Oregon

Tina Kotek, Governor

Department of Environmental Quality
Eastern Region Eugene Office
475 NE Bellevue Dr., Suite 110
Bend, OR 97701
(541) 388-6146
FAX (541) 388-8283
TTY 711

July 30, 2024

Peter and David Norrie
1800 SW First Avenue #400
Portland, OR 97201

Re: WQ: CAS: Variance Denial: 248-23-000475-VAR: 55335 Hen Lane; T.20S; R.10E; Sec. 26D; Tax Lot 3100; Oregon Water Wonderland Unit No. 1, 0.98 Acres; Deschutes County.

Dear Peter and David Norrie,

This correspondence verifies that a variance hearing provided for under Oregon Administrative Rules (OAR) 340-071-0430, was held at 11:30 am on May 29, 2024 at the property referenced above on Hen Lane in south Deschutes County. The purpose of the hearing was to provide a forum for the presentation of supportive facts to show that strict compliance with certain rules regulating onsite sewage disposal are inappropriate, or that special physical conditions at the site render strict compliance unreasonable, burdensome or impractical. The proposal and associated supporting information you provided with the application was presented during the recorded hearing.

Variance Decision:
Standards found in Oregon Administrative Rules Chapter 340, Division 071 & 073 have been developed to protect public health and the environment in Oregon. The variance officer's duty is to determine if in their professional judgement, the system proposed for this variance consideration is adequate to safeguard the public's health and the environment if variance from the requested standards in the Oregon Administrative Rules are granted. In my opinion, your proposal does not adequately address all of the limitations that are present at the site.

Based on review and evaluation of the variance record, observations made at the site, and testimony given during the variance hearing, I regret to inform you that your variance request is hereby denied. It is my judgement that the proposed system has the potential to present a health hazard risk and/or have significant adverse impact to groundwater or surface water quality if allowed.

Some factors for decision:

- Current Oregon Administrative Rules require that the water table is at least 24 inches below the ground surface throughout the year, and a minimum 24-inch separation is maintained between a water table and the bottom of the sand filter. The proposal assumes a seasonally high shallow permanent water table of 12 inches below ground surface; however, based on observed soil characteristics from the site evaluation by Deschutes County on September 19, 2023 and during the variance officer's site visit on April 23, 2024, it is likely that saturated conditions occur at even shallower depths within the proposed area.
- Southern Deschutes County is an area where nitrate contamination is of concern due to coarse rapidly draining soils overlaying a shallow unconfined aquifer. This area, Oregon Water Wonderland Area no.1 is served by a public water source however many lots that are

adjacent to this area are served by private wells and draw from this aquifer for drinking water. Even with a proposed design capable of producing high quality effluent before discharging into the soil, treatment does not eliminate all nutrients and pathogens from the wastewater.

- Even with a septic design capable of producing high quality effluent, the treatment proposed in conjunction with continued development in the area may still present a risk to the groundwater that may be irreversible to the shallow aquifer system from both an environmental health and public health perspective.
- Management area 11 represents a high risk to adverse impacts to groundwater, and is one of the three most susceptible to continued loading
- This site has a wetland that has been delineated adjacent to the subject area that was evaluated

Variance Proposal:
The proposal was to install an Orenco AdvanTex®AX20RTN-Mode 3B Alternative Treatment Technology (ATT) System prior to discharge to RidNox post anoxic tank (solid phase flow through filter) followed by a 250 square foot reduced sized Bottomless Sand Filter (BSF) system constructed on an additional 16 inches of sand filter media to the ground surface (total of 22 inches). This provides 30 inches of separation between the bottom of the conventional bottomless sand filter design at its lowest point and the highest potential groundwater in this area (assumed at 14 inches bgs for this design).

You are seeking a variance from the following Oregon Administrative Rules regulating onsite wastewater treatment systems:

1) **OAR 340-071-0130(1) which states: (1)** Protection of public waters from public health hazards. An agent may not authorize installing or using a system that is likely to pollute public waters or create a public health hazard. If, in the judgment of the agent, the minimum standards in this division will not adequately protect public waters or public health on a particular site, the agent must require a system to meet requirements that are protective. This may include but is not limited to increasing setbacks, increasing drainfield sizing, or using an alternative system. The agent must provide the applicant with a written statement of the specific reasons why more stringent requirements are necessary.

2) **OAR 340-071-0150(4)(a)(B) which states: (B)** All criteria for approving a specific type or types of systems, as described in this division are satisfied.

3) **OAR 340-071-0290(4)(a) which states: (4)** Sand filter without a bottom. Sites may use a bottomless sand filter if the site meets the criteria in this section and section (3) of this rule. **(a)** Saprolite; fractured bedrock; gravel; or soil textures of sand, loamy sand, or sandy loam occur in a continuous section at least 2 feet thick in contact with and below the bottom of the sand filter.

4) **OAR 340-071-0290(4)(d) which states: (4)** Sand filter without a bottom. Sites may use a conventional sand filter without a bottom (BSF) if the site meets the criteria in this section and section **(3)** of this rule. **(d)** The water table is at least 24 inches below the ground surface throughout the year, and a minimum 24-inch separation is maintained between a water table and the bottom of the sand filter.

Site History:
Deschutes County conducted a site evaluation with two test pits on the subject property on August 9, 2023 which was denied on August 10, 2023. The denied use of an onsite wastewater system was due to observed conditions associated with saturation that are used to determine water table levels and site suitability. These conditions are present above 24 inches, and were estimated to be between 12 and 17 inches below ground surface (bgs), though the soil notes also suggest that these conditions may occur shallower based on soil characteristics and depleted soil matrix colors closer to the ground surface.

A site visit was made by the variance officer on May 8, 2024 to observe the site and proposed system layout. The stake-out of the bottomless sand filter locations appeared to match the proposal site plan and were located near the existing test pits 1&2 from the site evaluation conducted by Deschutes County. Loose Stripping and staining were observed near the ground surface in all pits, indicating that the depth of seasonal high saturation could be higher than the assumed depths used for the proposed system.

Conclusion:
The decision to deny your variance request is a final Order of DEQ. You (or any other person who is adversely affected) have the right to appeal this Order to the Circuit Court for Marion County or the Circuit Court for the county within which you reside or have a principal business office, pursuant to ORS 183.484. To appeal you must file a petition for judicial review with the Circuit Court within 60 days from the day this Order was served on you. If this Order was personally delivered to you, the date of service is the day you received the Order. If this Order was mailed to you, the date of service is the day it was mailed, not the day you received it. If you do not file a petition for judicial review within the 60 day time period, you will lose your right to appeal.

Please feel free to contact me if you have any questions concerning this decision. I can be reached by telephone at (541) 776-6130 or by email at david.hurley@deq.oregon.gov

Sincerely,

David Hurley

David Hurley, REHS
Variance Officer
On-Site Sewage Disposal Program
Water Quality Division

cc:

Todd Cleveland, REHS; Deschutes County Onsite Wastewater Division, 117 NW Lafayette Ave, Bend OR 97703

Brian T. Rabe, CPSS, WWS; Principal Soil Scientist, of Elkhorn Consulting LLC, 14833 Goodrich Creek Lane, Baker City, OR 97814
Robert D. Vinje, 16621 Graywolf Lane, Sunriver, OR 97707
Three Rivers South LLC, 946 SW Veterans Way, #102-444, Redmond, OR 97756
Carrie Michelle Records, 19316 Soda Springs Drive, Bend, OR 97702
Cindy J. and Marcia D. Morales, 32645 Santa Cruz, Lake Elsinore, CA 92530
Wallace N. Livingston, 16723 Gross Drive, Bend, OR 97707
Peter J. and Marian Ness, 8410 SW Godwin Court, Portland OR 97223

STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY

Certificate of Mailing

Concerning the matter of a notice of variance hearing for property owned by Peter C. Norrie in Deschutes County, Oregon. Re: WQ: CAS: Variance Assignment: 248-23-000475-VAR: 55335 Hen Lane; T.20; R.10E; Sec. 26D; Tax Lot 3100; Lot 13, Block 11 Oregon Water Wonderland Unit No. 1, 0.98 Acres.

I certify that I mailed the attached letters containing the notice of variance hearing about this matter to each of the following persons on the date shown below:

Todd Cleveland, REHS; Deschutes County Onsite Wastewater Division, 117 NW Lafayette Ave, Bend OR 97703
Brian T. Rabe, CPSS, WWS; Principal Soil Scientist, of Elkhorn Consulting LLC, 14833 Goodrich Creek Lane, Baker City, OR 97814

In Addition, To The Following Adjacent Property Owners:
Robert D. Vinje, 16621 Graywolf Lane, Sunriver, OR 97707
Three Rivers South LLC, 946 SW Veterans Way, #102-444, Redmond, OR 97756
Carrie Michelle Records, 19316 Soda Springs Drive, Bend, OR 97702
Cindy J. and Marcia D. Morales, 32645 Santa Cruz, Lake Elsinore, CA 92530
Wallace N. Livingston, 16723 Gross Drive, Bend, OR 97707
Peter J. and Marian Ness, 8410 SW Godwin Court, Portland OR 97223

Mark Lannigan
Signature

Mark Lannigan
Name

5/24/24
Date

Oregon
Tina Kotek, Governor

Department of Environmental Quality
Eastern Region Bend Office
475 NE Bellevue Dr., Suite 110
Bend, OR 97701
(541) 388-6146
FAX (541) 388-8283
TTY 711

May 21, 2024

Peter C. and David D. Norrie
1800 SW First Ave #400
Portland, OR 97201

Re: WQ: CAS: Variance Assignment: 248-23-000475-VAR: 55335 Hen Lane; T.20S; R.10E; Sec. 26D; Tax Lot 3100; Lot 13, Block 11 Oregon Water Wonderland Unit No. 1; 0.98 Acres; Deschutes County.

Dear Peter and David Norrie,

The Department of Environmental Quality is in receipt of your onsite wastewater variance application and proposal. The application has been assigned to me for further action. I plan to hold an information gathering hearing (as provided under OAR 340-71-430) regarding your proposal on **Wednesday, May 29, 2024, at 11:30 am** at the subject property. Your proposal and system plans have been prepared by Brian T. Rabe, CPSS, WWS; Principal Soil Scientist, of Elkhorn Consulting LLC. It is my understanding that Mr. Rabe will be present to answer any questions regarding the proposal.

Deschutes County conducted a site evaluation with three test pits at the subject property on August 8, 2023, where a denial was issued for the use of an onsite wastewater system on August 9, 2023. The primary reason for denial was due to the predicted depth to the seasonally high permanent water table being less than 24 inches below the ground surface. Observed conditions associated with saturation that are used to determine water table levels and site suitability were observed less than 24 inches from the ground surface between 18 and 19 inches below ground surface (bgs).

Southern Deschutes County has a shallow water table that is typically unconfined in porous pumice soils and is susceptible to contamination from soluble and mobile constituents. The most common constituent of concern is nitrate-nitrogen from septic systems.

The proposal is to overcome the site limitations by installing an Orenco® AdvanTex AX20N-Mode 3B Alternative Treatment Technology (ATT) System followed by a reduced sized Bottomless Sand Filter (BSF) system constructed with a reinforced concrete berm. The nitrate-nitrogen is proposed to be further reduced with a post-anoxic RidNOx unit. You are seeking variance from the following Oregon Administrative Rules (OARs):

OAR 340-071-0135(1): which addresses Department of Environmental Quality approval of new or innovative technologies, materials, or designs for onsite systems.

OAR 340-071-0150(4)(a)(B) which states: All criteria for approving a specific type or types of systems, as described in this division are satisfied.

OAR 340-071-0290(4)(d) which states: Bottomless sand filter. Sites may use a conventional sand filter without a bottom (BSF) if the site meets the criteria in this section and section (3) of this rule. (d) The water table is at least 24 inches below the ground surface throughout the year, and a minimum 24-inch separation is maintained between a water table and the bottom of the sand filter.

Sometimes during a hearing, it can be determined that other rules or standards need to be considered in order to finalize a proposal. Should this occur, based on the proposal, site observations, and other considerations, I may or may not proceed with the hearing and my final decision process until further information is provided.

Notice of the hearing will be mailed to the neighboring property owners and to the Deschutes County Onsite Wastewater Division staff, see copy enclosed. However, all persons who wish to attend the hearing are welcome. The hearing will provide an opportunity for you and others to offer additional facts or reasons either in support of or in opposition to the proposal and requested variance to the rules.

Please remember, it is the burden of the applicant to show that strict compliance to the rules or standards are inappropriate, or that special physical conditions render strict compliance with the rules or standards to be unreasonable, burdensome or impractical. Additionally, the applicant needs to provide prudent reasonable justification in how their proposal will still protect both public health and the environment.

Deschutes County Onsite Wastewater Division staff will get a copy of your proposal and will have an opportunity to provide both written and verbal comments on your proposal. Others wishing to review your proposal can contact me.

The Department is committed to accommodating people with disabilities. Please notify DEQ of any special physical or language accommodations needed as far in advance of the hearing date as possible. To make any of these arrangements please contact, David Hurley, at (541) 776-6130 or toll free at (866)-863-6668, or by email at: david.hurley@deq.oregon.gov. People with hearing impairments can call DEQ's TTY at (800)-735-2900.

If you have questions concerning the variance process or hearing arrangements, please give me a call. You may also visit https://ordeq.org/septicvariance for more information about variances.

Sincerely,

David Hurley

David Hurley, REHS
Natural Resource Specialist 4
Variance Officer – Onsite Wastewater Program

cc: Todd Cleveland, REHS; Deschutes County Onsite Wastewater Division, 117 NW Lafayette Ave, Bend OR 97703
Brian T. Rabe, CPSS, WWS; Principal Soil Scientist, of Elkhorn Consulting LLC, 14833 Goodrich Creek Lane, Baker City, OR 97814

In Addition, To The Following Adjacent Property Owners:

Robert D. Vinje, 16621 Graywolf Lane, Sunriver, OR 97707
Three Rivers South LLC, 946 SW Veterans Way, #102-444, Redmond, OR 97756
Carrie Michelle Records, 19316 Soda Springs Drive, Bend, OR 97702
Cindy J. and Marcia D. Morales, 32645 Santa Cruz, Lake Elsinore, CA 92530
Wallace N. Livingston, 16723 Gross Drive, Bend, OR 97707
Peter J. and Marian Ness, 8410 SW Godwin Court, Portland OR 97223

Encl. Neighbor Notice

Oregon
Tina Kotek, Governor

Department of Environmental Quality
Eastern Region Bend Office
475 NE Bellevue Dr., Suite 110
Bend, OR 97701
(541) 388-6146
FAX (541) 388-8283
TTY 711

May 21, 2024

Hearing Date/Time is 11:30 AM on May 29, 2024

Re: WQ: CAS: Variance Assignment: 248-23-000475-VAR: 55335 Hen Lane; T.20S; R.10E; Sec. 26D; Tax Lot 3100; Lot 13, Block 11 Oregon Water Wonderland Unit No. 1, 0.98 Acres; Deschutes County.

Dear Resident:

Neighbors of yours, Peter and David Norrie, own the property referenced above and herein to be referred to as the "Property", has submitted an application to the Oregon Department of Environmental Quality (DEQ) requesting a "For Cause Variance" from Oregon Administrative Rules regulating Onsite Wastewater Treatment Systems. The Property has been denied due to conditions associated with saturation being within 24 inches of the ground surface.

In the variance application, the applicant's proposal is to install an Orenco® AdvanTex AX20N-Mode 3B Alternative Treatment Technology (ATT) System followed by a reduced sized Bottomless Sand Filter (BSF) system with an additional RidNOx unit for nitrate-nitrogen reduction.

For more detail, please review the enclosed variance hearing notice.

A variance to the Oregon Administrative Rules regulating Onsite Wastewater Treatment Systems may be granted if a variance officer finds that:

1. Strict compliance with the rules or standards are inappropriate: or

2. Special physical conditions render strict compliance unreasonable, burdensome or impractical.

Part of the variance process involves an information gathering hearing. In this hearing, information is shared about the site conditions, rule requirements, public health or environmental protection concerns, and how the proposed system design overcomes these concerns. It is also an opportunity for all parties involved, including adjacent property owners, to voice any concerns they might have with the proposal. Department policy requires a variance officer to inform all adjacent property owners of the variance hearing date, time and place. You are not required to attend this hearing, but can, should you desire to do so.

The information gathering hearing for this variance proposal is to begin at **1:30 PM, Wednesday, April 24, 2024,** at the subject property.
The Department is committed to accommodating people with disabilities. Please notify DEQ of any special physical or language accommodations needed as far in advance of the hearing date as possible. To make any of these arrangements please contact, David Hurley, at (541) 776-6130 or toll free at (866)-863-6668,, or by email at: david.hurley@deq.oregon.gov. People with hearing impairments can call DEQ's TTY at (800)-735-2900.

If you have any questions concerning this variance process or hearing arrangements, please give me a call.

Sincerely,

David Hurley

David Hurley, REHS
Natural Resource Specialist 4
Variance Officer – Onsite Wastewater Program

cc: Todd Cleveland, REHS; Deschutes County Onsite Wastewater Division, 117 NW Lafayette Ave, Bend OR 97703
Brian T. Rabe, CPSS, WWS; Principal Soil Scientist, of Elkhorn Consulting LLC, 14833 Goodrich Creek
Pineriver Homes, 23410 Highway 20, Bend, OR 97701

In Addition, To The Following Adjacent Property Owners:

Robert D. Vinje, 16621 Graywolf Lane, Sunriver, OR 97707
Three Rivers South LLC, 946 SW Veterans Way, #102-444, Redmond, OR 97756
Carrie Michelle Records, 19316 Soda Springs Drive, Bend, OR 97702
Cindy J. and Marcia D. Morales, 32645 Santa Cruz, Lake Elsinore, CA 92530
Wallace N. Livingston, 16723 Gross Drive, Bend, OR 97707
Peter J. and Marian Ness, 8410 SW Godwin Court, Portland OR 97223

Encl. Variance Hearing Notice

ELKHORN CONSULTING LLC

14833 Goodrich Creek Lane
Baker City, OR 97814 • 503-881-1604
elkhornconsultingllc@gmail.com

November 3, 2023

Variance Officer
Onsite Variance Program
DEQ - Eastern Region Water Quality
475 NE Bellevue, Ste. 110
Bend, Oregon 97701

SUBJECT: Formal Variance Request – Peter C. Norrie and David D. Norrie – T20S, R10E, Section 26D Tax Lot 3100 (0.98 acres), Deschutes County, South of Bend, Oregon.

Dear Variance Officer:

A formal variance from selected onsite rules is hereby requested under the provisions of Oregon Administrative Rules, Chapter 340, Division 071, Section 0415 (OAR 340-071-0415).[1] The property is located at 55335 Hen Lane, south of Bend in Deschutes County, Oregon (Site) (Figure 1) and consists of 0.98 acres. A Tax Lot map is attached in Appendix A and a copy of the Deed is attached in Appendix B.

Background

Deschutes County conducted a site evaluation for Tax Lot 3100 on August 9, 2023 and issued a denial on August 10, 2023. The denial was based on conditions associated with saturation noted at 12 to 17 inches below the ground surface (bgs) in 3 test pits. Test Pit 2 represented the best conditions and was in the middle of the eastern end of the lot. The other 2 test pits were closer to the northeast and southeast corners of the lot. The primary reasons cited for the denial was the predicted depth to the highest level attained by a fluctuating permanent water table and the risk to groundwater quality that could result from increased nitrogen loading to the underlying aquifer. A copy of the site evaluation documentation from Deschutes County is attached in Appendix C.

Southern Deschutes County has a shallow water table that is typically unconfined in porous pumice soils and is susceptible to contamination from soluble and mobile constituents. The most common constituent of concern is nitrate-nitrogen from septic systems. The onsite rules require a minimum of 24 inches of separation from the upper limit of the water table to the bottom of a bottomless sand filter.

Soils

There is no published soil survey information for the Site or surrounding area. The nearest available survey information is about 570 feet east of the Site. Based on the similarity of elevation and landscape position, it is assumed that the test pits would have been delineated within Map Unit 144A, Sunriver sandy loam 0 to 3% slopes. Sunriver soils are described as very deep, somewhat poorly drained soils that formed on pumice mantled stream terraces. The typical profile generally consists of the following:

[1] Onsite wastewater treatment systems, 340 OAR § 340.71. (2020).

- Up to 2 inches of organic material underlain by,
- 5 inches of very dark gray ashy sandy loam underlain by,
- 15 inches of dark gray ashy loamy coarse sand underlain by,
- 9 inches of light brownish gray ashy coarse sand underlain by,
- 31 inches of very dark gray sandy loam.

The Sunriver series is described as having a water table that rises to about 2 to 4 feet below the surface from April to June.

The characteristics observed at the Site are reasonably similar to the Sunriver series. The primary differences between the conditions noted in the 2023 soil notes and the conditions typical for the Sunriver series are related primarily to coloration (browner colors) that are more indicative of the Shanahan series.

Preliminary Assessment

The Site was reviewed by Brian Rabe, CPSS, WWS, on September 28, 2023. The purpose was to review the Site conditions and assess the potential to design a modified bottomless sand filter that incorporates additional fill to create adequate separation from the underlying water table following advanced secondary treatment meeting the criteria for Treatment Standard 2 (TS2). The proposed bottomless sand filter area is located on this highest ground, represented by the area east of Test Pit 2 in the 2023 site evaluation (eastern part of the lot - see Figure 2 and Appendix C).

Other Considerations

This parcel and developed parcels in the surrounding area are primarily served by a public water system, operated by Oregon Water Wonderland Unit I Sanitary District.

A search of the database of the Oregon Department of Water Resources was conducted for the section that the subject property lies within (Section 26 of Township 20 South, Range 10 East of the Willamette Meridian). There are about 14 records on file for this section and another 18 records in Section 25. A total of 2 well logs were identified that could be tied to specific parcels within about one-quarter of a mile of the subject property (Appendix D).

The well for Tax Lot 8000 is about 950 feet southwest of the proposed bottomless sand filter area and was completed on July 5, 2007 to a depth of 60 feet. Water was described as being first found at a depth of 30 feet in a layer of "silty black sand" and had a static water level of 8 feet bgs on the date of completion with a reported yield of 1.5 gallons per minute with 58 feet of drawdown after 1 hour.

The well for Tax Lot 3700 is about 1,000 feet northwest of the proposed bottomless sand filter area and was completed on June 4, 1992 to a depth of 360 feet. Water was described as being first found at a depth of 355 feet in a layer of "cemented gravel" and had a static water level of 9 feet bgs on the date of completion with a reported yield of 28 gallons per minute with 23 feet of drawdown after 4 hours.

The regional groundwater gradient, as indicated in a study published by the U.S. Geological Survey[2], is to the west-northwest toward the Deschutes River. The subject property is located within Management Area 11, which recommends a 79% to 100% reduction from the base scenario loading (standard

systems) for existing and future homes. The results of the Nitrate Loading Management Model within the study (Figures 25 and 26) suggest that this area represents a moderate to high risk of adverse impacts to groundwater quality unless a high level of treatment is achieved. According to the interactive map for Oregon Domestic Well Testing, this part of Deschutes County has an average nitrate-nitrogen concentration in domestic wells of 1.71 milligrams per liter (mg/L) with 18.83% exceeding 3 mg/L and 1.17% exceeding 10 mg/L (based on 1,200 test results, viewed on October 17, 2023).[3]

Formal Variance Request

Variance is requested from the following rules:

1. OAR 340-071-0135(1) – which addresses Department of Environmental Quality (DEQ) approval of new or innovative technologies, materials, or designs for onsite systems.[1]
2. OAR 340-071-0150(4)(a)(B) – which requires all criteria for approval shall be met.[1]
3. OAR 340-071-0290(4)(d) – which states that the water table is at least 24 inches bgs throughout the year.[1]

This request seeks to overcome the limitations of this Site by treating the sewage using a recirculating textile filter system (AdvanTex® AX20N-Mode 3B) prior to discharge into an elevated bottomless sand filter. AdvanTex units do an effective job of reducing five-day biochemical oxygen demand and total suspended solids to below 10 mg/L. Nitrogen is often fully converted from ammonia-nitrogen to nitrate-nitrogen (greater than 90%). Operating in Mode 3, the AdvanTex unit reduces total nitrogen sufficiently to meet TS2 (less than 30 mg/L). The DEQ approval of the AX20N in Mode 3B includes an ultraviolet light to satisfy the pathogen reduction requirements of TS2. However, this request includes the use of a modified bottomless sand filter to achieve the pathogen reduction requirements of TS2 instead of an ultraviolet light and, therefore, this configuration does not have (or need) an ultraviolet disinfection unit. The "B" designation indicates the AdvanTex unit is configured with the second pump for the final discharge to the modified bottomless sand filter.

The AX20 systems in the La Pine project produced effluent with an average total nitrogen (TN) concentration of 17 mg/L. A post-anoxic process similar to what is proposed, referred to at the time as Nitrex, was tested following treatment through a lined intermittent sand filter. The Nitrex unit consisted of a 2-compartment concrete tank filled with what was described as a proprietary carbon media (wood chips).

The sand filters produced an average TN of about 50 mg/L and the final effluent from the Nitrex units had an average TN of 2.4 mg/L, representing a 96% reduction from the 60 mg/L average TN concentration in the septic tank effluent. So long as there is sufficient soluble carbon being released from the wood chips, and the hydraulic loading rate is low enough to allow the dissolved oxygen in the effluent to approach zero, the NO_3-N concentration will typically be below the method detection limit. What nitrogen remains in the effluent will often be organic, as measured by the Total Kjeldahl Nitrogen (TKN) method. The organic nitrogen may be subsequently oxidized in the bottomless sand filter, but is just as likely to be retained or

[2] Morgan, D. S., & Hinkle, R. S. (2007). *Evaluation of approaches for managing nitrate loading from on-site wastewater systems near La Pine, Oregon*, (Scientific Investigations Report 2007-5237). Reston, VA: U.S. Geologic Survey.

[3] ARC GIS Online. (n.d.). Oregon domestic well testing, [Data file]. Retrieved July 14, 2023, from ARC GIS Online: https://www.arcgis.com/apps/MapSeries/index.html?appid=c0d7daea497049c1a686d07dab7106e5

recycled in the biomass that develops in the sand filter media. Therefore, the concentration of nitrogen leaving the bottomless sand filter after treatment through both the AX20 and the RidNOx unit is expected to be even lower than the results from the La Pine project.

The RidNOx unit described in this proposal is configured similar to larger units used on several systems permitted under Water Pollution Control Facilities (WPCF) permits and monitored on a regular basis. Some of these units have been in tanks and some have been in lined basins. Typical results from the post-anoxic process (prior to discharge, typically to a soil absorption system) include NO_3-N concentrations near or below the method detection limit and TKN concentrations between 1 and 3 mg/L.

A recent test result (August 2022) from a similarly configured system (predominantly residential sources using AdvanTex treatment with Mode 3-style pre-anoxic denitrification, followed by post-anoxic treatment in tanks filled with wood chips) produced a TKN concentration of 0.68 mg/L and a NO_3-N concentration of 0.13 mg/L for a TN of 0.81 mg/L.

A recent test result (July 2022) from a high-nitrogen source (150 mg/L TKN treated by AdvenTex with alkalinity augmentation to support full nitrification, configured in a Mode 3-style pre-anoxic process, followed by post-anoxic treatment in lined wood-chip beds) produced a TKN concentration of 0.99 mg/L and a NO_3-N concentration of 0.05 mg/L for a TN of 1.04 mg/L. Assuming a maximum 65 to 75% reduction from the starting concentration, the NO3-N concentration entering the post-anoxic process is expected range between 40 and 45 mg/L, similar to the sand filter effluent from the La Pine Project and higher than what is expected from the AX20 in a residential scenario.

Based on the performance of the commercial systems described above, and a typical residential total nitrogen concentration of 60 mg/L, the typical reduction from the base scenario presented in the groundwater study cited previously would be approximately 98 percent.

The initial and replacement bottomless sand filter areas are proposed on the highest ground near the eastern edge of the parcel. This represents an area with the appropriate spatial footprint and meets all required horizontal setback requirements.

Test Pit 2 (2023) was described as:

- Very dark grayish brown (10YR 3/2) loamy coarse sand from 0 to 8 inches with granular structure; friable; with many very fine, and few fine and medium roots; underlain by
- Very dark grayish brown (10YR 3/2) coarse sand from 8 to 26 inches with single grain (structureless) structure; loose; with few very fine, fine, and medium roots; with redoximorphic features described beginning at 17 inches, underlain by
- Dark grayish brown (10YR 4/2) gravelly fine sandy loam from 26 to 45 inches with moderate medium subangular blocky structure; friable; few roots; with redoximorphic features described throughout; underlain by
- Black (10YR 2/1) gravelly sand from 45 to 51 inches with weak medium subangular blocky structure; friable; no roots; with redoximorphic features throughout.

Relative elevation measurements were made at all 4 corners of both the proposed initial and replacement bottomless sand filters as well as at the existing ground surface adjacent to the described profiles for all three test pits. The highest level of the water table is expected to be 14 inches below the existing ground

surface at the lowest point within the area proposed for the initial and replacement sand filters based on the depth to the redoximorphic features described in Test Pit 2 (2023).

The proposed system seeks to overcome this limitation by elevating the modified bottomless sand filter in a manner that provides an additional 6 inches of separation (Figure 3). The sod and underlying sandy soil to a depth of 6 inches within the footprint of the sand filter will be excavated and replaced with sand filter media. An additional 16 inches of sand filter media (total of 22 inches) will be used to exceed the 24-inch separation from shallowest water table depth standard by providing a total separation of 30 inches. In order to optimize the use of the highest available ground and maximize separation from the underlying water table, the sand filters are proposed in a reinforced concrete container with inside dimensions of 16 feet by 16 feet with the south wall of the initial sand filter intended to serve as the north wall of the replacement sand filter at such time as it needs to be installed. The rest of the sand filter will be "conventional" from there up, consisting of 6 inches of underdrain media, 24 inches of sand filter media, 6 inches of drain media (with the distribution laterals), filter fabric, and 6 to 9 inches of backfill. The additional 6 inches of separation is intended to account for any potential mounding that may occur within the concrete container during an extreme weather event in conjunction with the highest predicted rise of the water table.

Deschutes County has noted that the results of the Nitrate Management Loading Model indicated that there was no surplus capacity within Management Area 11 to accommodate additional lots that were denied or otherwise not expected to be approved. In a recent variance hearing for another parcel within Management Area 11, Deschutes County stated that about 18 parcels have been approved through the formal variance process in this area and expressed concern about the cumulative effects of the additional nutrient load on groundwater and surface water quality.

Brian Rabe will need to be involved during the construction of this system to install the lysimeter in the sand filter and oversee the installation of the RidNOx unit. Additional information regarding the installation of the RidNOx unit and the lysimeter, as well as sampling instructions, are described in Appendix E and shown in Figures 4, 5, and 6. The owner agrees to facilitate sampling of the RidNOx effluent in conjunction with routine service visits (twice per year for the first 2 years and annually thereafter) to monitor the performance. Samples will be collected from the pump basin between the RidNOx unit and the sand filter. When the media begins to show signs of depletion (as indicated by average nitrogen concentrations climbing to above 7 mg/L nitrate-nitrogen or 10 mg/L total nitrogen), the owner will schedule media replacement for the following summer when the water table is at least 30 inches below the top of the tank (to prevent displacement of the empty tank by buoyant forces). If this request is approved, a condition of approval will require access be allowed to the treatment system and sand filter by current and future property owners for periodic supplemental third-party sampling.

In addition to the high level of treatment achieved by the AdvanTex treatment system and post-anoxic denitrification process, further treatment of the effluent will occur with predominantly unsaturated flow within the imported sand and native sandy soil beneath the bottomless sand filter (minimum of 24 inches above the highest predicted level of the underlying fluctuating water table). Small doses, coupled with substantial resting periods achieved with pressure distribution (see recommended sand filter plan detail in Figure 4), will facilitate unsaturated, thin-film flow through the soils above the water table. This will further reduce pathogens and other residual contaminants. The subsoil found beneath the sandy surface soils include evidence of both oxidation and reduction of iron. Conditions that support the reduction of iron will reduce nitrate-nitrogen to nitrogen gas since nitrate ions are used as electron acceptors preferentially over iron compounds. This will facilitate additional reduction of nitrate-nitrogen as the highly treated effluent is assimilated into the environment.

As described, the proposed combination of treatment components are expected to produce a final effluent with very high quality and a low potential to impact water quality, human health, or the environment. Given the unique circumstances at this Site, strict compliance with the rules is considered to be unreasonable.

It is acknowledged that detailed plans and specifications will need to be submitted and approved before any construction can take place. It is also understood that if this request is approved, there will be language included that allows the county to allow or require a prescriptive system that is demonstrated to perform equal to or better than what is described in this proposal.

Directions to the Site as well as a map showing the ownership of adjacent parcels along with a list of names and addresses are attached in Appendix F. If you have any questions or comments, please do not hesitate to contact me directly at (503) 881-1604.

Sincerely,
ELKHORN CONSULTING LLC

Brian T. Rabe, CPSS, WWS
Principal Soil Scientist

BTR/ddr
Enc: Figures 1-6, Appendices A-F
c: David Norrie
Todd Cleveland, REHS – Deschutes County

CPSS
Certified Professional
Soil Scientist
BRIAN T. RABE
15239 Exp. 31DEC23
Registered Wastewater Specialist
No. EH-W-448430 Exp. 30SEP24

FIGURES

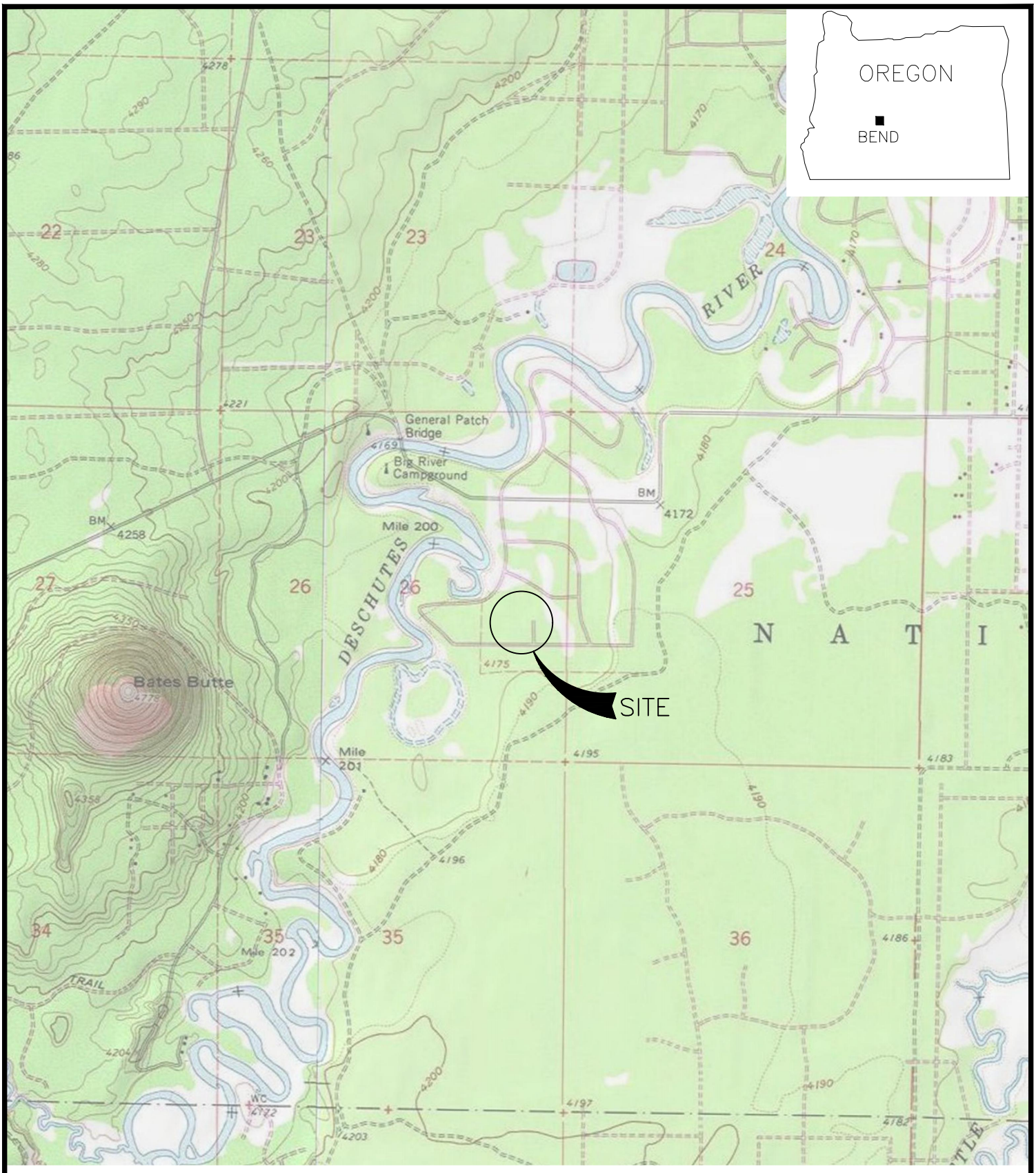

Figure 1. Vicinity Map

0 2,000'

1" = 2,000'

(LOCATIONS AND SCALE ARE APPROXIMATE)

(SOURCE: ©2013 National Geographic Society, i-cubed)

PROJECT NUMBER: 2023006	Formal Variance T20S, R10E, Section 26D, Tax Lot 3100
DATE: 10/16/2023	
DWG NO: 2023006 F1-6.DWG	David Norrie and Peter Norrie 55335 Hen Lane Bend, OR 97707
DWG BY: 6NSG / PROJECT MANAGER: BRIAN RABE	
REVISED:	ELKHORN CONSULTING LLC

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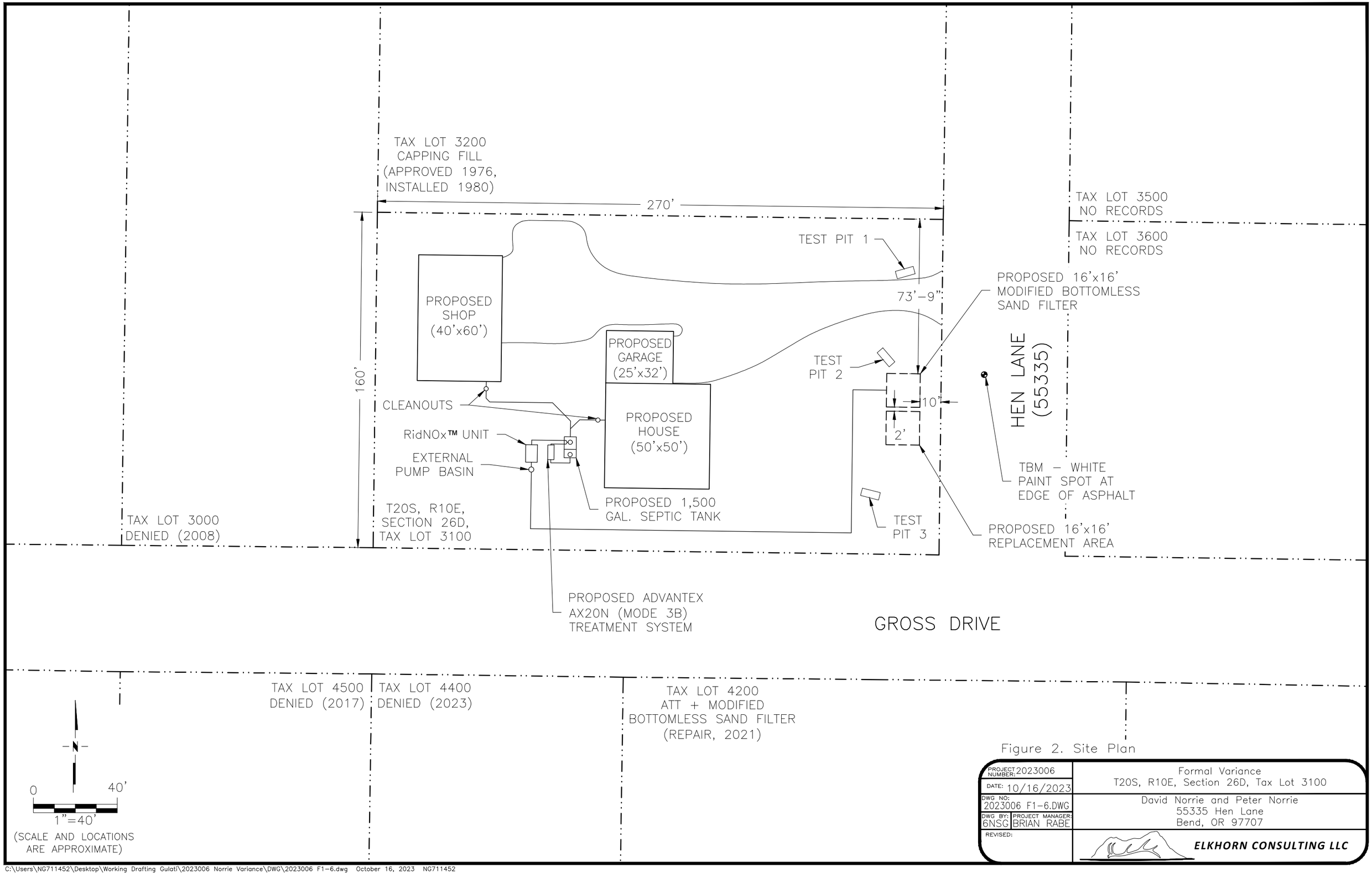

Figure 2. Site Plan

PROJECT NUMBER: 2023006	Formal Variance T20S, R10E, Section 26D, Tax Lot 3100
DATE: 10/16/2023	
DWG NO: 2023006 F1-6.DWG	David Norrie and Peter Norrie 55335 Hen Lane Bend, OR 97707
DWG BY: 6NSG / PROJECT MANAGER: BRIAN RABE	
REVISED:	ELKHORN CONSULTING LLC

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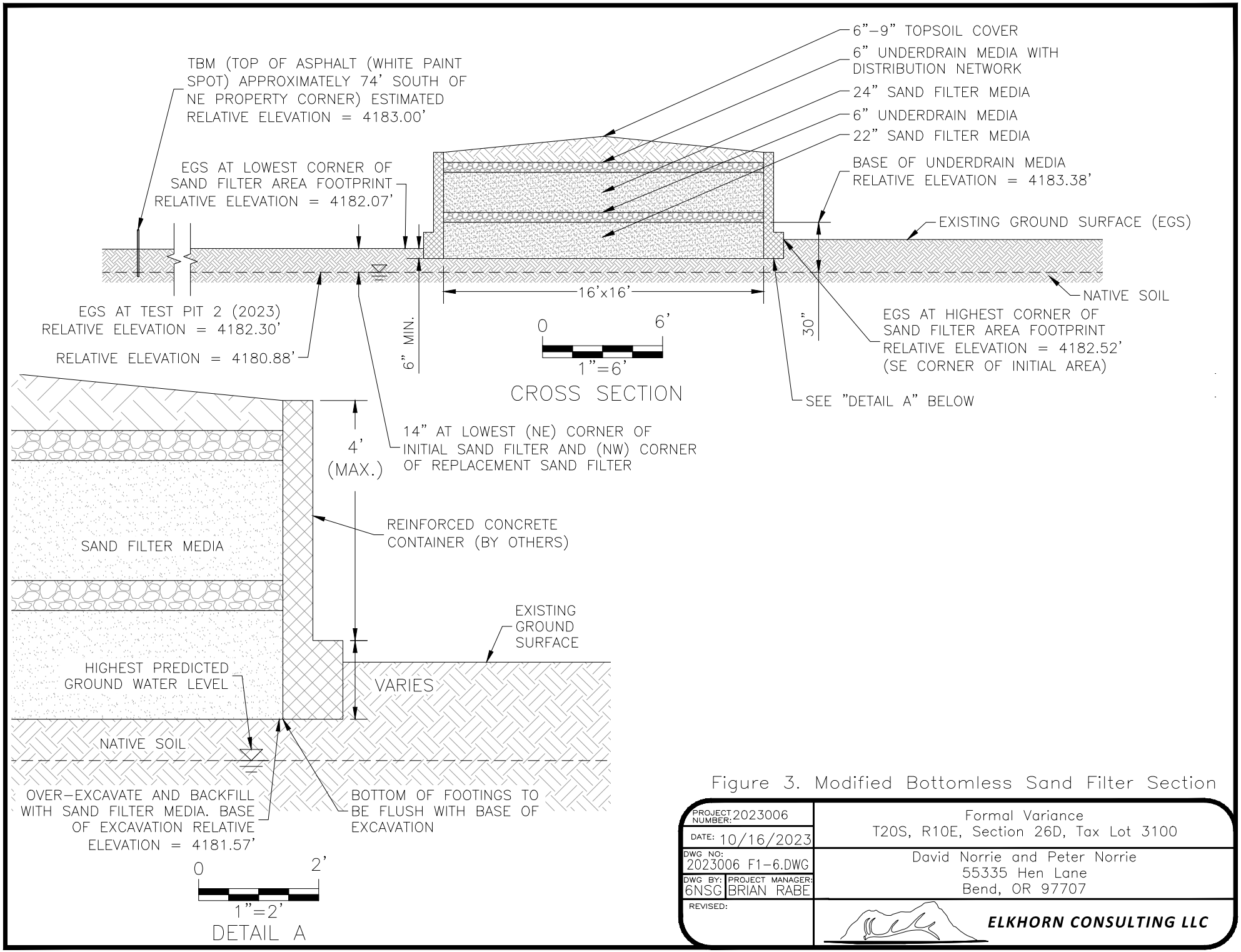


Figure 3. Modified Bottomless Sand Filter Section

PROJECT NUMBER: 2023006	Formal Variance
DATE: 10/16/2023	T20S, R10E, Section 26D, Tax Lot 3100
DWG NO: 2023006 F1–6.DWG	David Norrie and Peter Norrie
DWG BY: 6NSG / PROJECT MANAGER: BRIAN RABE	55335 Hen Lane
REVISED:	Bend, OR 97707
	ELKHORN CONSULTING LLC

2023006 F1–6.dwg October 16, 2023 NG711452

TOTAL OF 64 ORIFICES
0.52 GALLONS PER MINUTE
AT 7.1 FT RESIDUAL HEAD
(33.1 GPM AT 45.5 FT TDH)
RECOMMENDED PUMP PF3005

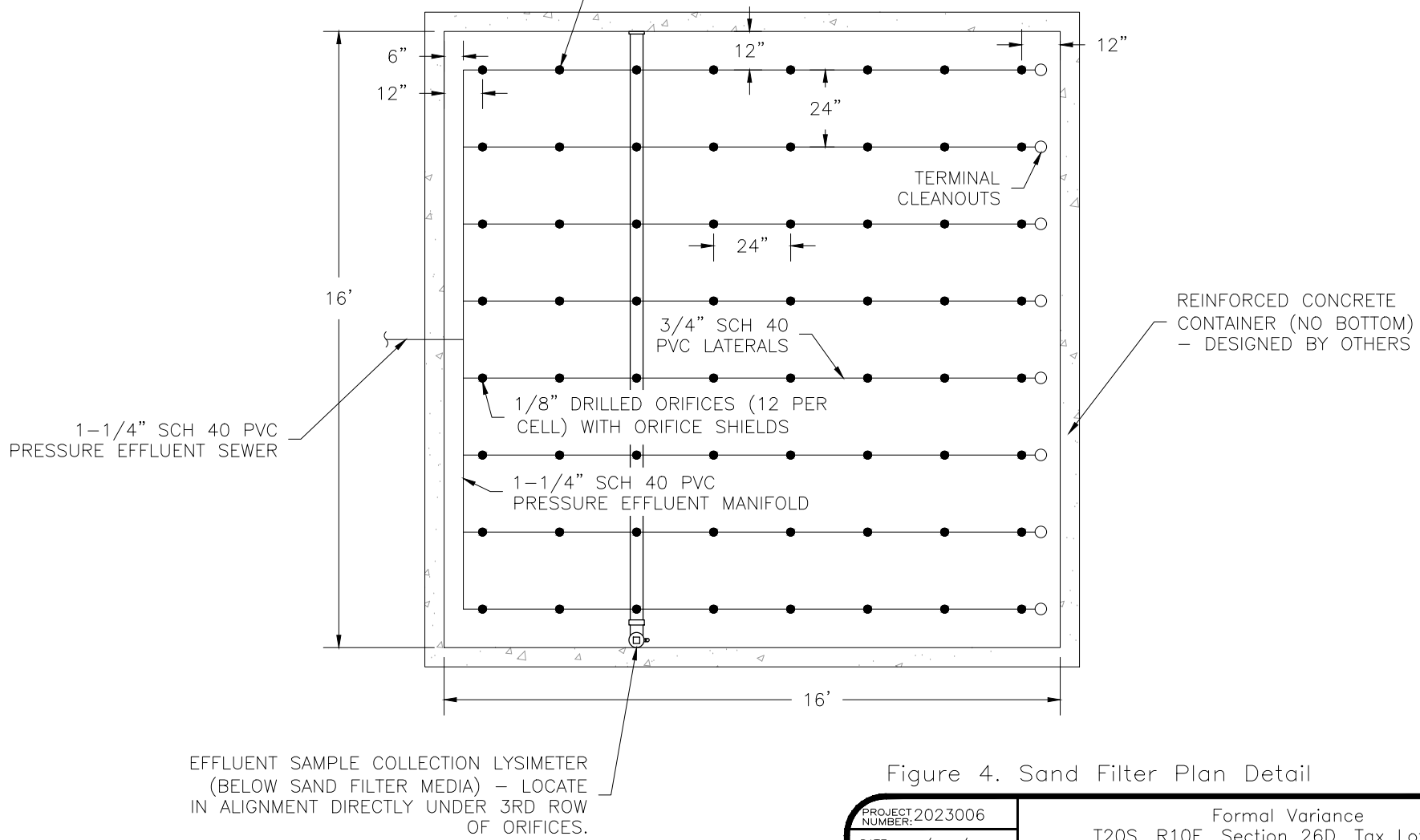
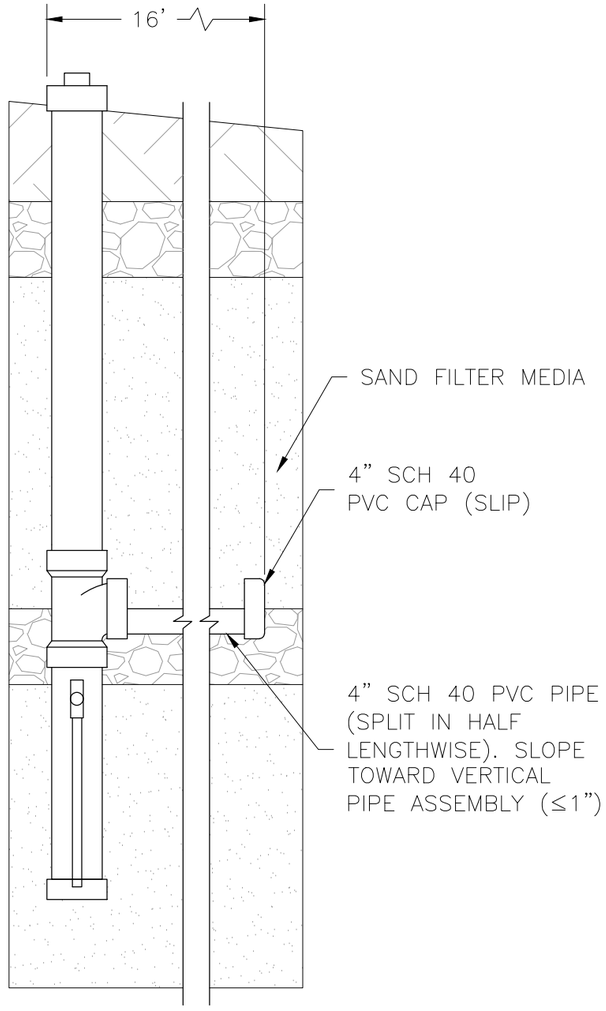


Figure 4. Sand Filter Plan Detail

0 4'
1"=4'

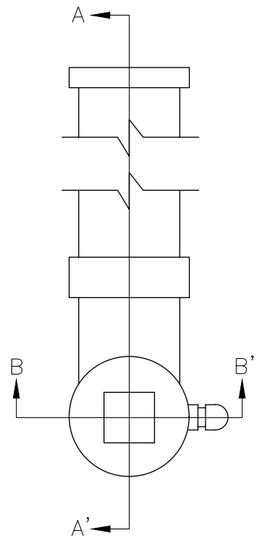
PROJECT NUMBER: 2023006	Formal Variance
DATE: 10/16/2023	T20S, R10E, Section 26D, Tax Lot 3100
DWG NO: 2023006 F1–6.DWG	David Norrie and Peter Norrie
DWG BY: 6NSG / PROJECT MANAGER: BRIAN RABE	55335 Hen Lane
REVISED:	Bend, OR 97707
	ELKHORN CONSULTING LLC



VIEW A–A'

0 1'

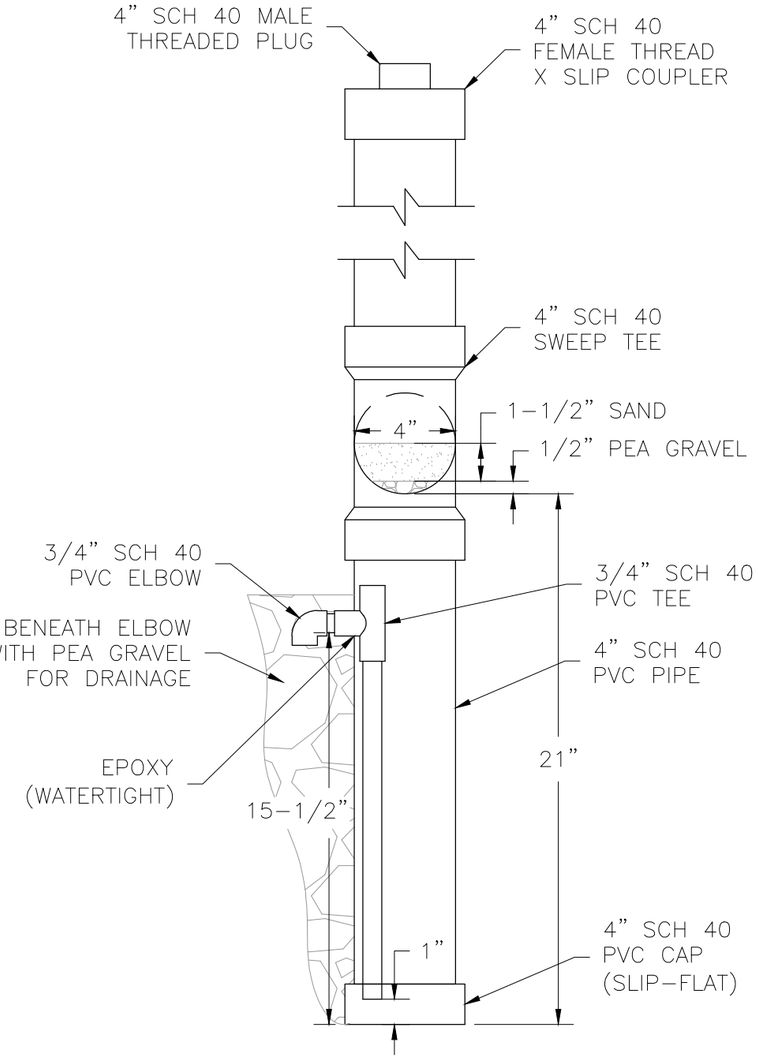
1"=1'



PLAN VIEW

0 0.5'

1"=0.5'



VIEW B–B'

0 0.5'

1"=0.5'

Figure 5. Lysimeter Details

PROJECT NUMBER: 2023006	Formal Variance T20S, R10E, Section 26D, Tax Lot 3100
DATE: 10/16/2023	
DWG NO: 2023006 F1–6.DWG	David Norrie and Peter Norrie 55335 Hen Lane Bend, OR 97707
DWG BY: 6NSG PROJECT MANAGER: BRIAN RABE	
REVISED:	ELKHORN CONSULTING LLC

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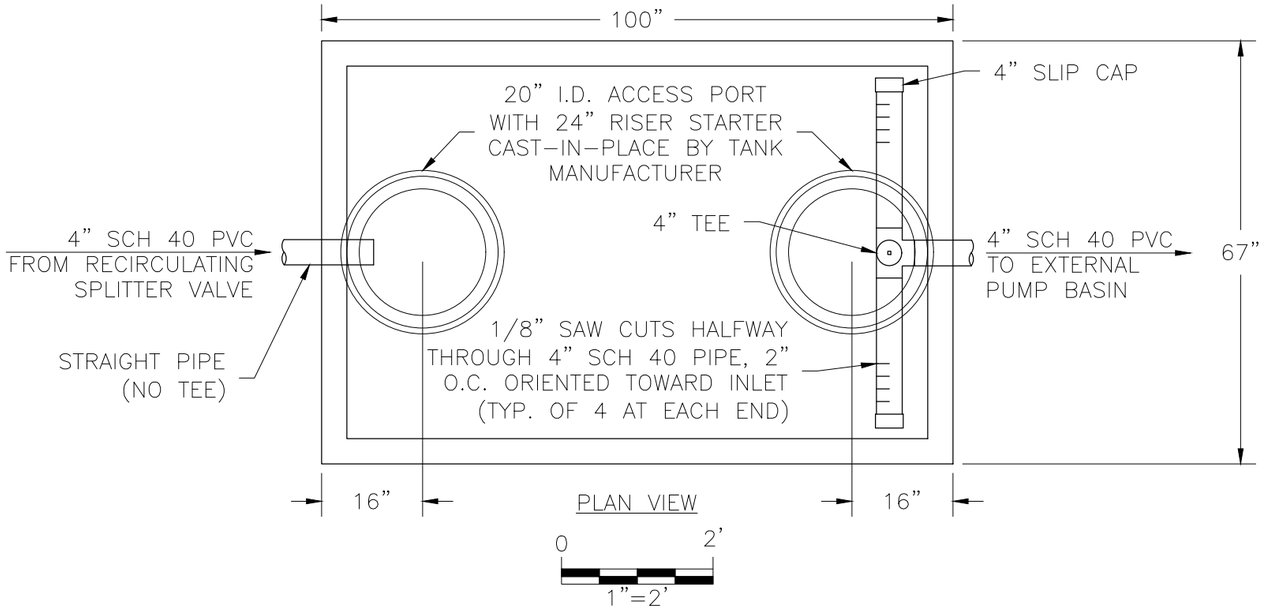

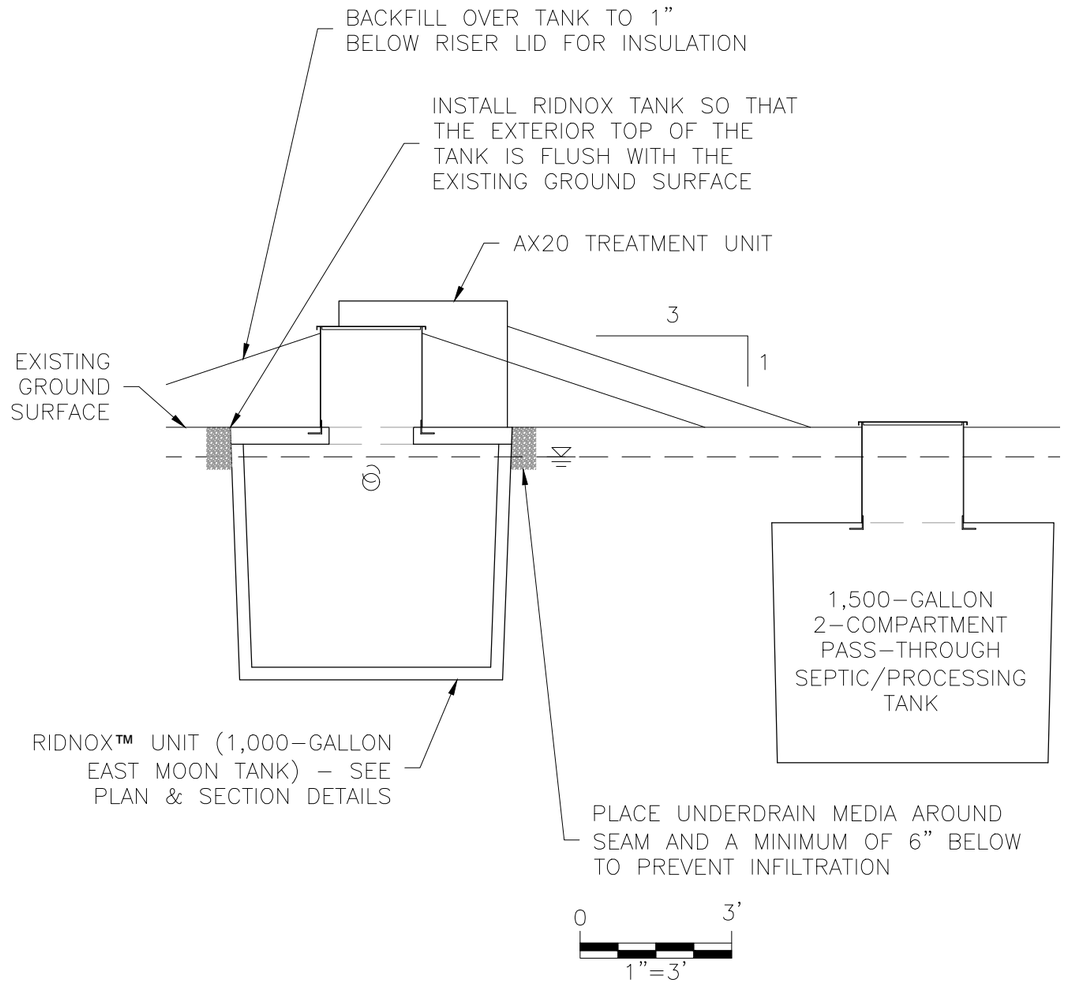

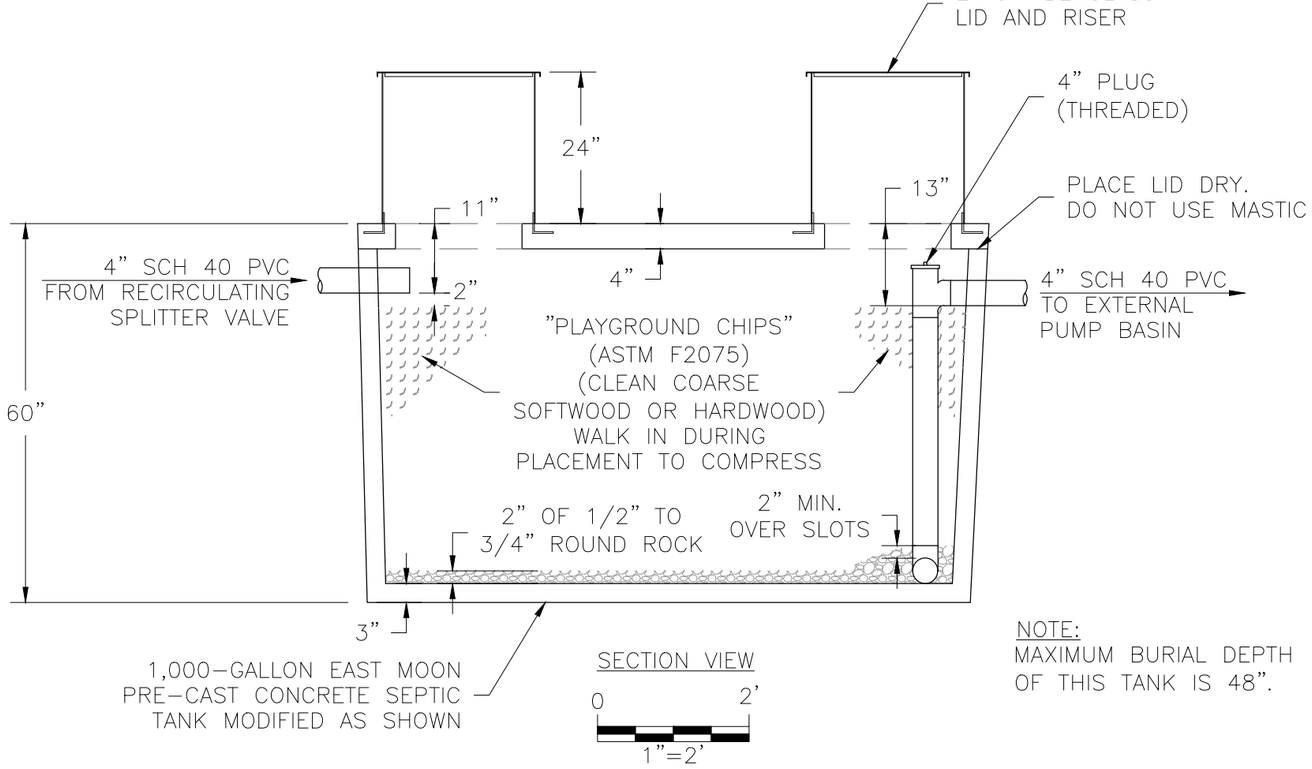

NOTE:
MAXIMUM BURIAL DEPTH OF THIS TANK IS 48".

Figure 6. RidNOx™ Details

PROJECT NUMBER: 2023006	Formal Variance
DATE: 10/16/2023	T20S, R10E, Section 26D, Tax Lot 3100
DWG NO: 2023006 F1-6.DWG	David Norrie and Peter Norrie
DWG BY: 6NSG / PROJECT MANAGER: BRIAN RABE	55335 Hen Lane
REVISED:	Bend, OR 97707
	ELKHORN CONSULTING LLC

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APPENDICES

Appendix A.

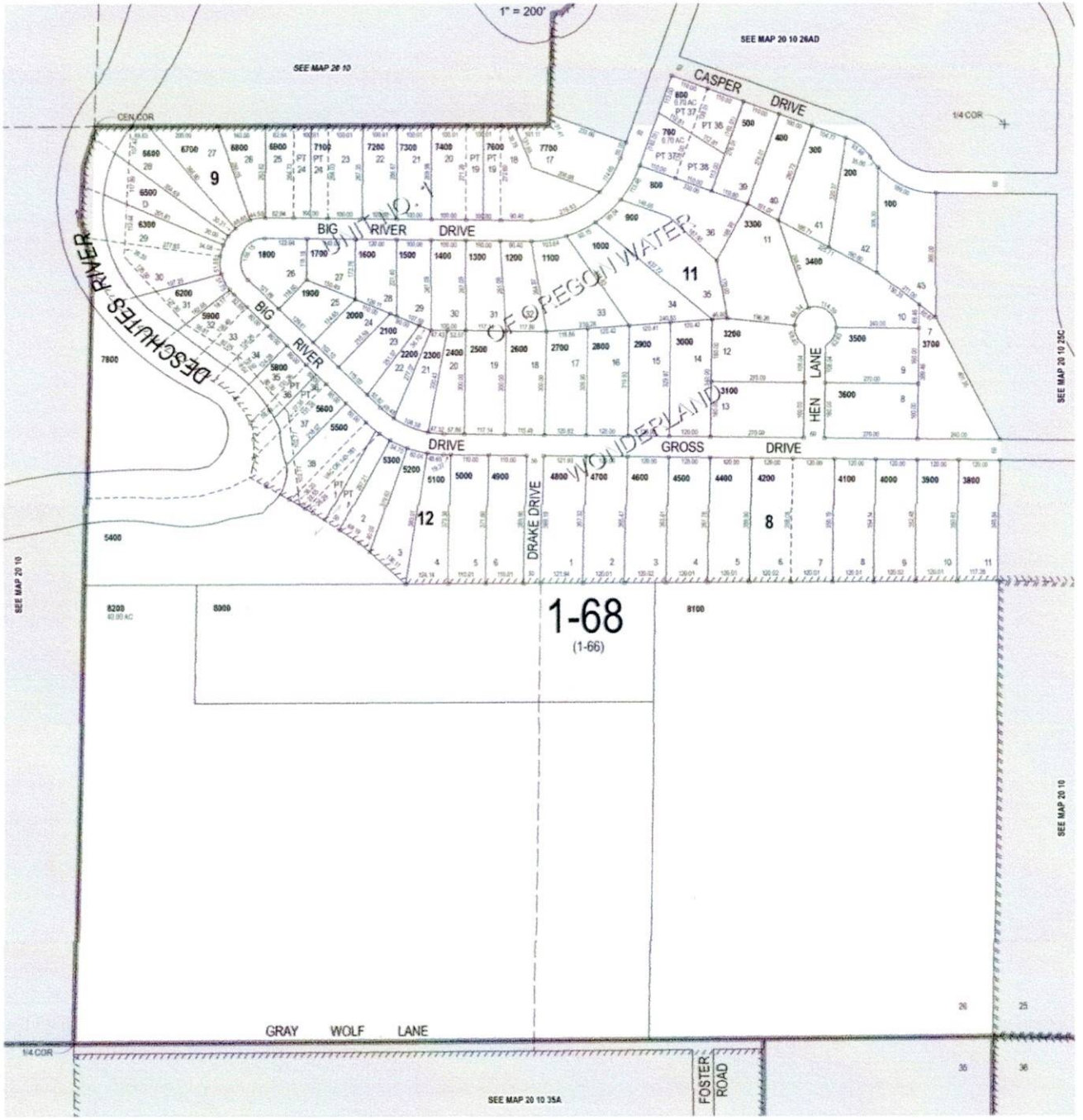
Tax Lot Map

THIS MAP WAS PREPARED FOR ASSESSMENT PURPOSE ONLY

9/9/2022

S.E.1/4 SEC.26 T.20S. R.10E. W.M.
DESCHUTES COUNTY

20 10 26D0



Cancelled Nos.
4300
5700
5701
6000
6100
6400
7000
7500
7900

20 10 26D0

Appendix B.

Deed

FORM No. 762 – SPECIAL WARRANTY DEED (Individual or Corporate). 405 - 0415

NA

96-12199

SPECIAL WARRANTY DEED

KNOW ALL MEN BY THESE PRESENTS, That Wallace Livingston W.L. *hereinafter called grantor, for the consideration hereinafter stated, does hereby grant, bargain, sell and convey unto* Peter C. Norrie and David D. Norrie *hereinafter called grantee, and unto grantee's heirs, successors and assigns all of that certain real property with the tenements, hereditaments and appurtenances thereunto belonging or in any way appertaining, situated in the County of* Deschutes, *State of Oregon, described as follows, to-wit:*

Lot 13, in block 11 of Unit 1 Oregon Water Wonderland

Deschutes County

Tax Acc. # 20-10-26 D 03100

(IF SPACE INSUFFICIENT, CONTINUE DESCRIPTION ON REVERSE SIDE)

To Have and to Hold the same unto the grantee and grantee's heirs, successors and assigns forever.

And the grantor hereby covenants to and with the grantee and grantee's heirs, successors and assigns that the real property is free from encumbrances created or suffered thereon by grantor and that grantor will warrant and defend the same and every part and parcel thereof against the lawful claims and demands of all persons claiming by, through, or under the grantor.

The true and actual consideration paid for this transfer, stated in terms of dollars, is $ 6,200.00 ①*However, the actual consideration consists of or includes other property or value given or promised which is the whole part of the consideration (indicate which).* ①*(The sentence between the symbols①, if not applicable, should be deleted. See ORS 93.030.)*

In construing this deed, where the context so requires, the singular includes the plural and all grammatical changes shall be made so that this deed shall apply equally to corporations and to individuals.

In Witness Whereof, the grantor has executed this instrument this 4 *day of* Apr. *, 19*96*; if a corporate grantor, it has caused its name to be signed and its seal, if any, affixed by an officer or other person duly authorized thereto by order of its board of directors.*

Wallace P. Livingston

THIS INSTRUMENT WILL NOT ALLOW USE OF THE PROPERTY DESCRIBED IN THIS INSTRUMENT IN VIOLATION OF APPLICABLE LAND USE LAWS AND REGULATIONS. BEFORE SIGNING OR ACCEPTING THIS INSTRUMENT, THE PERSON ACQUIRING FEE TITLE TO THE PROPERTY SHOULD CHECK WITH THE APPROPRIATE CITY OR COUNTY PLANNING DEPARTMENT TO VERIFY APPROVED USES AND TO DETERMINE ANY LIMITS ON LAWSUITS AGAINST FARMING OR FOREST PRACTICES AS DEFINED IN ORS 30.930.

STATE OF OREGON, County of Deschutes) ss. April 4, 1996

This instrument was acknowledged before me on April 4, 1996,

by WALLACE LIVINGSTON

This instrument was acknowledged before me on ....., 19.....,

by .....

as .....

of .....

OFFICIAL SEAL
BONNIE C WILKINS
NOTARY PUBLIC - OREGON
COMMISSION NO. 025765
MY COMMISSION EXPIRES JULY 27, 1997

Bonnie C Wilkins

Notary Public for Oregon

My commission expires 7-27-97

Wallace P. Livingston
16723 Gross Dr
Bend Or. 97707
Grantor's Name and Address

Peter and David Norrie
1964 S.W. Mill St Terrace
Portland Or. 97201
Grantee's Name and Address

After recording return to (Name, Address, Zip):
Peter and David Norrie
1964 SW Mill St. Terrace
Portland Or. 97201

Until requested otherwise send all tax statements to (Name, Address, Zip):
Same as above

STATE OF OREGON
COUNTY OF DESCHUTES) SS.

I, MARY SUE PENHOLLOW, COUNTY CLERK AND RECORDER OF CONVEYANCES, IN AND FOR SAID COUNTY, DO HEREBY CERTIFY THAT THE WITHIN INSTRUMENT WAS RECORDED THIS DAY:

96 APR -4 PM 3:43

MARY SUE PENHOLLOW
COUNTY CLERK

STATE OF OREGON, } ss.

BY. ..... DEPUTY FEE .....

NO. 96-12199

DESCHUTES COUNTY OFFICIAL RECORDS

Appendix C.

Site Evaluation Reports

COMMUNITY DEVELOPMENT

August 10, 2023

NORRIE, PETER & DAVID
PO BOX 3941
INCLINE VILLAGE NV 89450

RE: 247-23-000673-EVAL
55335 HEN LN, BEND

A site evaluation for an onsite wastewater treatment system for a single family dwelling was recently completed at the property noted above. Test pits were evaluated on 8/9/23. Part of the evaluation is to determine the level to which the groundwater rises during the wet season of a normal weather year. Permanent water tables are present throughout the year although they may fluctuate in elevation seasonally. The soil indicators used to determine the level to which the water table rises include gray soils and discoloration of the soil.

In the test pits on the property the indicators suggest the water table may rise to within 12 inches of the ground surface. Stripping and staining, observed as a splotchy pattern in the soil profile, was observed starting between 12 and 17 inches below ground surface and a depleted matrix with iron concentrations was observed starting at 25 and 26 inches below ground surface in the test pits, both of which are conditions associated with saturation. Past observations and site evaluations in the surrounding area also verify the presence of a high water table. Extensive study and modeling of the groundwater in south Deschutes County has demonstrated that this area is sensitive to added loading from areas that do not meet separation to groundwater. **This site is denied due to high permanent groundwater observed and conditions associated with saturation.**

The site is denied based on the following:

- Does not meet minimum separation from permanent water table (OAR 340-071-0220, 0260, 0265, 0275, 0280, 0285, 0290, 0302).
- Installation of an onsite wastewater system in the area evaluated will likely lead to nitrate pollution of public waters. The Nitrate Loading Management Model indicates this area, Management Area 11, cannot sustain added loading from high groundwater lots if nitrate levels are to remain below the action level in groundwater (Morgan, Hinkle, Weick. USGS. 2007). Groundwater shall be protected from pollution that could impair existing and future beneficial uses, including domestic drinking water from wells (OAR 340-040-0020).
- Deschutes County, may not authorize installation or use of a system that is likely to pollute public waters or create a public health hazard (OAR 340-071-0130(1)).

You have 90 days from the initial site visit to provide additional test pits for evaluation at no additional fee. However, it appears that other areas on the property would not be suitable because the remainder of the lot is at a similar landscape position.

REVIEW AVAILABLE

Pursuant to Oregon Administrative rules (OAR 340-071). You may request a site evaluation report review if you

believe this report to be in violation of the rules. The Oregon DEQ conducts report reviews upon submission of the appropriate application materials including: a written request that includes all information you have received from Deschutes County, the reason the report is in error including the specific Oregon Administrative Rules that conflict with the report, and the application fee. The DEQ will review the county's report and visit the site to determine the report's compliance with the appropriate rules.

Also pursuant to this rule, you may request a variance from these rules. The Oregon DEQ reviews variance requests upon application. This is not an automatic variance. You must provide technical justification that demonstrates your proposed system will operate over an extended period of time, will not degrade the environment, and will provide public health protection.

An application, application fee, justification and exhibits, including this report, a land use compatibility statement and detailed plans of your proposed system are required for the application. Technical advice from a knowledgeable consultant is recommended. A Variance Office from DEQ will review your application and the property and issue a written determination following an informational hearing.

Deschutes County recognizes your right to a variance request. This property, however, has severe limitations for onsite wastewater treatment as noted above. Unless public health and environmental protection can be assured, a variance request cannot be supported by the Deschutes County Onsite Wastewater Division and will not likely be approved by DEQ.

For further information regarding a report review for a variance request, please contact the Oregon Department of Environmental Quality at 471 NE Bellevue Dr., #110, Bend, OR 97701, phone 541-388-6146.

If you have any questions, please do not hesitate to call this office at 541-388-6519.

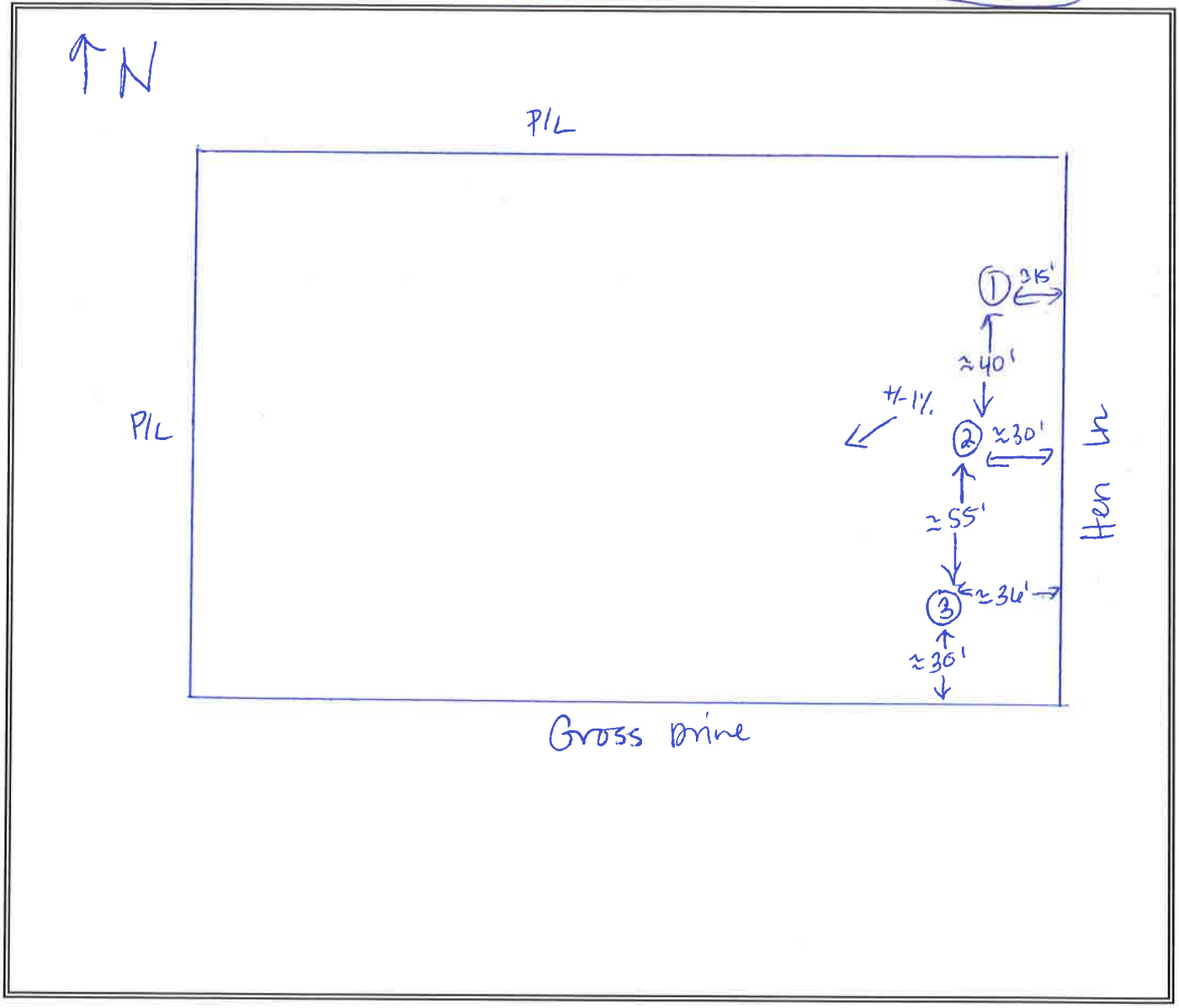
Sincerely,
Onsite Wastewater Division

KILEY RUCKER CLAMONS, REHS
Onsite Wastewater Specialist II

SITE EVALUATION FIELD INSPECTION FORM

Applicant: Peter & David Nanie Site Evaluation # 247-23-000673-EVAL
Evaluator: K. Rucker Clamans Date: 8/9/2023 Parcel Size: 0.98 Acres
Subdivision: Oregon Winter Wonderland I T 20 R 10 S 26 TL 3100 L 13 B 11

Suitable **Sketch/Not to Scale** **Unsuitable**



*systems approved are the **minimum** to meet current DEQ rules and are not design specifications*

System type approved: _____
Initial _____
Replacement _____
Tank Size _____
Special Conditions: Denied

Absorption facility:
Min. Size _____ Max. Depth _____ Min. Depth _____
Min. Size _____ Max. Depth _____ Min. Depth _____
Sewage Flow _____

SITE EVALUATION FIELD INSPECTION FORM

Applicant: Peter & David Norne Site Evaluation # 247-23-000673-EVAL
Evaluator: K. Rucker Clemons Date: 8/9/2023 Parcel Size: 0.98 Acres
Subdivision: Oregon Winter Wonderland T 20 R 10 S 26 TL 3100 L 13 B 11

	DEPTH	TEXTURE	COLOR	Notes on roots, structure, rock frag, redox, limiting layer type & depth
1	0-5"	LCOS	10YR 3/2	3vf1f1m; granular; FR
	5-25"	COS	10YR 4/2	+5/6; 1vf1f; sg; loose; prominent stripping (10YR 8/1) & staining (5YR 3/4) @
	25-35"	grfsl	10YR 4/2	few roots; 2msbk; FR; m2d Fe concentrations throughout 12"
	35-52"	grs	10YR 2/1	no roots; 1msbk; FR; c2d Fe concentrations throughout
2	0-8"	LCOS	10YR 3/2	3vf1f1m; granular; FR
	8-26"	COS	10YR 3/2	1vf1f1m; sg; loose; stripping (10YR 5/4) & staining (10YR 5/6) @ 11"
	26-45"	grfsl	10YR 4/2	few roots; 1msbk; FR; m2d Fe concentrations throughout
	45-51"	grs	10YR 2/1	no roots; 1msbk; FR; c2d Fe concentrations throughout
3	0-10"			Similar to Pit #2; stripping & staining @ 12"
	10-26"			
	26-43"			
	43-51"			
4				
5				
6				
7				

Landscape Note: Lodge pole; bitterbrush; broadleaf strawberry; currant; Idaho fescue; baltic rush
Slope: +/- 1% Aspect: SW Groundwater: permanent
Other site notes:

Comments:

Reason for Unsuitability: (Include Rule Reference)
See details in Site Evaluation report letter dated 8/10/23.
OAR 340-071-0220, 0260, 0265, 0275, 0280, 0285, 0290, 0302
OAR 340-040-0020
OAR 340-071-0130(1)

Appendix D.

Water Well Reports

DESC 58113

STATE OF OREGON

WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D. # L 88644
START CARD # W 191277

Instructions for completing this report are on the last page of this form.

(1) LAND OWNER Well Number
Name Garrett Garcia
Address P.O. Box 3896
City Sunriver State OR Zip 97707

(2) TYPE OF WORK
☒ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☐ Rotary Air ☐ Rotary Mud ☒ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 60 ft.
Explosives used ☐ Yes ☒ No Type Amount

Hole Diameter	From	To	Material	Seal From	Seal To	Sacks or pounds
10"	0	20'	Bentonite	0'	20'	14 sacks
6"	20'	60'				

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☒ Other poured Dry
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1	60	250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Drive Shoe used ☐ Inside ☐ Outside ☒ None
Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☒ Perforations Method Torch
☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe slip	Casing	Liner
55'	60'	6"	20	7/8"	6"	☒	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☒ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
1.5	58'		1 hr.

Temperature of water 45° Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Deschutes Latitude Longitude
Township 20 N or S Range 10 E or W WM
Section 26 1/4 NE 1/4 SE
Tax Lot 8000 Lot Block Subdivision
Street Address of Well (or nearest address) 55300 Drake Dr.

(10) STATIC WATER LEVEL:
8 ft. below land surface. Date 7-5-07
Artesian pressure lb. per square inch Date

(11) WATER BEARING ZONES:
Depth at which water was first found 30'

From	To	Estimated Flow Rate	SWL
30'	60'	1.5 GPM	8'

(12) WELL LOG:
Ground Elevation 4,000 ft.

Material	From	To	SWL
Top Soil	0'	3'	
Compacted Gravel &	3'		
sand & clay		22'	
Silty Black sand	82'	60'	8'

RECEIVED
JUL 16 2007
WATER RESOURCES DEPT
SALEM, OREGON

Date started 6-18-07 Completed 7-5-07

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number
Signed Date

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1761
Signed Richard Bryden Date 7-8-07

STATE OF OREGON

WATER WELL REPORT

(as required by ORS 537.765)

DESC 1430

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AUG 12 1992

WATER RESOURCES DEPT. SALEM, OREGON

208/10E/26

(START CARD) # 41555

(1) OWNER:

Name Charles + Margaret Perrott

Address 7698 N.E. Skidmore Street

City Portland State ORE. Zip 97218

Well Number:

(2) TYPE OF WORK:

☑ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD

☐ Rotary Air ☐ Rotary Mud ☑ Cable

☐ Other

(4) PROPOSED USE:

☑ Domestic ☐ Community ☐ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval Yes ☐ No ☐ Depth of Completed Well 360 ft.

Explosives used Yes ☐ No ☐ Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
10	0	18	Cement	0	18	20 Sacks
6	18	360				

How was seal placed: Method ☐ A ☐ B ☑ C ☐ D ☐ E

☐ Other

Backfill placed from ft. to ft. Material

Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1	360	250	☑	☐	☑	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

☑ Perforations Method Torch

☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
355	360	8x6	30	6		☑	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour

☑ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
28	23		4 1 hr.

Temperature of water 47 Depth Artesian Flow Found

Was a water analysis done? ☐ Yes By whom

Did any strata contain water not suitable for intended use? ☐ Too little

☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other

Depth of strata:

(9) LOCATION OF WELL by legal description:

County Des. Latitude Longitude

Township 20 N or S. Range 10 E or W. WM.

Section 26 ¼ ¼

Tax Lot Lot Block Subdivision

Street Address of Well (or nearest address) 55411 Big River Dr. Sun River ORE, 97707

(10) STATIC WATER LEVEL:

9 ft. below land surface. Date 6-4-92

Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found 355

From	To	Estimated Flow Rate	SWL
355	360	28	9

(12) WELL LOG:

Ground elevation

Material	From	To	SWL
Top Soil	0	3	
Clay	3	24	
Clay + Gravel	24	30	
Broken lava with clay	30	36	
Silt + Clay	36	280	
Hard clay + Fine Gravel	280	350	
Cemented Gravel	350	355	9
Fine Gravel + Course Sand	355	360	

Date started 5-18-92 Completed 6-4-92

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

WWC Number

Signed Date

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 620

Signed Mike Kodas Date 6-14-92

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 3/88

Appendix E.

RidNOx™ and Lysimeter Installation, and Sampling Instructions

ELKHORN CONSULTING LLC

14833 Goodrich Creek Lane
Baker City, OR 97814 • 503-881-1604
elkhornconsultingllc@gmail.com

RidNOx Installation Instructions

RidNOx Installation

1. Excavate to a depth that will result in the top of the RidNOx tank being at the same elevation as the existing ground surface.
2. Prepare a level, stable base.
3. Set the body of the tank in the hole.
4. Prepare and install inlet and outlet fittings as shown on the approved plans.
5. Place a 2-inch layer of ½ to ¾-inch round rock on the floor of the tank.
6. Cover the slotted outlet pipe with the same rock to a minimum depth of 2 inches.
7. Install the clean wood media (playground chips meeting ASTM F2075) in 6 inch lifts, walking in each lift to compress the media, to the bottom of the outlet fitting.
8. Set the lid on the tank. **Do not use mastic.**
9. Backfill the tank to 6 inches below the seam between the body and the lid.
10. Place underdrain media to the top of the tank.
11. Backfill over the tank with native soil after the risers are attached.

Media Replacement

- Pothole near tank to make sure the water table is at least 30” below the top of the tank to prevent buoyancy during replacement operations.
- Carefully remove the soil cover from over and around the tank to a level below the seam.
- Carefully remove the lid from the tank.
- Use a sump pump to transfer free water from the media to the pump basin.
- Scoop the media from the tank being careful not to damage the inlet and outlet piping or the underdrain media.
- After the excess moisture drains from the spent media, it can be loaded into a dump truck and hauled to a sanitary landfill.
- Install fresh media and re-install the lid as described in steps 7 through 11 above.

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Lysimeter Installation Instructions

Lysimeter Installation in a Bottomless Sand Filter

- Remove duff and surface soil layer (typically 6 inches) to provide an infiltrative surface free of roots.
- When installing sampling devices (trough lysimeters), carefully mark the location of the orifice positions on each side of the sand filter container.
- Also mark the target elevations for each layer on the walls.
- Install the lower layer of medium sand and the underdrain media.
- Remove enough underdrain media from a 4-inch wide strip (trough) across the bottom aligned with a row of orifices (typically the 4th row from either end).
- With an auger or a tile spade, dig a hole at one end of the trough large enough and deep enough to set the vertical part of the lysimeter against the wall.
- Fine-grade the placement of the body of the lysimeter with the horizontal fitting of the sanitary tee aligned with the trough.
- Bed the half pipe with a slight slope (no more than 1 inch in 10 feet) toward the body of the lysimeter.
- Glue one end of the half pipe into the coupler extending from the sanitary tee with a cap glued at the opposite end.
- Place about one-half inch of underdrain media (pea gravel) in the bottom of the trough with enough ramped up inside the sanitary tee to cover the drilled holes in the debris cap.
- Backfill around the lysimeter with pea gravel to provide drainage from the self-emptying port.
- Secure the body of the lysimeter to the wall with a metal strap or other device to stabilize it during the placement of the various layers of media.
- The rest of the sand filter will be constructed in a customary fashion.

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RidNOx and Bottomless Sand Filter Sampling Instructions

General

- Contact the laboratory to coordinate scheduling and acquire sample containers,
- Target parameters are total Kjeldahl nitrogen (TKN) and nitrate-nitrogen (NO_3-N).
- Make sure you have the proper sampling equipment, chain-of-custody forms, and a cooler with ice.
- Label all sample bottles in advance.

RidNOx Sampling Procedures

- Remove the lid from the pump basin.
- Use a bailer, peristaltic pump, or other appropriate sampler, to carefully collect a sample from the pump basin without disturbing and attached growth on the surfaces of pipes, floats, etc.
- Transfer sample into sample bottles.
- Repeat as necessary until all bottles are filled.
- Secure the caps on each bottle and place them immediately in a cooler with ice.
- Deliver samples to the laboratory (nitrate-nitrogen samples need to be analyzed within **48 hours** of sample collection).

Lysimeter Sampling Procedures (if/when desired)

- Loosen the square nut plug on the lysimeter.
- Shine a flashlight down the pipe to confirm the presence of filtrate.
- Use a bailer (disposable or cleaned) on a string to collect sample from the body of the lysimeter.
- Transfer sample into sample bottles.
- Repeat as necessary until all bottles are filled.
- Secure the caps on each bottle and place them immediately in a cooler with ice.
- Replace the square nut plug.
- If funding allows, collect sample of the AdvanTex-treated effluent as it flows into the RidNOx unit at the inlet of the tank.
- Deliver samples to the laboratory (nitrate-nitrogen samples need to be analyzed within **48 hours** of sample collection).

Appendix F.

Directions to Site, List of Names and Addresses for Neighboring Property Owners

Google Maps 475 NE Bellevue Dr, Bend, OR 97701 to 55335 Hen Ln, Bend, OR 97707

You can enter notes here.

475 NE Bellevue Dr
Bend, OR 97701

Take NE Dalton St to US-20

26 sec (361 ft)

1. Head east toward NE Dalton St

125 ft

2. Turn right onto NE Dalton St

236 ft

Take SE 27th St, Knott Rd, US-97 S and S Century Dr to Gross Dr

31 min (24.3 mi)

3. Turn right onto US-20

0.2 mi

4. Turn left onto SE 27th St

3.3 mi

5. Continue onto Knott Rd

4.2 mi

6. Slight right

0.3 mi

7. Merge onto US-97 S

12.0 mi

8. Slight right onto Vandevert Rd

1.0 mi

9. Turn left onto S Century Dr

1.1 mi

10. Turn right to stay on S Century Dr

2.2 mi

Follow Gross Dr to Hen Ln

3 min (0.8 mi)

11. Turn left onto Gross Dr

0.7 mi

12. Turn right onto Hen Ln
Destination will be on the left

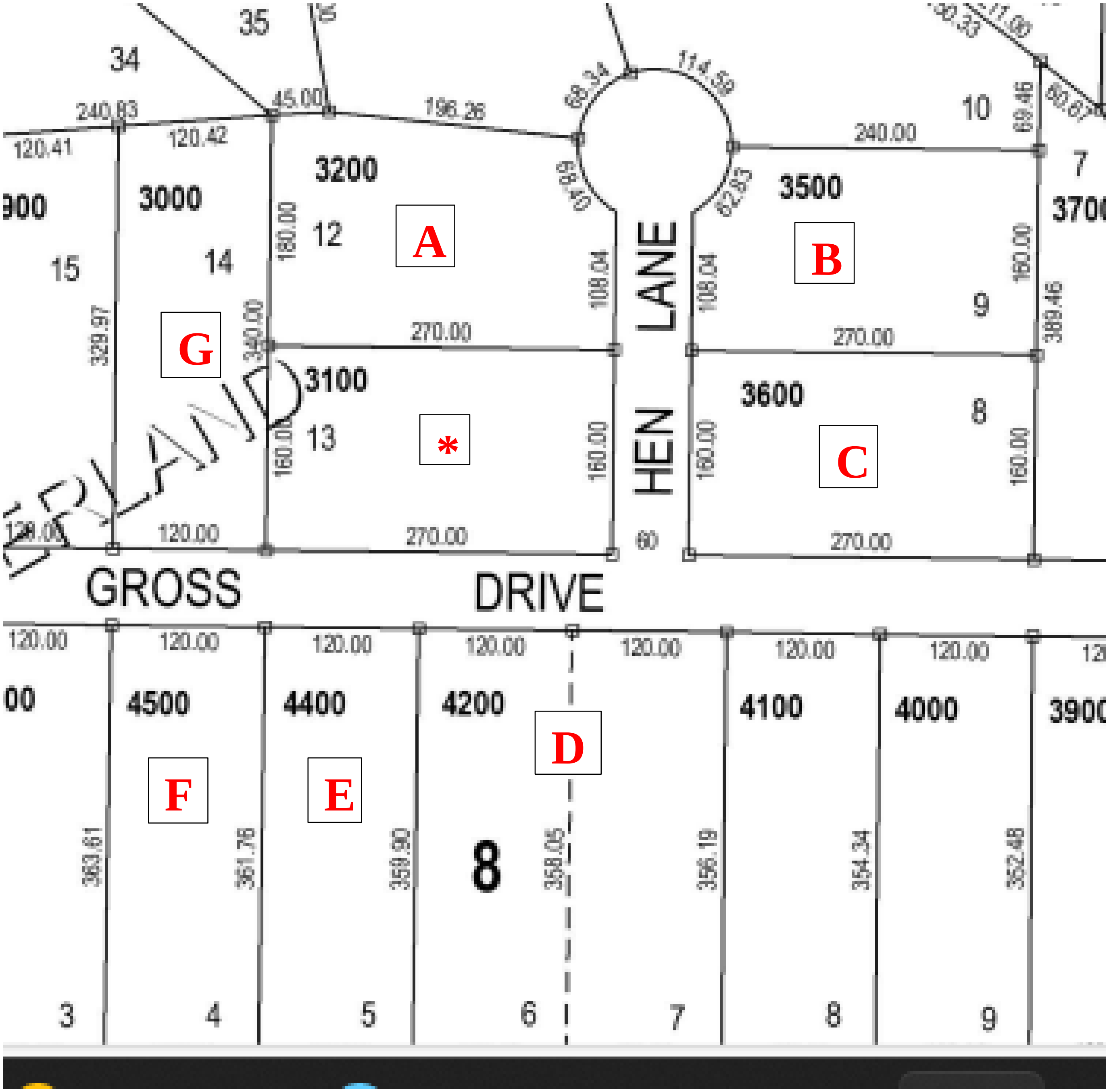
108 ft

55335 Hen Ln
Bend, OR 97707

Adjacent Parcels Property Owners

55335 Hen Lane, Bend, Oregon
(T20S, R10E, Section 26D, Tax Lot 3100, 0.98 acres

*	Tax Lot	3100	Norrie, Peter C and David D. 1800 SW First Avenue #400 Portland, OR 97201
A.	Tax Lot	3200	Vinje, Robert D. 16621 Graywolf Lane Sunriver, OR 97707
B.	Tax Lot	3500	Three Rivers South LLC 946 SW Veterans Way, #102-444 Redmond, OR 97756
C.	Tax Lot	3600	Three Rivers South LLC 946 SW Veterans Way, #102-444 Redmond, OR 97756
D.	Tax Lot	4200	Records, Carrie Michelle 19316 Soda Springs Drive Bend, OR 97702
E.	Tax Lot	4400	Morales, Cindy J. and Marcia D. 32645 Santa Cruz Lake Elsinore, CA 92530
F.	Tax Lot	4500	Livingston, Wallace N. 16723 Gross Drive Bend, OR 97707
G.	Tax Lot	3000	Ness, Peter J. and Marian 8410 SW Godwin Court Portland, OR 97223



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