NorthWest Colorado Consultants, Inc.
Geotechnical / Environmental Engineering • Materials Testing

July 7, 2021

Luke Berlet
P.O. Box 774000 #81
Steamboat Springs, CO 80477

Job Number: 22-12594

Subject: On-Site Wastewater Treatment System Design, Proposed Berlet Residence, 23570 Frayser Lane, Routt County, Colorado.

Luke,

This report presents the results of an On-site Wastewater Treatment System (OWTS) Design for your proposed residence to be constructed at 23570 Frayser Lane in Routt County, Colorado. The design was completed in accordance with Colorado Department of Public Health and Environment-Water Quality Commission On-site Wastewater Treatment System Regulation #43 (Regulation), as adopted by Routt County.

NWCC previously completed a Subsoil and Foundation Investigation (SFI) for the proposed residence under this job number in a report dated April 22, 2022.

Proposed Construction: It is our understanding, based on our conversations with you that a four bedroom residence, a future one bedroom auxillary dwelling unit; and a detached garage with a bathroom will be constructed on the subject property. The soil treatment area (STA) for the OWTS will be placed to the southwest of the proposed residence; northwest of the future auxillary dwelling unit; and north of the proposed detached garage.

Site Conditions: The property is situated at the south end of Frayser Lane; south and west of County Road 16; and within Lot 2 of the Ski View Estates Subdivision in Routt County, Colorado. The location of the subject property is shown in Figure #1.

Potable water will be supplied to the lot by a proposed well to be constructed in the northeast corner of the property and east of the main residence. The proposed STA will be located at least 200 feet southwest of the proposed residence and well. The vegetation in the area of the proposed STA consists of grasses, weeds, deciduous bushes and aspen trees. The topography in the area of the proposed STA is variable and generally slopes moderately to strongly down to the northwest on the order of 5 to 10 percent.

A site plan showing the overall site and approximate locations of the existing features and proposed structures and OWTS is provided in Figure #2. A detailed site plan showing the proposed OWTS layout is shown in Figure #3.

Subsurface Conditions: Three profile pits were excavated in the area of the proposed STA at the time of the field investigation for the SFI. The subsurface conditions encountered in the area of the STA generally consisted of a layer of topsoil and organic materials overlying natural clays and sands overlying siltstone-sandstone bedrock to the maximum depth investigated, 6 feet below the existing ground surface (bgs).

A layer of natural topsoil and organic materials was encountered at the ground surface and was approximately 14 to 16 inches in thickness. The topsoil and organic materials consisted of sandy to silty loam. Natural clays and sands were encountered below the layer of topsoil and organic materials and extended to depths of 4 and 4 ½ feet bgs. The natural clays and sands were fine grained, low to moderately plastic, very stiff, moist and brown to light brown in color. A sample of the clays and sands classified as a CL soil in accordance with the Unified Soil Classification System (USCS). Siltstone-sandstone bedrock was encountered below the clays and sands and extended to the maximum depth investigated in each profile pit. The siltstone-sandstone bedrock was clayey, fine to coarse grained, very low plastic, hard, moist and light brown to tan in color. Samples of the bedrock classified as ML soils in accordance with the USCS.

Groundwater was not encountered in the profile pits at the time of excavation and no indication of a seasonal groundwater table was observed.

Percolation testing was not conducted at the site; however, the upper 14 to 16 inches of natural topsoil and organic materials will likely exhibit percolation rates of 25 to 40 minutes per inch. Based on the assumed percolation rate of the near surface soils and visual soil classification of the soils encountered in the profile pits, NWCC classified the natural topsoil and organic materials as Soil Type 2A in accordance with Table 10-1 of the Regulations.

OWTS Design: Based on our understanding of the proposed construction, NWCC has determined, using Table 6-1 of the Regulations, an effluent design flow of 525 gallons per day (gpd) for the four bedroom residence and 150 gpd for the future auxillary dwelling unit. Based on the soil classifications and assumed percolation rate the OWTS design consists of a minimum 2 feet mounded, unlined (open bottom) sand filter.

The OWTS design presented below is based on the total anticipated number of bedrooms for the structures, as well as the assumed percolation rate and classification for the natural soils. An effluent design flow of 675 gallons per day (gpd) was used for the system. Based on the soil type and design effluent flow and using an application rate 0.8 gpd/ft^2 (Treatment Level 1-Secondary Media), a minimum sand filter bed area of 844 square feet is required for the residence and future caretaker residence. Therefore, the sand filter bed will need to be 12 feet wide by 71 feet in length with a minimum depth of 2 feet of sand filter material to achieve a minimum vertical separation of 3 feet from the anticipated "restrictive layer". The sand filter material must be approved by NWCC prior to use and consist of a clean, well graded sand, which meets

ASTM C33 specifications for concrete sand with 1 percent or less passing the No. 200 sieve. Based on a Soil Type 2A for the topsoil and organic materials, the minimum basal area required is 1,350 square feet. The minimum basal area can be achieved by constructing the sand fill materials at a 2(H):1(V) along the downhill side and to a 1 (H):1(V) or flatter slope on the uphill side. Compacted clay fill materials, a minimum of 12 inches in thickness, must be placed around the perimeter of the mounded sand filter at a minimum 3(H):1(V) final slope configuration.

A pressurized distribution system is required for the mounded sand filter. The pressurized distribution system will consist of six 1.5-inch diameter PVC pipe (Schedule 40) laterals with 1/8-inch diameter orifice's spaced at 368 inches on center. The orifices should be oriented to spray upward (12 o'clock) and should be staggered between adjacent pipes. To allow the distribution lines to drain and prevent freezing, NWCC recommends two of the orifices, in each lateral, be oriented downward (6 o'clock). The perforated distribution lines should be placed in a minimum of 12 inches of washed gravel (3/4" to 2.5" diameter) placed over the sand filter materials.

The effluent will be distributed to each of the perforated distribution lines from a high head pump (Orenco PF500511) through a 2-inch diameter solid PVC (Schedule 40) transport line to a level 1.5-inch diameter solid PVC (Schedule 40) manifold, located at the southwest end of the gravel distribution bed. A flow control valve must be placed in each of the lateral lines, after the manifold. The flow control valves should be adjusted to maintain a minimum 4 to 5 feet spray height at the last orifice. The solid 2-inch diameter PVC distribution line should be constructed to drain to the manifold when the pump is off. NWCC recommends a minimum soil cover of 48 inches and/or insulation to prevent freezing if the piping is not allowed to drain.

Septic Tank: A septic tank with a minimum capacity of 1,250-gallons is required for the four bedroom residence. A septic tank with a minimum capacity of 1,000-gallons is required for the future one bedroom auxillary dwelling unit and a second 1,000 gallon tank is required for the detached garage. Due to the subsurface conditions encountered at the site, NWCC recommends concrete septic tanks be used.

The manhole lids must be exposed at final grades. Manhole ring extensions should be used as needed to reach final grades. The tank must be placed to allow access for pumping. Generally, a septic tank can be pumped from 100 feet away with a maximum lift of 10 feet; however, a local sewage pumping contractor should be consulted in regards to the tank maintenance access.

The mounded sand filter treatment system is required to be pressurized. NWCC recommends a 500-gallon dosing tank be used for the system. The dosing tank should be placed near the STA to minimize the length of pipe between the pump and the distribution manifold. The pump system for the pressurized dosing system will consist of a high head pump (Orenco PF 500511) with a 2-inch diameter PVC (Schedule 40) discharge assembly to achieve a 60" residual head at the last orifice. The pump must be installed in an Orenco Biotube pump vault with a 24-inch Biotube filter. The effluent will be distributed to each of the perforated distribution lines from the pumps discharge assembly through a 2-inch diameter solid PVC (Schedule 40) transport line to a level manifold, 1 ½-inch diameter solid PVC (Schedule 40) pipe, located at the west end of the mounded sand filter bed. The solid 2-inch diameter PVC transport line should be

constructed to drain to the manifold when the pump is off. NWCC recommends a minimum soil cover of 48 inches and/or insulation to prevent freezing if the piping is not allowed to drain.

NWCC recommends the system have a high level alarm float, a low level/pump off float and a pump ON/OFF float. We recommend the floats in the dosing tank be set to provide a dose of 125 to 140 gallons. A control panel with high level alarm (light and audible) should be placed outside the residence in a location that allows line of sight between the control panel and the pump chamber. The control panel should not be placed adjacent to a bedroom area, since an audible clicking will occur when the pump cycles on and off. A secondary or backup pump stored on-site for quick change over is also recommended in the event of a pump failure.

The system design for the sand filter system is presented in Figures #3, #4 and #5; the septic tank details are presented in Figure #6: and the dosing tank details are presented in Figure #7. The design calculations are shown in Appendix A and the specifications for the system are given in Appendix B. **Any variance of equipment/materials specified in this design must be approved by NWCC prior to construction.**

Operation and Maintenance: Observing the operation and performing routine maintenance of the OWTS is essential to allow proper, long term functioning of the system. NWCC recommends the operation be monitored and a qualified, licensed maintenance contractor provide maintenance of the system.

1) *Septic Tanks*: The scum and sludge accumulation in the septic tanks should be monitored yearly. Once the scum or sludge thickness reaches 25% of the chamber depth, the septic tank should be pumped. A pumping frequency of 1 to 3 years is likely at the design flows used for this system; however, depending on use, pumping may only be required every 3 to 5 years.

2) *Effluent Filters and Dosing/Pump System*: The effluent filters in the pump vault should be cleaned when the septic tanks are inspected or as required. The effluent pump should be checked semi-annually to ensure the pump is functioning properly. If the high water alarm sounds, the system should be inspected and serviced immediately. NWCC strongly recommends a backup pump be stored on-site for quick change over in the event of a pump failure.

3) *Sand Filter Soil Treatment Area*: STA should be fenced off to livestock. The surface area around the STA should be observed monthly for signs of failure, such as lush vegetation growth or ponding. Liquid levels within the gravel bed or Infiltrator chambers should be observed through the observation pipes.

4) *Treated Water*: NWCC does not recommend water softeners or water treatment systems be connected to the OWTS. The chemical and hydraulic loading from the backwash of these treatment systems may be detrimental to the OWTS. If a treatment system is used, a separate dry well should be constructed for the backwash waste. In addition, chemically treated water from a swimming pool or spa must not be discharged into the OWTS.

5) *Floor Drains*: NWCC does not recommend garage floor drain systems be connected to the OWTS. Oils, grease and chemicals from vehicles may be detrimental to the OWTS. NWCC recommends garage floor slab be sloped to drain to the garage door.
If a garage floor drain is constructed, NWCC recommends the drain be connected to a separate sand/oil interceptor tank, which can be pumped as required or daylighted in accordance with current regulations.

6) *General Notes*: The owner should be aware that the operation of the OWTS is different from a public sewer service. Plastic and other non-biodegradable materials should not be placed into the system. Water use should be monitored so fixtures are not allowed to run if a seal malfunctions. Allowing fixtures to flow continuously to prevent water lines from freezing or a malfunctioning faucet or toilet can consume in excess of 1,000 gallons per day. Excessive flows could continually flood and cause premature failure of the system. No plastic or landscaping that requires additional irrigation should be placed over the absorption field.

Limitations: The procedures and design criteria used in this evaluation/design were obtained from the EPA "Design Manual - On-site Wastewater Treatment and Disposal Systems", 1980, as well as the Colorado Department of Public Health and Environment-Water Quality Control Commission, On-site Wastewater Treatment System Regulation, Regulation #43, effective June 30, 2017.

The OWTS design presented is based on currently accepted design procedures, the proposed structures and usage of the facilities. If the usage of the structure or addition of new facilities to those currently planned in the building changes, the OWTS design will also most likely change. It should also be noted that all OWTS require periodic maintenance as noted above. The failure of the owner to provide periodic inspection and maintenance of the system can lead to premature system failure.

Please be advised that Colorado law requires that a permit must be obtained prior to construction, alteration or use of an OWTS. In addition, this office must be retained by the client to observe the construction/installation of new components of the OWTS and evaluate the existing absorption field as well as provide an as-built report to the Routt County Department of Environmental Health when the construction is completed.

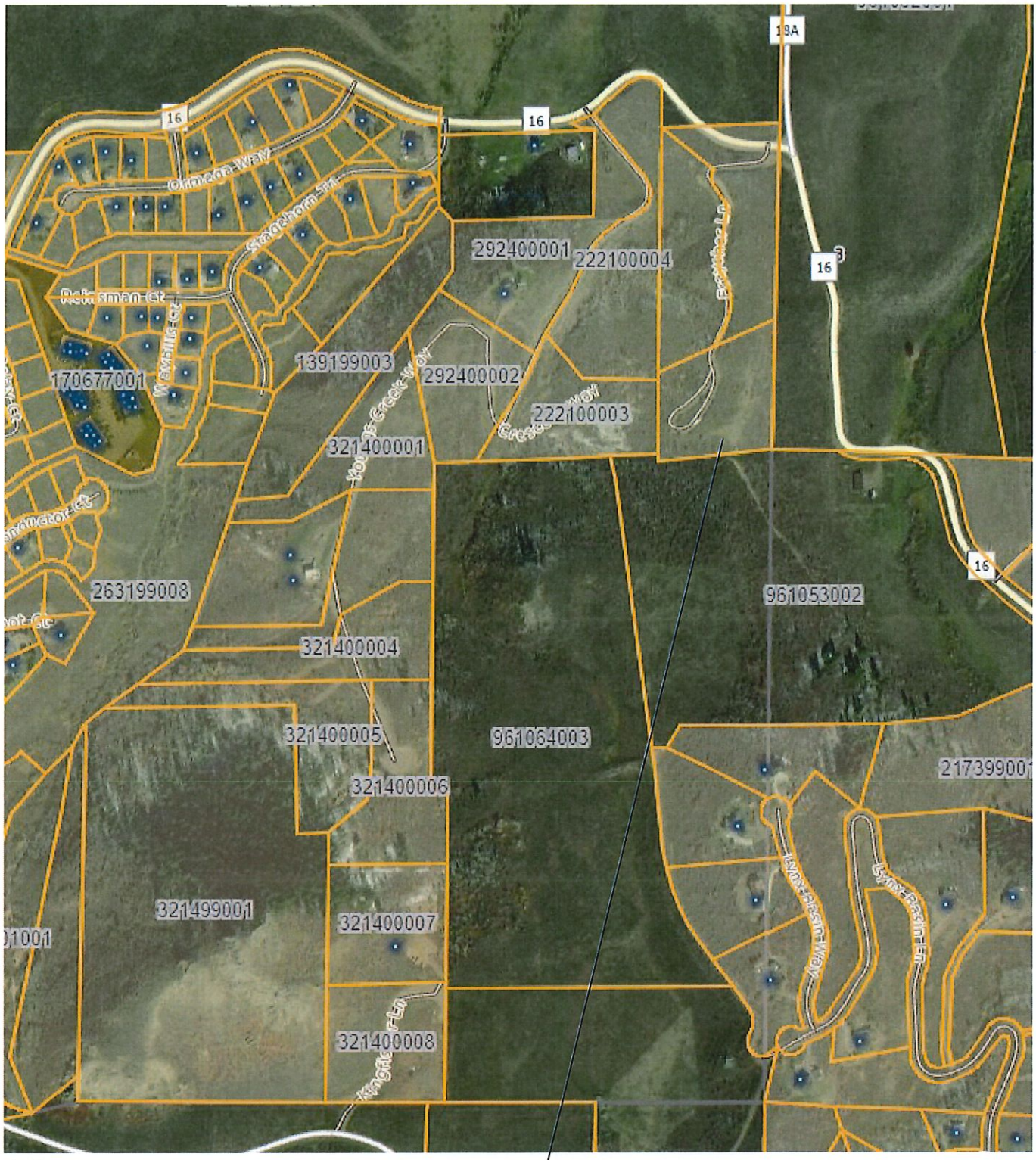
If you have any questions concerning this report, or if we may be of further service, please contact this office.

Sincerely,
NWCC, Inc.

COLORADO LICENSED
BRIAN D. LEE
25750
PROFESSIONAL ENGINEER

7/9/2021

Brian D. Lee, P.E.
Principal Engineer



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(Not To Scale)

Title: Vicinity Map	**Date:** 7/5/2022	
Job Name: Proposed Berlet Residence	**Job No.** 22-12594	
Location: 23570 Frayser Lane, Routt County, Colorado	**Figure** #1	

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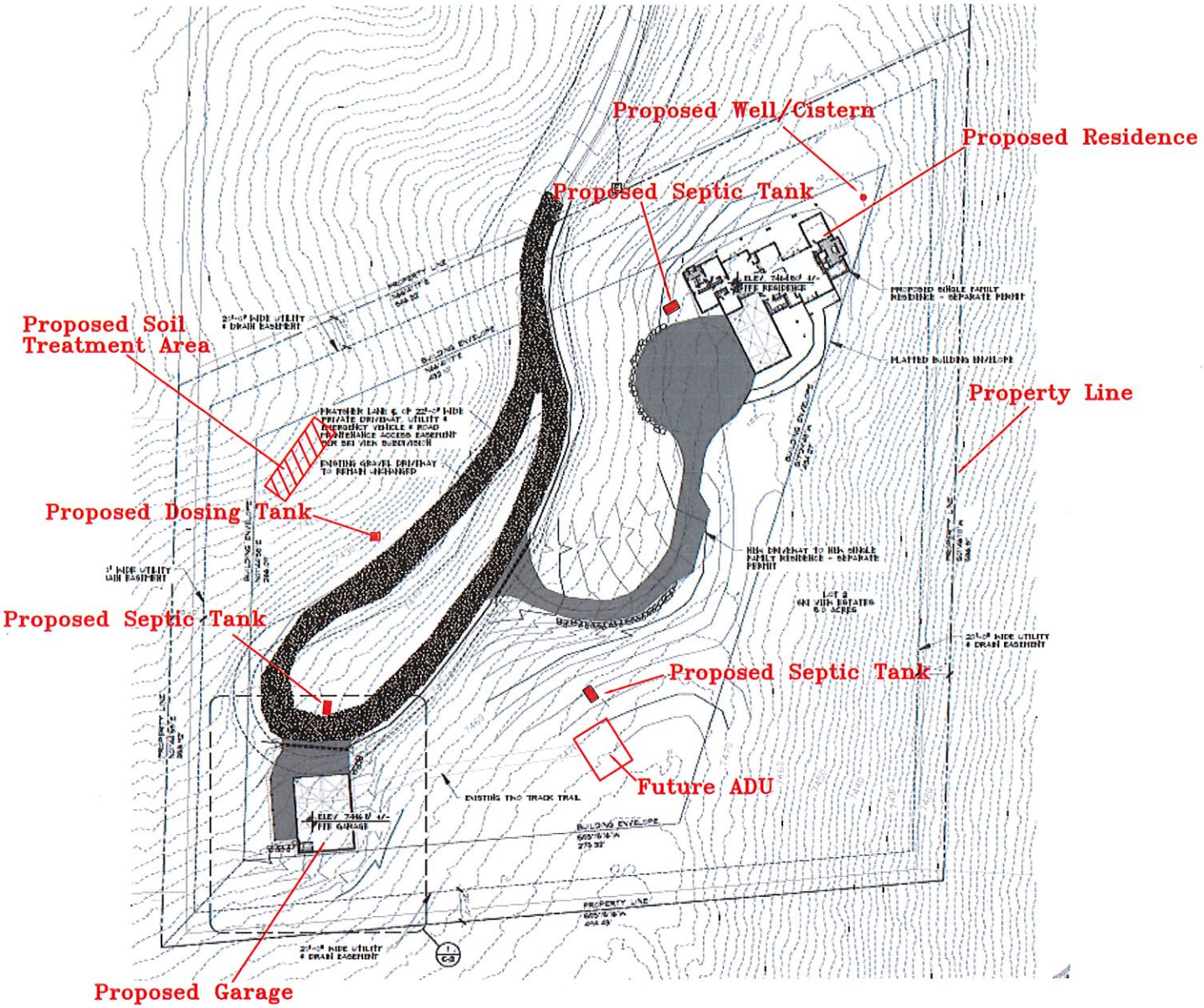
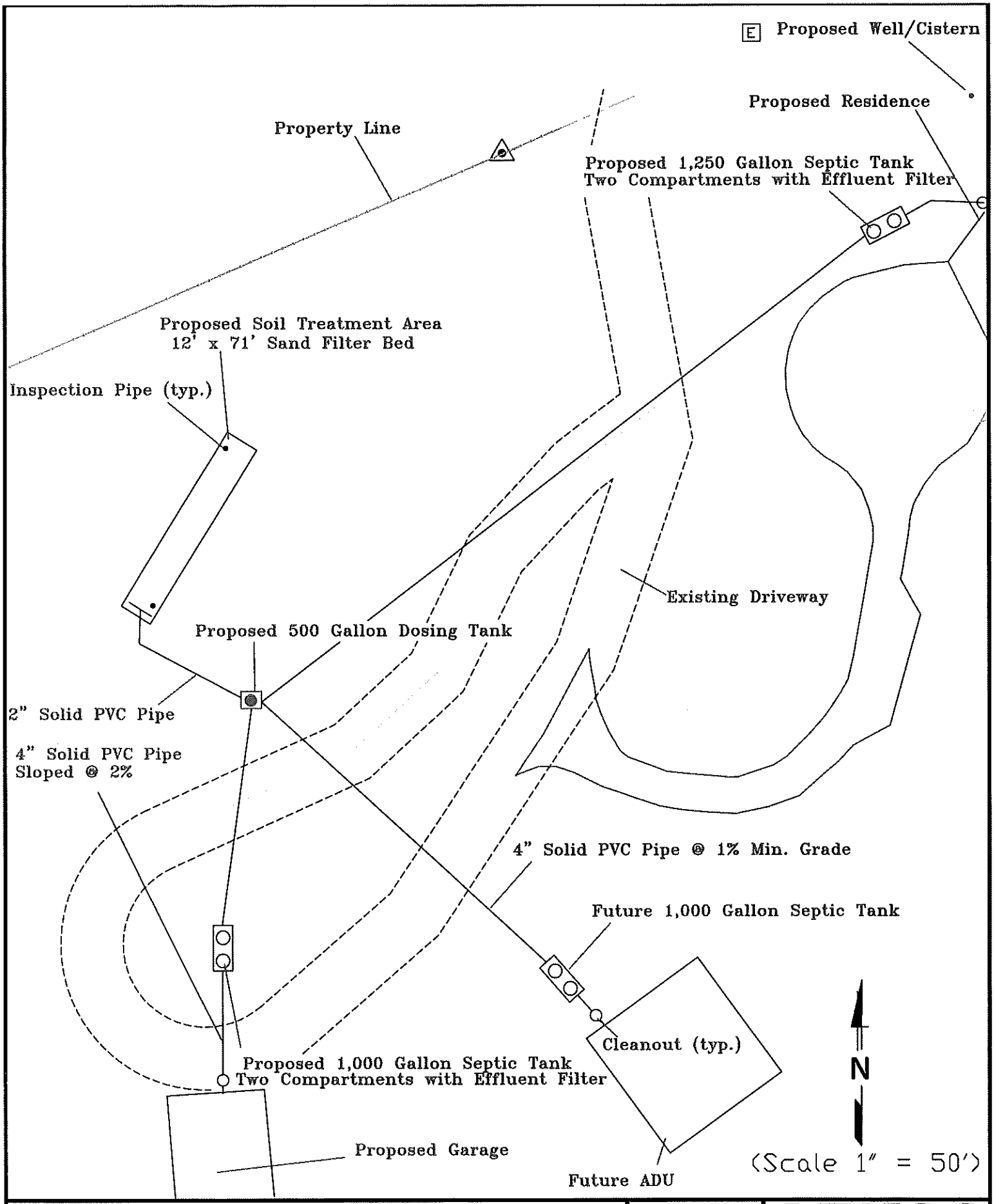
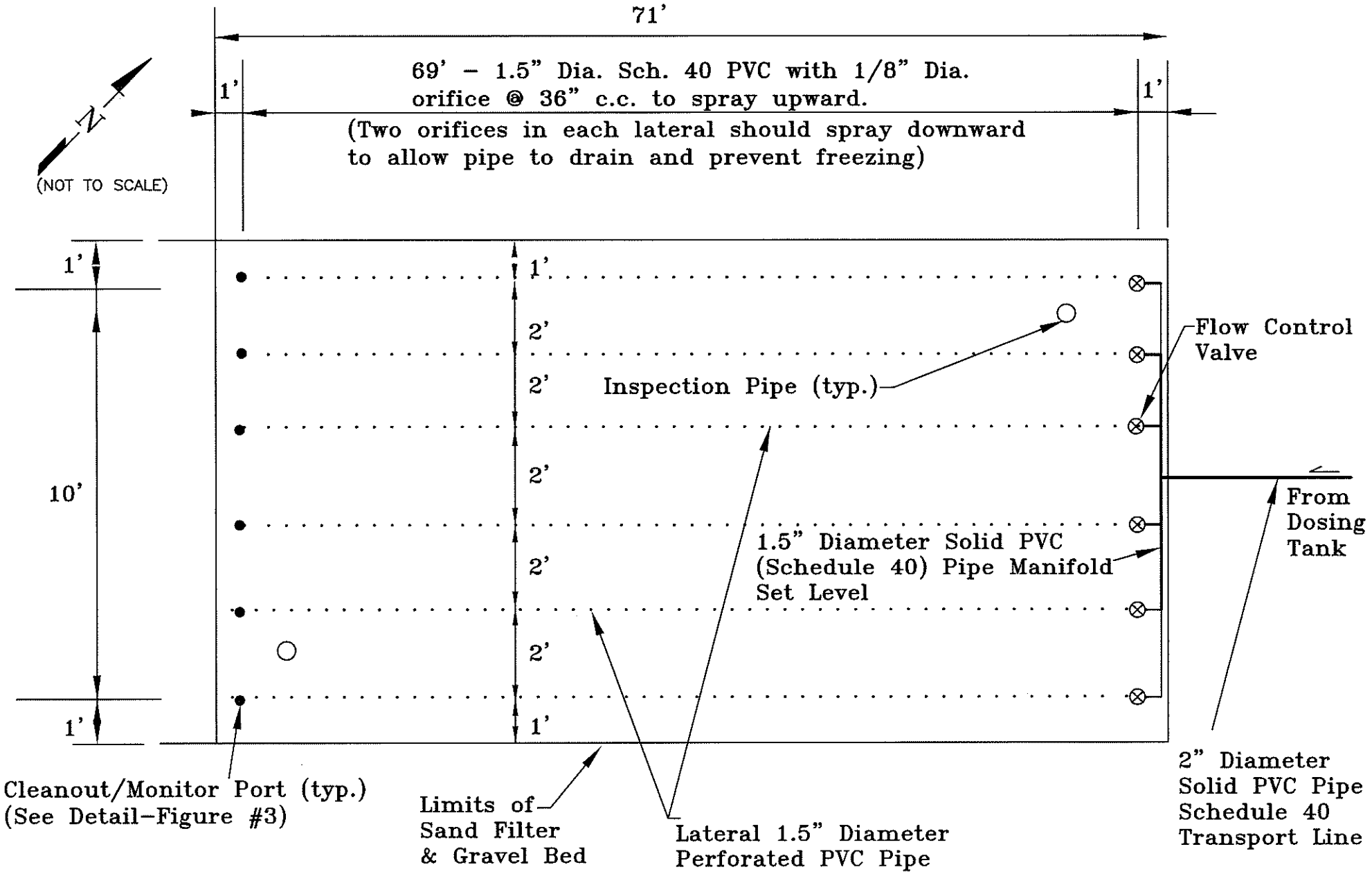


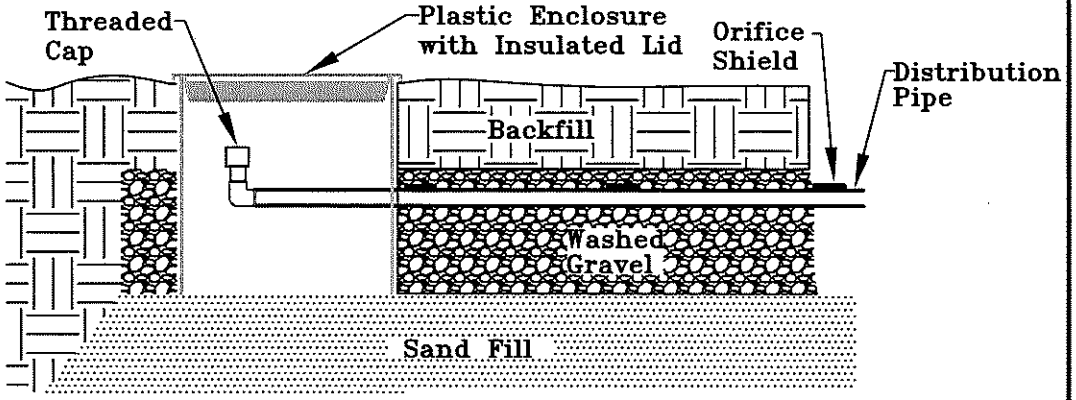
Title: OWTS – OVERALL SITE PLAN		**Date:** 7/5/2022	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering · Materials Testing
Job Name: Proposed Berlet Residence		**Job No.** 22-12594	(970)879-7888 · Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Location: 23570 Frayser Lane, Routt County, Colorado		**Figure** #2	



Title: OWTS – SITE PLAN	Date: 7/5/2022	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering · Materials Testing
Job Name: Proposed Berlet Residence	Job No. 22-12594	(970)879-7888 · Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Location: 23570 Frayser Lane, Routt County, Colorado	Figure #3	



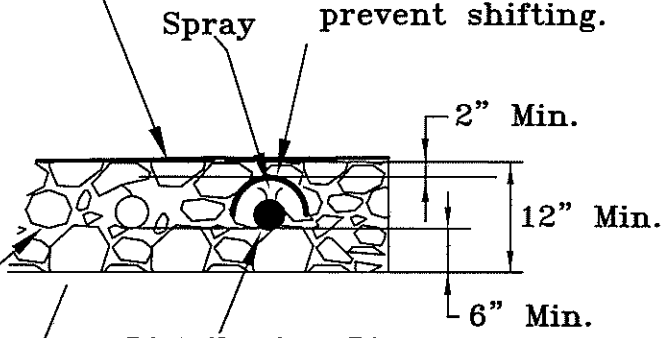
Title: OWTS – SAND FILTER/GRAVEL BED PLAN	Date: 7/5/2022	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing
Job Name: Proposed Berlet Residence	Job No. 22-12594	(970)879-7888 · Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
LOCATION: 23570 Frayser Lane, Routt County, Colorado	Figure #4	



Cleanout and Monitoring Port

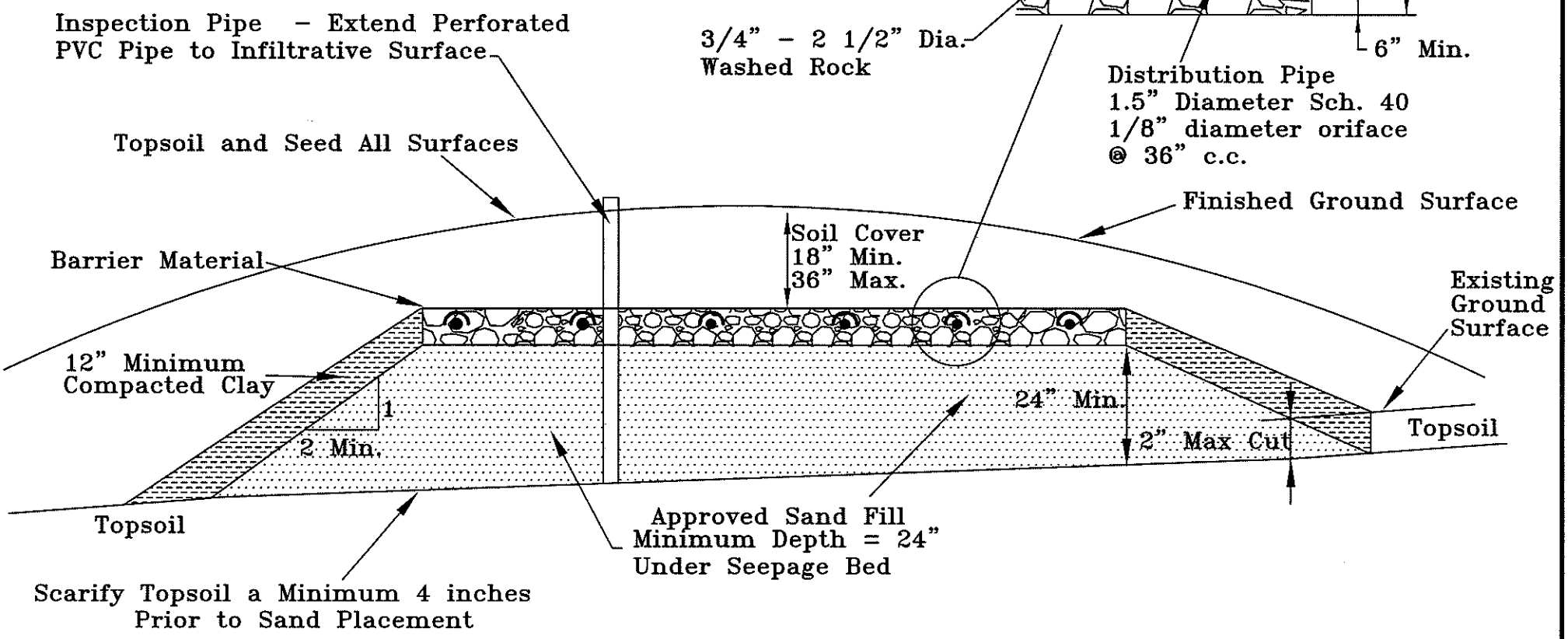
Barrier Material
Non-Woven Permeable
Geotextile (Max. Thickness
of 2.0 oz./square yard)

Orifice Shield-
Orenco (OS150) or
6" Diameter Solid
PVC Pipe Cut in
1/2. Brace to
prevent shifting.



3/4" - 2 1/2" Dia.
Washed Rock

Distribution Pipe
1.5" Diameter Sch. 40
1/8" diameter oriface
@ 36" c.c.



Title:	OWTS - SAND FILTER/GRAVEL BED CROSS SECTIONS	Date:	7/5/2022
Job Name:	Proposed Berlet Residence	Job No.	22-12594
LOCATION:	23570 Frayser Lane, Routt County, Colorado	Figure	#5

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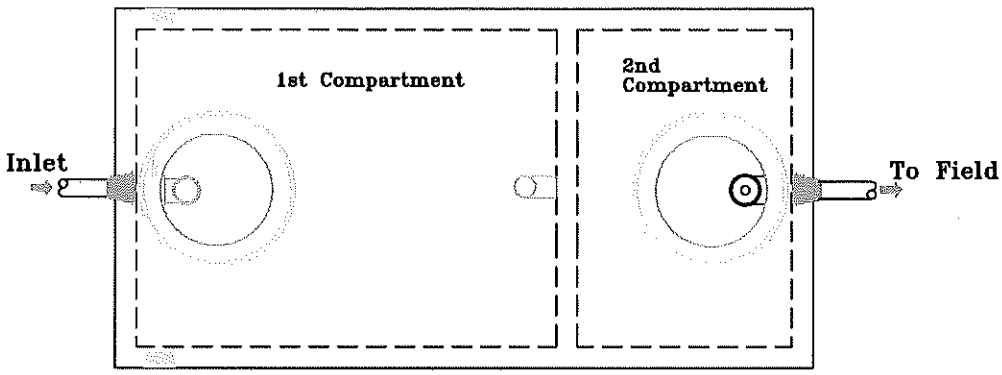
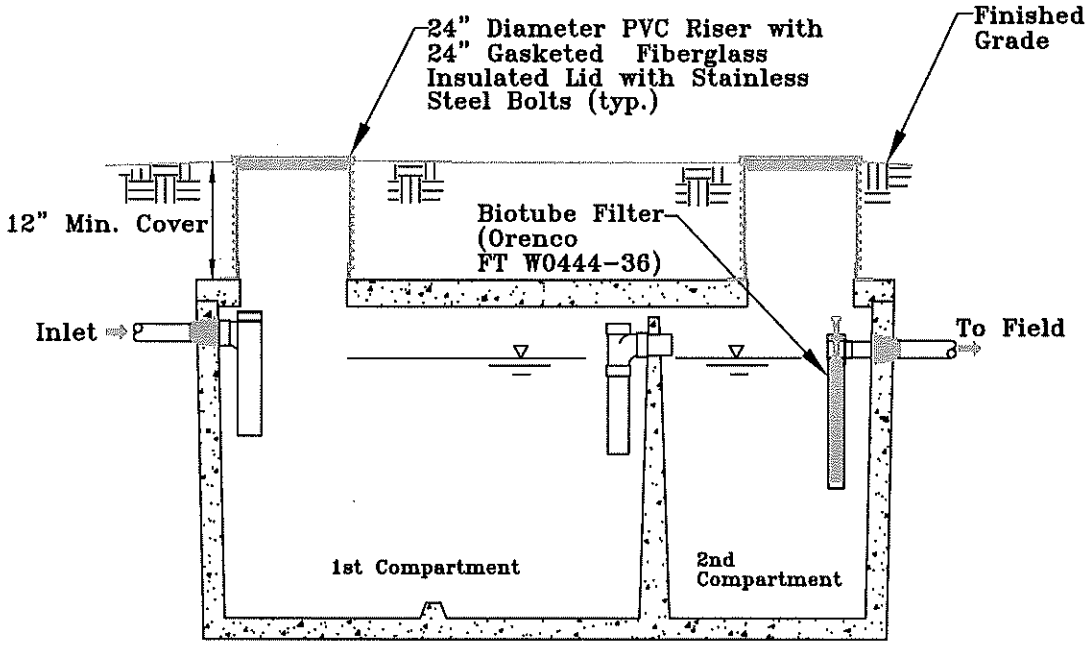


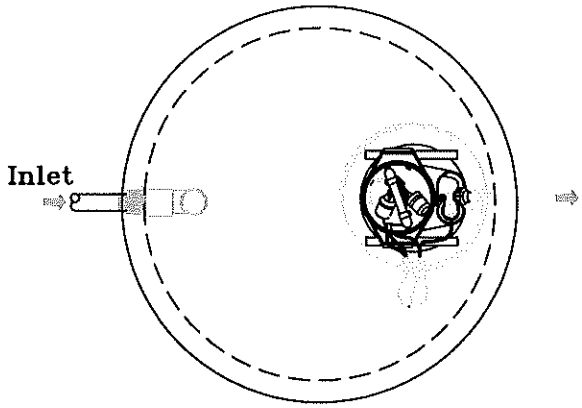
Top View



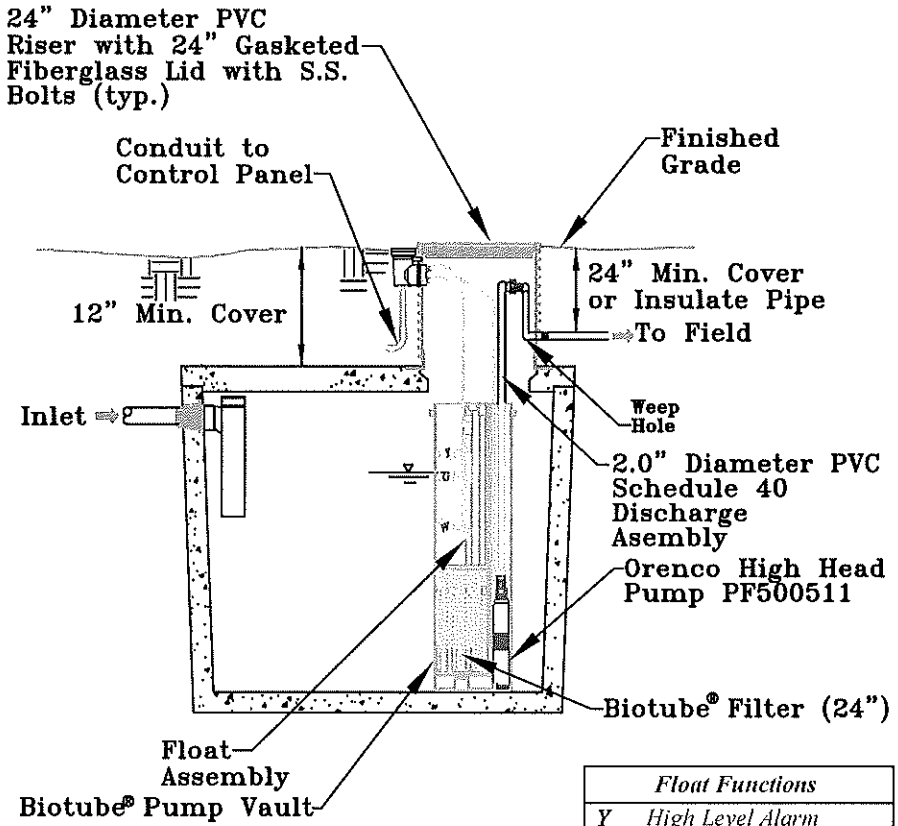
Section View

* Note: Septic tank shown is a typical 2-compartment septic tank configuration. Installer must submit detail from septic tank manufacturer, for approval by NWCC prior to construction.

Title: OWTS – SEPTIC TANK DETAILS	Date: 7/5/2022	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing
Job Name: Proposed Berlet Residence	Job No. 22-12594	(970)879-7888 · Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Location: 23570 Frayser Lane, Routt County, Colorado	Figure #6	



Top View



Float Functions	
Y	*High Level Alarm*
G	*Override Timer ON/OFF*
W	*LLA/RO*

Section View

* Note: Septic tank shown is a typical 3-compartment septic tank/pump configuration. Installer must submit detail from septic tank manufacturer, for approval by NWCC prior to construction.

Title: OWTS – DOSING TANK DETAILS	Date: 7/5/2022	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing
Job Name: Proposed Berlet Residence	Job No. 22-12594	(970)879-7888 - Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Location: 23570 Frayser Lane, Routt County, Colorado	Figure #7	

APPENDIX A

SUMMARY OF DESIGN CALCULATIONS

A. Sewage Volume Calculations

1) Proposed Residence- Four Bedrooms: ..... 525 gpd

2) Proposed Auxillary Dwelling Unit-One Bedroom: ..... 150 gpd

3) Design Flow ..... Q = 675 gpd

B. System Sizing

1) Soil Type 2A (Natural Topsoil) (Table 10-1)

2) Minimum mounded sand filter bed area = Q/LTAR = 675gpd/0.8gpd/ ft^2 = 844 ft^2

3) Minimum basal area = 675 gpd/0.5 gpd/ ft^2 = 1,350 ft^2.

4) Designed sand filter bed area = 12' x 71' = 852 ft^2.

5) Designed basal area = (12' + 2' + 4') x (71' + 4') = 1,350 ft^2.

6) Septic Tank - 1,250-gallon septic tank minimum for the four-bedroom residence (Table 9-1).
Septic Tank - 1,000-gallon septic tank minimum for the one-bedroom residence (Table 9-1).
Septic Tank - 1,000-gallon septic tank minimum for the detached garage with bathroom.

Minimum Horizontal Setbacks in Feet

	Spring, Well, Potable Water Supply Cistern	Potable Water Supply Line	Dwelling, Occupied Building	Property Line, Piped or Lined Irrigation Ditch	Waterbody (Lake, Water Course, Irrigation Ditch, Wetland)	Dry Gulch/Swale, Subsurface Drain, Intermittent Irrigation Lateral
Septic Tank/ DosingTank	50	10	5	10	50	10
Building Sewer or Effluent Line	50	5		10	50	10
Soil Treatment Area	100	25	20	10	50	25

APPENDIX B

1) The Rules and Regulations of the CDPHE and Routt County Department of Environmental Health must be complied with during the installation/construction of the system.

2) Periodic inspections must be made by NWCC at the following points during construction:
   a. After subgrade excavation and septic tank and solid PVC pipe installation.
   b. After placement of sand fill, washed gravel and perforated PVC piping, prior to backfilling. NWCC should observe flow control valve adjustment for proper spray height.
   c. Upon final completion of the project.

3) The 4-inch PVC pipe shall conform to ASTM 3034/SDR 35 or better quality. Pressurized lines shall consist of Schedule 40 PVC or other approved piping material suitable for pressurized wastewater transmission. Pressurized lines should be constructed to drain to field or pump tank or have adequate cover and/or insulation to prevent freezing. The piping should also be tested prior to approval. The perforated pipe in the STA should be constructed level.

4) Soils beneath the pipes entering and leaving a septic or dosing tank, which has been excavated, shall be backfilled in 6 inch lifts and mechanically compacted to a minimum of 95% of the maximum standard Proctor density. PVC pipe meeting ASTM 3034-SDR 35 or schedule 40 shall be used for 5 feet on the inlet and outlet sides of the tank.

5) Provide a minimum of 12 inches of soil cover over the septic tank, 18 inches of soil over the STA and 24 inches of soils cover over all pipes. Any piping placed under a driveway or other plowed areas should have a minimum of 48 inches of soil cover or be protected from freezing using insulation or other approved means. Manhole and distribution box lids must be exposed at final grades. Provide manhole ring or distribution box extensions as needed to reach final grades. Insulated lids are required.

6) Special care should be taken when backfilling the system to prevent disturbance/crushing of the distribution lines. In addition, the distribution lines must be carefully bedded to minimize the settlement in these lines.

7) Surface drainage shall be ditched and diverted away from the soil treatment area and all tanks.

8) Disturbed surfaces, mounds and berms shall be covered with topsoil and heavily seeded. Heavy farm equipment and livestock should be fenced or kept off of the soil treatment area.

9) The washed rock shall be covered with non-woven permeable geotextile (max. 2 oz/square yard) barrier material before overlying soils layers are placed. The washed rock will consist of gravel from 0.75 to 2.5 inches in size. The sand filter materials must be approved prior to use by NWCC and consist of a clean, well graded sand meeting ASTM C33 for concrete sand with 1 percent or less passing the No. 200 sieve.