oregon exclude an average of 48.6% of landfill surface area from SEM each quarterly monitoring. On the other hand, county government operated landfills exclude an average of 10% surface area from SEM. We documented all exclusions, whether those exclusions have been shown to comply with Oregon rules or are more ambiguous.

Some landfills chose to give a reason for an exemption, and in other cases we were able to speculate a reason based on the design of the landfill. For example, we noticed Short Mountain, operated by Lane County, continuously did not monitor their asbestos pit, but did not specify that reason. In other cases, the landfill simply stated areas were exempt without providing a description and how a claimed exemption complies with the requirements, and we were unable to determine the criteria used to comply with exemption requests. Given this pattern, it was difficult to ascertain which exceptions were for working faces or other reasons consistently across all landfills. For this reason, we combined all exemptions to get a higher level view.

Table 2

Landfill, Operator	Private/Public	Quarter	Total Area (acres)	Exempted areas	% Excluded
Finley Butte, Waste Connections	Private	2023 - 1	140.08	37.52	26.78%
Finley Butte, Waste Connections	Private	2023 - 2	140.08	46.72	33.36%
Finley Butte, Waste Connections	Private	2023 - 3	140.08	80.92	57.77%

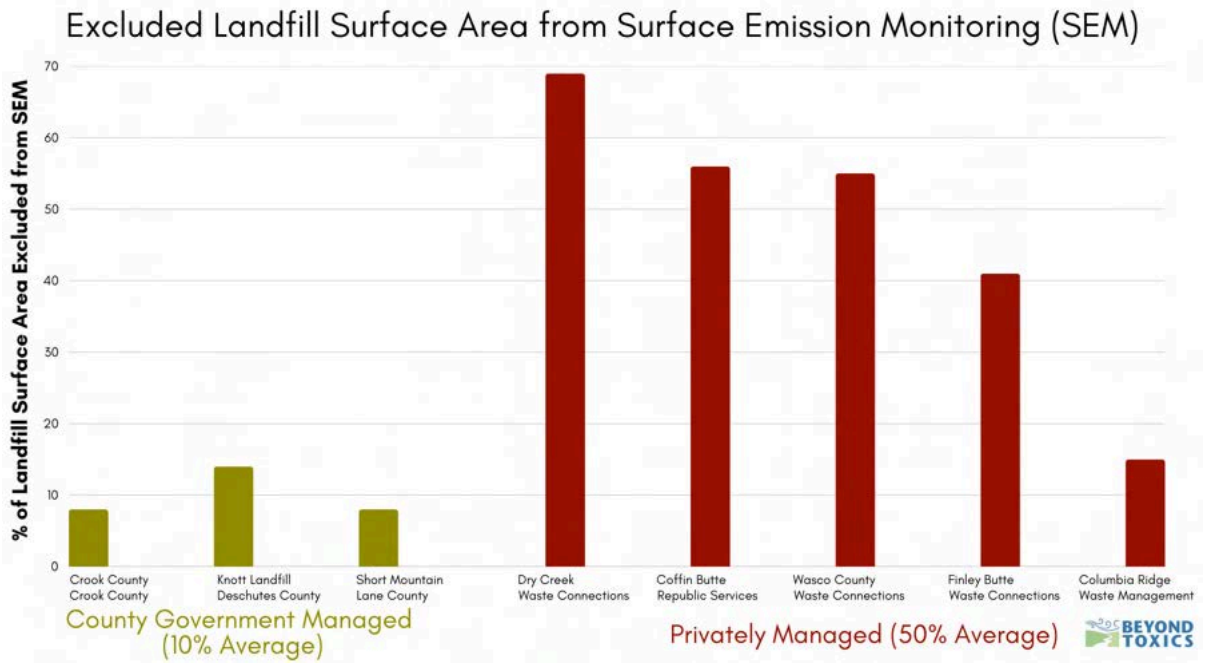
Finley Butte, Waste Connections	Private	2023 - 4	140.08	63.23	45.14%
Dry Creek, Waste Connections	Private	2023 - 1	85.86	59.62	69.45%
Dry Creek, Waste Connections	Private	2023 - 2	85.86	59.62	69.45%
Dry Creek, Waste Connections	Private	2023 - 3	85.86	59.62	69.45%
Dry Creek, Waste Connections	Private	2023 - 4	85.86	59.62	69.45%
Wasco County, Waste Connections	Private	2023 - 1	176.27	109.50	62.12%
Wasco County, Waste Connections	Private	2023 - 2	176.27	81.89	46.45%
Wasco County, Waste Connections	Private	2023 - 3	176.27	89.41	50.72%
Wasco County, Waste Connections	Private	2023 - 4	176.27	100.22	56.86%
Coffin Butte, Republic Services	Private	2023 - 1	136.34	84.21	61.77%
Coffin Butte, Republic Services	Private	2023 - 2	136.34	74.04	54.31%

Coffin Butte, Republic Services	Private	2023 - 3	136.34	74.04	54.31%
Coffin Butte, Republic Services	Private	2023 - 4	136.34	71.87	52.71%
Columbia Ridge, Waste Management	Private	2023 - 1	335.53	41.13	12.26%
Columbia Ridge, Waste Management	Private	2023 - 2	85.86	46.96	14.00%
Columbia Ridge, Waste Management	Private	2023 - 3	85.86	45.83	13.66%
Columbia Ridge, Waste Management	Private	2023 - 4	176.27	64.26	19.15%
Knott Landfill, Deschutes County	Public	2023 - 1	107.48	14.91	13.88%
Knott Landfill, Deschutes County	Public	2023 - 2	107.48	12.92	12.02%
Knott Landfill, Deschutes County	Public	2023 - 3	107.48	16.05	14.93%
Knott Landfill, Deschutes County	Public	2023 - 4	107.48	17.14	15.95%
Short Mountain, Lane County	Public	2023 - 1	111.34	9.30	8.35%
Short Mountain, Lane County	Public	2023 - 2	111.34	9.30	8.35%
Short Mountain, Lane County	Public	2023 - 3	111.34	9.30	8.35%

Short Mountain, Lane County	Public	2023 - 4	111.34	9.30	8.35%
Crook County. Crook County	Public	2023 - 1	84.52	5.82	6.88%
Crook County, Crook County	Public	2023 - 2	84.52	6.29	7.44%
Crook County, Crook County	Public	2023 - 3	84.52	6.96	8.23%
Crook County, Crook County	Public	2023 - 4	84.52	6.50	7.69%

The table above features the eight landfills following stricter SEM protocols and the data we were able to derive from their reports. Note that the working face is included in exemptions for SEM because most landfills did not specify the location and why an area of land was exempt. Total acres for landfills did not change over the course of a year because operators did not add any landfill surface area.

Figure 2.



Caption: The bar graph shows the average percentage of landfill surface area omitted from SEM by landfill site. Privately operated landfills for the most part excluded far more surface area than their government operated counterparts.

Our study found that the five private MSW landfills we analyzed on average omit nearly half (48.6%) of surface area from SEM every quarter (as opposed to the whole year together), leaving operators and regulatory agencies blind to vast portions of the landfill and the emissions emanating from them. While some of these exemptions might be intended to keep workers safe or are legally permissible, the large amount of surface area excluded raises questions as to whether private landfill operators are improperly excluding land from SEM. We found that 75% ofpublic landfills specified their exemptions for the working face, asbestos pits, or gravel and soil stockpiles, which totaled to an average of 10% of landfill surface areas. We were able to cross reference the fourth landfill based on other information they included in their report. On the other hand no private landfills specified the reason for exemptions in 2023 reports. The wide gap between private and public facilities may be an indication of non or limited compliance on the part of private waste corporations.

Examples of reasons given for not conducting surface emissions monitoring on certain areas

1. Waste Connections in Medford exempted 69% of its landfill, Dry Creek, from SEM monitoring without explanation. These areas all had final grade slopes, which could possibly be argued are too steep for monitoring. However, the EPA has stated that regular final grade side slopes of a landfill are not to be exempted.[25]

2. Owner-operator Waste Connections in Boardman, Oregon, chose not to monitor portions of the Finley Butte landfill that the U.S. EPA had monitored in June 2022. Waste Connections repeatedly denied the need to monitor anywhere they had placed waste in the last five years, even if that section of the landfill had waste older than five years. (Five years after waste is placed is the federal regulatory requirement to start SEM monitoring). Owner-operators then argued that the EPA should have never inspected that area due to safety concerns, even though they had never warned EPA of any safety concerns while accompanying them during their inspection. In 2023, Finley Butte Landfill continued to exclude those areas from monitoring.[26]

[25] Environmental Protection Agency. (2024, September 25). Enforcement Alert: EPA Finds MSW Landfills are Violating Monitoring and Maintenance Requirements. EPA Investigations Find Municipal Solid Waste Landfill Operators Are Failing to Properly Conduct Compliant Monitoring and Maintenance of Gas Collection and Control System. https://www.epa.gov/enforcement/enforcement-alert-epa-finds-msw-landfills-are-violating-monitoring-and-maintenance

[26] Environmental Protection Agency & Daniel Heins. (2022). Clean Air Act Inspection Report Republic Services Waste Connections Finley Buttes Landfill, Boardman Oregon. EPA Region 10.

3 Republic Services, the owner-operator of Coffin Butte landfill near Corvallis, Oregon, argued 30-40 acres[27] of its landfill had too much vegetation to monitor. We would emphasize the owner-operators chose not to maintain the vegetation, which means this is a problem they created. Vegetation breaks through the upper cover material which would be highly prone to methane leakage (figure 3).

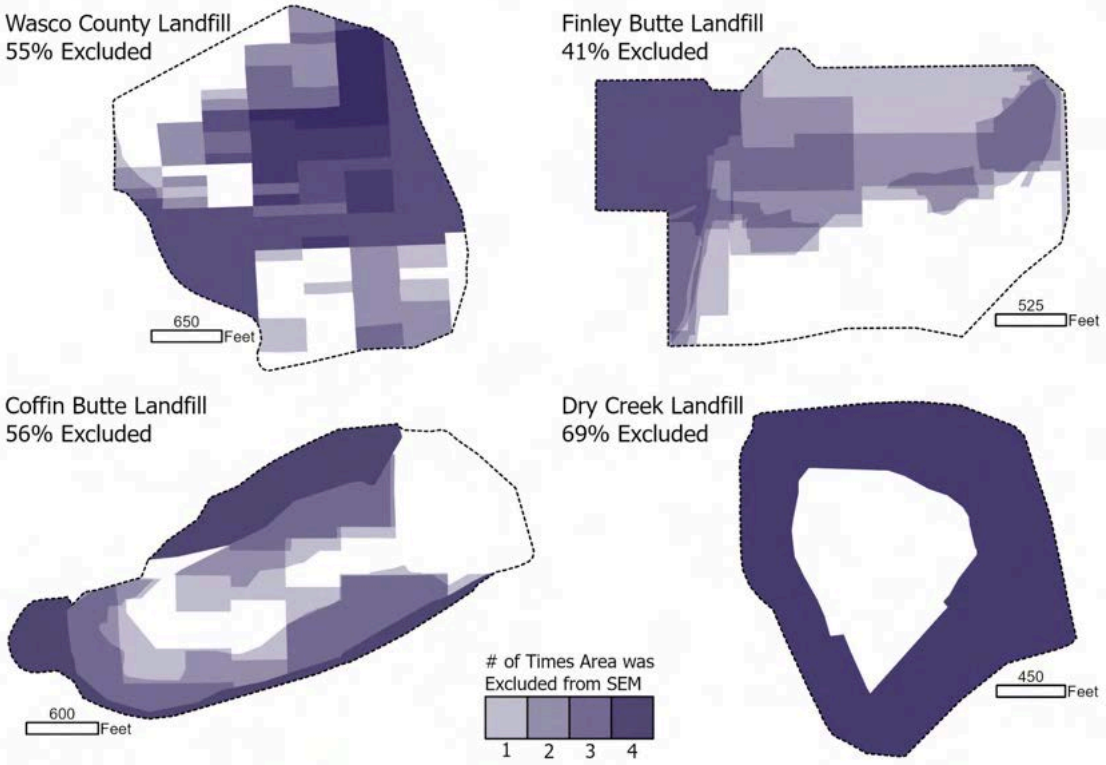


Caption: The EPA found multiple instances of vegetation growing through the tarp of the Coffin Butte landfill in both 2022 and 2024. The picture is one such example. The EPA measured methane at 1,000 ppm, twice the regulatory limit, near the base of the plant. Operators are supposed to constantly monitor the tarp integrity to ensure that there are no areas where methane could be leaking.

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[27] Coffin Butte specifically exempted 40 acres in quarter 3 2022 and 30 acres in quarter 4 for high vegetation (both outside of our study). However, they continued to exempt the same areas in 2023, which spans the duration of our study, but they decline to specify the reason. We assume they are exempting those areas for the same reason based on satellite imagery from the times of inspection in 2023.

Figure 2



Caption: The maps feature four privately operated Oregon landfills with waste deposits outlined in black dotted lines. Each exempted area for the four quarterly reports in 2024 is layered and features where operators did not conduct SEM. The darker the shade of violet, the more frequently the area of the landfill went unmonitored. Oregon's private landfills excluded an average of 48.6% of landfill surface area from each quarterly monitoring.

Oregon rules exempt "the working face of the landfill to areas of the landfill surface where the landfill cover material has been removed and solid waste has been exposed for the purpose of installing, expanding, replacing, or repairing components of the landfill gas, leachate, or gas condensate collection and removal system, for conducting a remedial action, or for law enforcement activities requiring excavation. Rules specify this exclusion should be kept to the minimum size and time duration as possible."[28]

However, Oregon rules also allow for an alternative monitoring plan for "Alternative walking patterns to address potential safety and other issues, such as: steep or slippery slopes, monitoring instrument obstructions, and physical obstructions" approved by DEQ.

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[28] https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=6533

The reports we analyzed did not include information or details on alternative monitoring plans approved by DEQ, so it's difficult to evaluate exactly what agreements are made between private owner-operators and DEQ. Regardless, the large disparity between private and public owner-operators calls for further scrutiny by the DEQ for how and when they allow exceptions to SEM. As of now, the agency and public are completely blind to what is happening on 48.6% of private landfill surface areas. Large swaths of preventable methane leaks may be and likely are going undetected and unrepaired.

Further Limitations of SEM

Excluding large portions of landfills from any SEM is one demonstrated method of reducing the efficacy of methane monitoring. Not only can operators avoid conducting SEM over vast swaths of landfills, the EPA has repeatedly observed poor practices of operating SEM equipment. The EPA recently stated there is a massive gap in the monitoring methodology used by private operators and regulatory agency staff.[29] When conducting limited SEM, as part of inspections of several Oregon MSW landfills in 2022 and 2024, U.S. EPA inspectors found glaring issues with private operators including failing to use SEM equipment at a proper height leading to underrepresented emissions, ignoring protruding waste piercing through landfill cover, not monitoring leachate clean outs and gas wells, and more.[30] These led to landfills filing reports appearing to have fewer methane leaks of lesser severity. For example, at the Coffin Butte landfill owned and operated by Republic Services, a 2022 EPA inspection report stated that "despite Republic having seen no more than six exceedances in the recent SEM reports supplied ahead of the inspection that included penetration monitoring, including reports with zero exceedances, the EPA identified 61 points in exceedance of legal limit of 500 ppm, including 21 points above 10,000 ppm."[31]

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[29] Environmental Protection Agency. (2024, September 25). Enforcement Alert: EPA Finds MSW Landfills are Violating Monitoring and Maintenance Requirements. EPA Investigations Find Municipal Solid Waste Landfill Operators Are Failing to Properly Conduct Compliant Monitoring and Maintenance of Gas Collection and Control System. https://www.epa.gov/enforcement/enforcement-alert-epa-finds-msw-landfills-are-violating-monitoring-and-maintenance

[30] Environmental Protection Agency & Daniel Heins. (2022). Clean Air Act Inspection Report Waste Connections Finley Butte Landfill, Boardman Oregon. EPA Region 10.

[31] Environmental Protection Agency & Daniel Heins. (2022). Clean Air Act Inspection Report Republic Services Coffin Butte Landfill, Corvallis Oregon. EPA Region 10.

Coffin Butte was not alone. The EPA also found glaring issues at Finley Butte landfill and Wasco County landfill both operated by Waste Connections. EPA inspectors found multiple large pieces of waste protruding through the cover, including wind turbine blade parts and tires, compromising the integrity of Finley Butte's landfill tarp cover.[32] At Wasco County, inspectors noted that the landfill operator had failed to keep adequate records of organic waste, which artificially reduced the projected methane emissions from LandGEM modeling.[33] These are three of the 100 landfills the EPA inspected across the nation before the agency put out an alert of widespread noncompliance with SEM rules.[34]

Recommendation: There are a variety of ready-to-go solutions that Oregon's regulatory agency can leverage to improve SEM and methane emissions prevention. For the immediate future, state regulators should immediately follow-up with MSW landfill operators, require explanations for areas excluded from monitoring and ensure that operators are following state regulations. Further, there are available advanced sensing technologies such as fixed methane sensors and drones that can comprehensively monitor large areas with greater frequency, including steep slopes and areas with vegetation, to provide Oregon operators and regulators with the missing information they need to find and mitigate methane leaks.

Are landfill operators monitoring in a walking 25-foot grid pattern, per state regulatory requirements?

Oregon requires that operators conduct SEM every 25 feet of a landfill over the course of a year. An operator can accomplish this by monitoring every 25 feet every quarter. Or, they can monitor every 100 feet every quarter, then offset that path by 25 feet for each consecutive quarter, so that by the end of the year every 25 feet has been covered. Notably, this rule was not followed in areas that were marked as exempt one or more times in a year.

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[32] Environmental Protection Agency & Daniel Heins. (2022). Clean Air Act Inspection Report Republic Services Waste Connections Finley Buttes Landfill, Boardman Oregon. EPA Region 10.
[32] Environmental Protection Agency & Daniel Heins. (2022). Clean Air Act Inspection Report Republic Services Waste Connections Wasco County Landfill, The Dalles Oregon. EPA Region 10.
[33]Environmental Protection Agency. (2024, September 25). Enforcement Alert: EPA Finds MSW Landfills are Violating Monitoring and Maintenance Requirements. EPA Investigations Find Municipal Solid Waste Landfill Operators Are Failing to Properly Conduct Compliant Monitoring and Maintenance of Gas Collection and Control System. https://www.epa.gov/enforcement/enforcement-alert-epa-finds-msw-landfills-are-violating-monitoring-and-maintenance
[34] Environmental Protection Agency. (2024, September 25). Enforcement Alert: EPA Finds MSW Landfills are Violating Monitoring and Maintenance Requirements. EPA Investigations Find Municipal Solid Waste Landfill Operators Are Failing to Properly Conduct Compliant Monitoring and Maintenance of Gas Collection and Control System. https://www.epa.gov/enforcement/enforcement-alert-epa-finds-msw-landfills-are-violating-monitoring-and-maintenance

Five of the eight landfill operators did not report the GPS route they took to conduct SEM. Unfortunately, they are not required to report this information by Oregon rule. In our analysis of walking 25-foot grid patterns, we focused on landfill reports that provided actual monitoring paths because actual monitoring each quarter differs substantially from planned monitoring paths (see Figure 4).

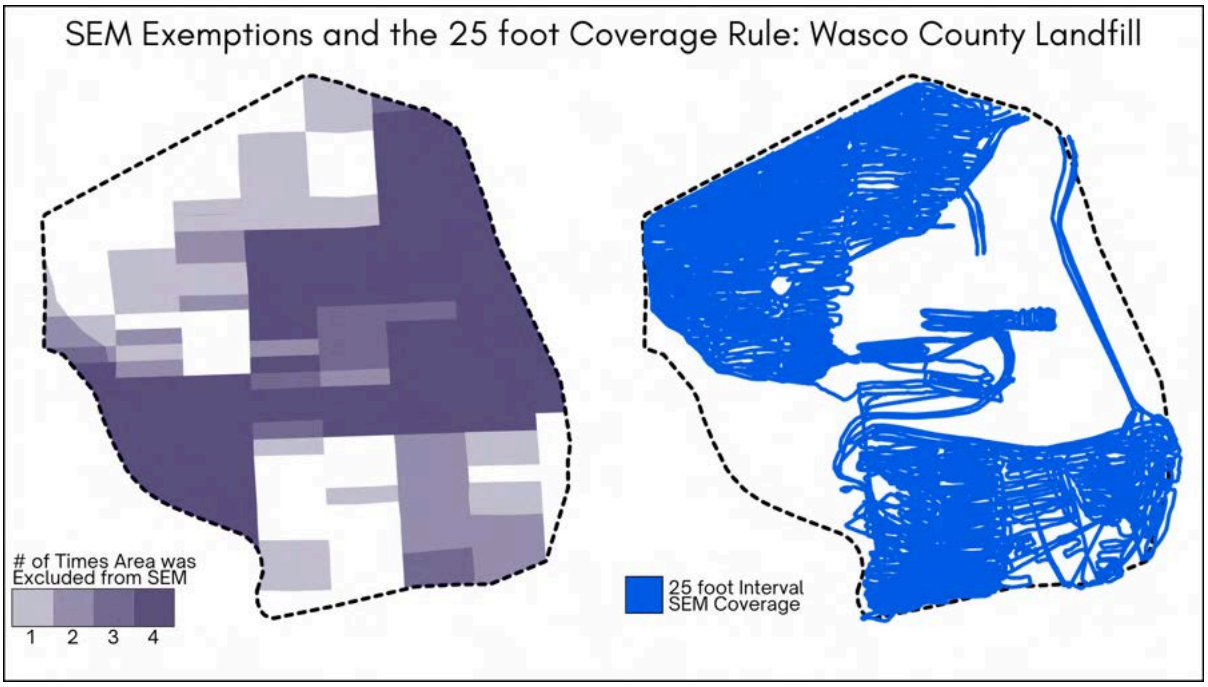
Figure 4 - Planned SEM route Differs Greatly from Actual SEM route



Caption: The first frame of the figure features a planned SEM path that the Coffin Butte Landfill operator submitted to the DEQ. The second frame is a map of the actual GPS tracked SEM route. We can see far less of the landfill was actually monitored with the GPS path than the estimated route. These GPS referenced paths are much more accurate than planned routes when evaluating the comprehensiveness of SEM.

Only three out of eight MSW landfills (Coffin Butte, Finley Butte, and Wasco County) that conducted SEM voluntarily reported the GPS tracked SEM monitoring path. Our analysis found that, for the most part, those landfill operators that shared their SEM traversed path in reports appeared to have followed this rule with some room for improvement and one substantial failure. Given many of these operators excluded substantial surface area of their landfill from any SEM (see above section), the 25 foot rule was often not followed in areas that were excluded one or more times (Figure 5).

Figure 5



Caption: On the left is Waste Connections' exempted areas for Wasco County Landfill in 2023. The darker shade of violet, the more often that area was excluded from SEM over the course of the year. On the right, the graphic shows how the 25 foot rule was followed. If an area is completely blue, the 25 foot rule was followed. Gaps of white show where operators failed to monitor every 25 feet. By comparing the two graphics, we can see that operators most consistently met the 25 foot rule in areas that were monitored all four quarters. We can also observe the inverse relationship. The more often operators excluded an area from SEM, the more that area failed to follow the 25 foot rule.

Recommendation: This can easily be remedied by adding GPS tracked SEM paths to the recordkeeping and reporting requirements in OAR 340-239-0700, and a similar mechanism at the federal level. It would be beneficial to require that this data is not only reported in print form, but also in some spatial data format (shapefile, GeoJSON, etc.). The reason for this is Oregon does not require monitoring every 25 feet every quarter. Rather, they require that over the course of a calendar year, every 25 feet of a landfill is monitored. Having access to the spatial data will allow regulatory agencies to view all quarterly monitoring paths and results at once, and quickly verify the results.

Are landfill operators conducting integrated monitoring and reporting results?

Integrated monitoring is a key early identification monitoring strategy to identify where there are problematic methane emissions. It involves dividing the landfill into an integrated monitoring grid of 50,000 square foot cells, an area slightly smaller than a football field. After conducting SEM looking for individual, instantaneous exceedances of 500 ppm, the operators create an aggravate reading for each 50,000 square foot cell by averaging all individual SEM readings within each grid. If a grid has an aggregate SEM average above 25 ppm, then the landfill needs to perform remediation and do follow up SEM to ensure the average falls below 25 ppm.[35] State regulations require the landfill to report integrated monitoring exceedances over 25 ppm. State regulations do not specifically require the reporting of operators' integrated monitoring grids or non-exceedance integrated monitoring results. The requirements only stipulate that operators must tell DEQ if they have a 50,000 square foot cell exceeding 25 ppm.

Given that, we found that seven out of eight landfills reported at least some integrated monitoring result. Two of those landfills only reported their grid cells that exceeded 25 ppm as legally required. Five out of eight voluntarily shared all of their integrated monitoring results – the average SEM reading for each grid cell including their exceedances of 25 ppm.[36] The last landfill either did not have a 25 ppm integrated exceedance, or it simply did not report any data

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[35] https://www.oregon.gov/deq/EQCdocs/100121_I_Slides.pdf

[36] https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=6533 340-239-0700, 3(c) Semi-Annual Report. A landfill owner or operator subject to this rule, must prepare semi-annual reports for the periods of January 1 through June 30 of each year, unless otherwise approved in writing by DEQ. The Semi-Annual Report will be due on July 30, unless otherwise approved in writing by DEQ. The Semi-Annual Report must contain the following information:

Figure 6



Caption: The above graphic was submitted to DEQ by Waste Management at Columbia Ridge landfill showing how they divided the landfill into 50,000 square foot grids for their integrated monitoring results. In the full report, the operator submitted a table with each grid numbered and the associated average SEM reading result. Ideally, operators should be required to report this information to DEQ. Columbia Ridge is an example of data reporting that should be required by law.

Oregon Administrative Rules do not require operators to report the grid or integrated monitoring results unless a grid exceeds 25 ppm. We strongly recommend regulatory agencies require this basic information and they add a requirement for it to be in a spatial data format. We also recommend agencies require all SEM measurements and the coordinate it was recorded at (also in spatial data). Some landfills already report this information, but it's in a print table, which is too time intensive for a state agency to turn into spatial data.

Recommendation: Given the U.S. EPA's findings of widespread noncompliance, and as the climate crisis intensifies, Oregon DEQ needs to take a stronger stance in monitoring operators. DEQ should require operators to transfer the data they generate for annual and semiannual reports directly into spatial data formats.

We also recommend that regulators require spatial data on the location of gas extraction wells. Oregon DEQ could then visualize all of this data (integrated monitoring, instantaneous monitoring, SEM paths, Gas Collection and Control infrastructure, leaks detected by satellites, etc.) simultaneously using GIS software. This is important because it allows them to efficiently identify gaps in methane gas collection infrastructure and SEM results including exceedances and integrated monitoring measurements. Regulatory agencies need a complete picture of the puzzle, and allowing operators to spread those puzzle pieces across different reports and in unusable formats wastes public agencies' resources and hinders their ability to conduct oversight.

The Limits of SEM: Additional Solutions to Mitigating and Preventing Landfill Methane

SEM is a critical tool for identifying and mitigating methane leaks from landfills. However, there are more solutions already in use that operators and regulators can leverage to more effectively prevent harmful air emissions. Remote sensing, both passive (solar spectrometer) and active (Lidar), are promising avenues to enhance methane monitoring. Sensors are mounted on planes, satellites, and even drones, which then fly over landfills and detect methane plumes and concentrations at various scales depending on the air/spacecraft and instrument.

The White House National Strategy to Advance an Integrated U.S. Greenhouse Gas Measurement, Monitoring, and Information System notes that remote sensing has found many preventable methane leaks that are currently going undetected by traditional SEM.[37] Recent findings from remote sensing technology have demonstrated that methane emissions are much higher than formula estimates by the EPA.[38] Remote sensing technology has been used to reduce methane emissions and associated environmental justice burdens posed by other air pollutants associated with methane leaks.[39]

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[37] Greenhouse Gas Monitoring and Measurement Interagency Working group. (2023). National Strategy To Advance an Integrated U.S. Greenhouse Gas Measurement, Monitoring, and Information System. The White House. https://www.whitehouse.gov/wp-content/uploads/2023/11/NationalGHGMMISStrategy-2023.pdf
[38] Daniel H. Cusworth et al., Quantifying methane emissions from United States landfills.Science383,1499-1504(2024).DOI:10.1126/science.adi7735
[39] Daniel H Cusworth et al 2020 Environ. Res. Lett. 15 054012

There are readily available advanced methane detection technologies that can detect and pinpoint methane leaks at landfills, as illustrated in EPA's draft White Papers issued in Fall 2024, EPA's Landfill Methane Emissions Workshop in April 2021, EPA's Methane Detection Workshop in August 2021, CARB's Public Workshop on Landfill Methane Emissions in California in December 2022, and EPA's LMOP Webinar on Detecting Landfill Methane Emissions with Drones in September 2023.[40] Technology providers with drone surveying capabilities at landfills include ABB, Aerometrex, Bridger Photonics, Project Canary, Scientific Aviation, SeekOps, and SnifferDrone, among others. Airborne and satellite remote sensing are currently offered by Carbon Mapper and GHG Sat. Drones can survey a full landfill footprint with precision using point sensing or active imaging, measuring methane concentration in parts per million (ppm) or parts per million per meter (ppm-m). One drone provider has its technology deployed at over 150 landfills nationwide.[41] Stationary and land-based methane sensors can be placed strategically to support rapid and ongoing leak detection and repair on the active working face. These methods are the next wave in "smart" landfill design and can identify methane hot spots via always-on sensors on low towers or tripods on the landfill surface – meaning a methane spike can be found and dealt with quickly.

Recommendation: Oregon policymakers should ensure landfills move into the 21st century by requiring advanced methane sensing technology deployment that makes methane emissions visible, accurate and actionable. Both California and Colorado are building out programs that require owner-operators to respond to methane leaks detected by satellites orbiting the earth operated by third party institutions such as Carbon Mapper and GHG Sat.[42]

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[40]Greenhouse Gas Monitoring and Measurement Interagency Working group. (2023). National Strategy To Advance an Integrated U.S. Greenhouse Gas Measurement, Monitoring, and Information System. The White House. https://www.whitehouse.gov/wp-content/uploads/2023/11/NationalGHGMMISStrategy-2023.pdf
[41]Greenhouse Gas Monitoring and Measurement Interagency Working group. (2023). National Strategy To Advance an Integrated U.S. Greenhouse Gas Measurement, Monitoring, and Information System. The White House. https://www.whitehouse.gov/wp-content/uploads/2023/11/NationalGHGMMISStrategy-2023.pdf
[42] https://carbonmapper.org/ and https://www.ghgsat.com/en/

Diverting Organic Waste

Given that methane generation is the byproduct of placing organic waste in landfills, an obvious solution is to stop placing organic waste into landfills. Food rescue, food waste as an animal feedstock, composting food waste, placing synthetic organics (inorganic/organic hybrids for example carpet) in anaerobic digesters, and other forms of waste sorting are desirable alternatives to landfilling or incineration. These strategies preserve space in landfills for other uses, preventing or significantly delaying the need for landfill expansions and, depending on the policy, make progress towards zero-waste circular economies.

It's critical to note that methane is generated over the course of decades. Therefore, while organic diversion is an important solution to implement, we will need to monitor and mitigate methane from active and closed landfills decades into the future regardless.

CONCLUSION

In this report, we analyzed 36 Surface Emissions Monitoring (SEM) reports from eight currently operating municipal solid waste landfills in Oregon. We found that landfills in Oregon have varying levels of compliance with state regulations. Additionally, although legal, owner-operators under-report key pieces of information, which make it hard for regulators to ensure full compliance with the law. The Oregon DEQ needs to act quickly to remedy this situation by requiring owner-operators to monitor larger sections of their landfills and use other forms of monitoring when walking SEM is not possible or to support walking SEM with early identification of leaking emissions. Landfills are responsible for 90% of Oregon's industriously produced methane emissions ahead of both enteric fermentation (cattle) and the oil and gas sector. Curbing the pollutant is key to mitigating climate damage in the immediate future. The technology is available, and taking advantage of it is low hanging fruit for fighting the climate crisis.

Recommendations Review:

1. Use Advanced Methane Sensing Technology. Gathering this comprehensive data set will lead to rapid mitigation of super-emitter leaks, improved methane capture for use in local energy generation or methane destruction through enclosed flaring.

- The Oregon Department of Environmental Quality (DEQ)[43] should immediately move to require the use of advanced methane detection technology such as drones.

- Require landfill operators to respond to third party satellite methane detection systems, which provide comprehensive and more accurate measurements of the concentration of methane plumes, the direction of methane plumes off the landfill property, and the exact location of emission exceedances from landfills.

2. Update regulations to require Surface Emissions Monitoring (SEM) on all areas of landfills

   - Require fixed monitors for real time methane tracking in unsafe or other areas to ensure full coverage and to protect workers from hazards of conducting walking SEM. This requirement should also be instituted for landfills with high volumes of odor complaints from nearby communities.

   - Include steep slopes, closed cells, locations with covering vegetation and unspecified exemptions.

   - Actionable emissions data combined with mitigation strategies such as vertical and horizontal gas collection is critical for reducing greenhouse gas impacts and associated air toxics such as VOCs, hydrogen sulfide, forever chemicals and fine particulate matter thereby improving air quality and climate mitigation.

3. Oregon DEQ should immediately address reporting gaps by updating their regulations to require landfill owners and operators who are required to conduct surface emissions monitoring to:

   - Report all data in a spatial data format such as a shapefile, which makes for more efficient analysis of data gathered through surface emissions monitoring.

   - Report and identify the areas exempted from monitoring and report the reasons for those exemptions.

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[43] Throughout this report we emphasize Oregon because these are the arenas at which Beyond Toxics focuses their advocacy. Our findings could be replicable in other states. Thus regulatory recommendations are likely also applicable to other U.S. states.

- Report measured concentration of methane in ppm for each instantaneous SEM reading and integrated monitoring results.
- The SEM path walked by operators.
- Gas Control and Collection System Infrastructure– Gas extraction wells, piping, landfill cover.

4. To prevent future potent methane emissions, advance mandatory organic diversion policies requiring consumers and haulers to sort organic waste so that food waste can be used as a resource that is sent to facilities other than landfills to make compost and other products thereby preventing future generation of methane in landfills.

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