March 7, 2024

Zane Williams
Z Properties
219 W Comstock Avenue
Winter Park, Florida 32789

Re: On-Site Wastewater Treatment System Design
Proposed Williams Residence
Lot 3, Pavilion Ranch Subdivision
Routt County, Colorado
Western Slope Geotech Project No. 23-1090

Dear Zane,

Western Slope Geotech (WSG) has completed the On-Site Wastewater Treatment System (OWTS) design you requested for your proposed residence to be constructed within Lot 3 of the Pavilion Ranch Subdivision, Routt County, Colorado. The results of our site and soil evaluations, design calculations, schematic system design drawings and other pertinent information is included with this report.

PROPOSED CONSTRUCTION

Based on WSG's review of available plans, we understand proposed construction will consist of a single family residence containing four (4) bedrooms. Therefore, this design is based on anticipated wastewater flow for a four (4) bedroom residence.

No other future building additions or other wastewater generating features are anticipated at this time. Potable water supply for the residence is unknown at this time. WSG assumes development of a new well will occur near the building site.

SITE CONDITIONS

The property consists of an approximate 53-acre parcel of vacant and undisturbed rural land located off the south side of County Road 129. The proposed building and STA sites are generally located in the southwestern portion of the property in vacant and undisturbed land. The site lies within irrigated hay meadow and was vegetated with grass and weeds.

Site topography at the proposed STA was somewhat variable and generally sloped moderately down to the south-southwest on the order of 5 to 10 percent. Existing and proposed site features are shown on the OWTS Vicinity Plan, Figure 1.

SOIL EVAULATION

A soil evaluation program consisting of the excavation and observation of three test pits and two profile pits was conducted at the project site on November 10, 2023, to provide subsurface information at the proposed STA location. The approximate test and profile pit locations are shown on both Figures 1 and 2. Graphic logs and associated legend and notes are shown on Figure 4.

The subsurface conditions encountered in the profile pits were fairly consistent and generally consisted of a layer of topsoil/silt loam overlying natural lean clay to the maximum depth explored at the STA, 5 feet.

Topsoil/silt loam was encountered at the ground surface in both profile pits and was estimated at approximately 30 inches in thickness in profile pit 2. Natural lean clay was encountered beneath the topsoil and was slightly to very sandy with scattered gravel, low to moderately plastic, stiff, moist and reddish brown.

Groundwater seepage was not observed in the profile pits at the time of excavation. No other indications of a seasonal high groundwater condition were observed in the profile pits. Groundwater levels will vary seasonally and over time based on weather conditions, site development, irrigation practices and other hydrologic conditions.

LTAR Determination: Based on WSG personnel's evaluation of soil types encountered in the profile pits, the Long Term Acceptance Rate (LTAR) values, depths and associated percolation rate ranges for the natural soils are summarized in Table A below. Based on our experience, WSG recommends the topsoil/silt loam be considered the limiting layer and be classified as Soil Type 2A. Soil types, LTARs, and average percolation rates are shown below and are reproduced from Table 10-1 of the Routt County Department of Environmental Health OWTS Regulations (CDPHE Regulation No. 43 (2018)).

TABLE A

Soil Type	**Depth** (in)	**Avg. Perc Rate** (mpi)	**LTAR** (gpd/ft^2)
Silt Loam- (Soil Type 2A)	12-30	26-40	0.50

OWTS DESIGN ANALYSIS AND RECOMMENDATIONS

The site and soil evaluations indicate suitable conditions for wastewater disposal at an approximate depth of 12 to 18 inches below existing grades. Based on proposed construction and WSG's experience with similar sites and conditions in Routt County, we recommend the OWTS consist of a gravity-fed septic tank and Soil Treatment Area (STA) sized using TL-1 treatment levels. The recommended STA design consists of infiltration chambers (Standard Quick 4 Infiltrators®, or other equivalent, approved product) installed in a trench configuration.

A potential "reserve" STA for use as a replacement to the "primary" STA is also shown on Figure 2. The reserve STA would serve as a potential replacement site in the event of future primary STA failure.

Existing land irrigation practices and features in the area of the proposed STA should be modified such that irrigation water is not directed to or is present directly upslope of the STA.

Based on anticipated lateral shallow groundwater (effluent) flow direction (similar to site topography), WSG believes the underlying clay does not represent a restrictive layer to efficient wastewater treatment and no future effluent surfacing will occur based on topography and final site grading. Additionally, proposed Contour Loading Rates (CLR) are estimated at approximately 2.1 gallon per day/linear foot (gpd/lf), representing a favorable loading rate according to recognized (NAWT – National Association of Wastewater Technicians) design standards.

Based on the silt loam soils encountered in the profile pits and WSG's experience with similar soils and site conditions, an LTAR of 0.5 gpd/ft^2 (Soil Type 2A) was used in system sizing. Pertinent system components are summarized below, and associated design

calculations are provided in Appendix A. Regulatory, inspection and system component specifications are provided in Appendix B.

Septic Tank: 1,250-gallon minimum with effluent filter. Risers extended to finished grade.

Transmission Piping: 4-inch solid PVC, gravity discharge, 1% min. grade.

Distribution Box: Min. 4-outlet (min.) with Speed Levelers®. Risers extended to finished grade.

Infiltration Chambers: 62 - Infiltrator® Standard Quick 4 chambers (or approved equivalent) (248 LF).

Infiltrative Surface: Elevation Varies - establish at approx. 12 to 18 inches below existing ground surface.

Chamber Protective Underlayment: ¼-inch galvanized steel mesh.

Topsoil Cover: Provide all absorption field areas with minimum 18 to maximum 36 inches topsoil cover.

Marking and Protection: Septic tank and distribution box locations marked with metal T posts. Absorption field (STA) fenced off to prevent machinery, livestock and wildlife damage.

*Please note that WSG recommends infiltration chambers be protected from rodent excavating and backfilling activity by the placement of ¼-inch galvanized steel mesh that completely covers the open base area of the chamber. Mesh should be secured to chamber base using an approved method and frequency. Schematic OWTS site plan and typical absorption field cross section are shown on Figures 2 and 3, respectively.

OWTS OPERATION AND MAINENANCE

Proper OWTS operation and maintenance is crucial for satisfactory long-term system performance. WSG recommends the following operation and maintenance criteria be observed by the owner/operator.

1. Regular inspection and pumping of the septic tank and effluent filter located at the tank outlet should be conducted by a qualified service provider. A recommended frequency of 3 to 5 years is typical for normal usage. More frequent pumping and filter cleaning may be required based on higher usage.

Seasonal or periodic use facilities may also require additional pumping and maintenance due to inconsistent hydraulic and biological loading.

2. Inspection of STA for signs of surfacing effluent should be conducted on a yearly basis.
3. The installation of water conserving plumbing fixtures, judicious use of water and minimization of solid waste directed to the OWTS is strongly recommended to extend system life.
4. Leaking plumbing fixtures should be repaired immediately. The additional hydraulic loading can permanently damage the STA.
5. Discharge from spas, pools and water treatment systems should not be directed to the OWTS. The chemical and hydraulic loading from these features can permanently damage the STA.
6. The OWTS treatment process is based on naturally occurring biological processes. Discharge of various harsh chemicals, solvents, excessive oil and grease and non-organic wastes to the system can damage or limit biological treatment processes, reducing system performance and life. These materials should not be directed to the OWTS.

LIMITATIONS

Site and soil evaluations and design report were conducted and prepared by Harold Schlicht (Colorado P.E. No. 30299). This report and design are based on the evaluations and were completed in accordance with the Routt County and CDPHE Regulation No. 43 (2018) and using currently accepted OWTS design procedures and standard of care for the profession at the time of service.

This report has been prepared for the exclusive use of WSG's client for the specific application indicated. No warranties express or implied, are made. Changes to the stated proposed construction and usage or addition of wastewater generating features may require changes to the OWTS.

Please be advised that construction or alteration of an OWTS requires a valid permit from the Routt County Department of Environmental Health (970-870-5588).

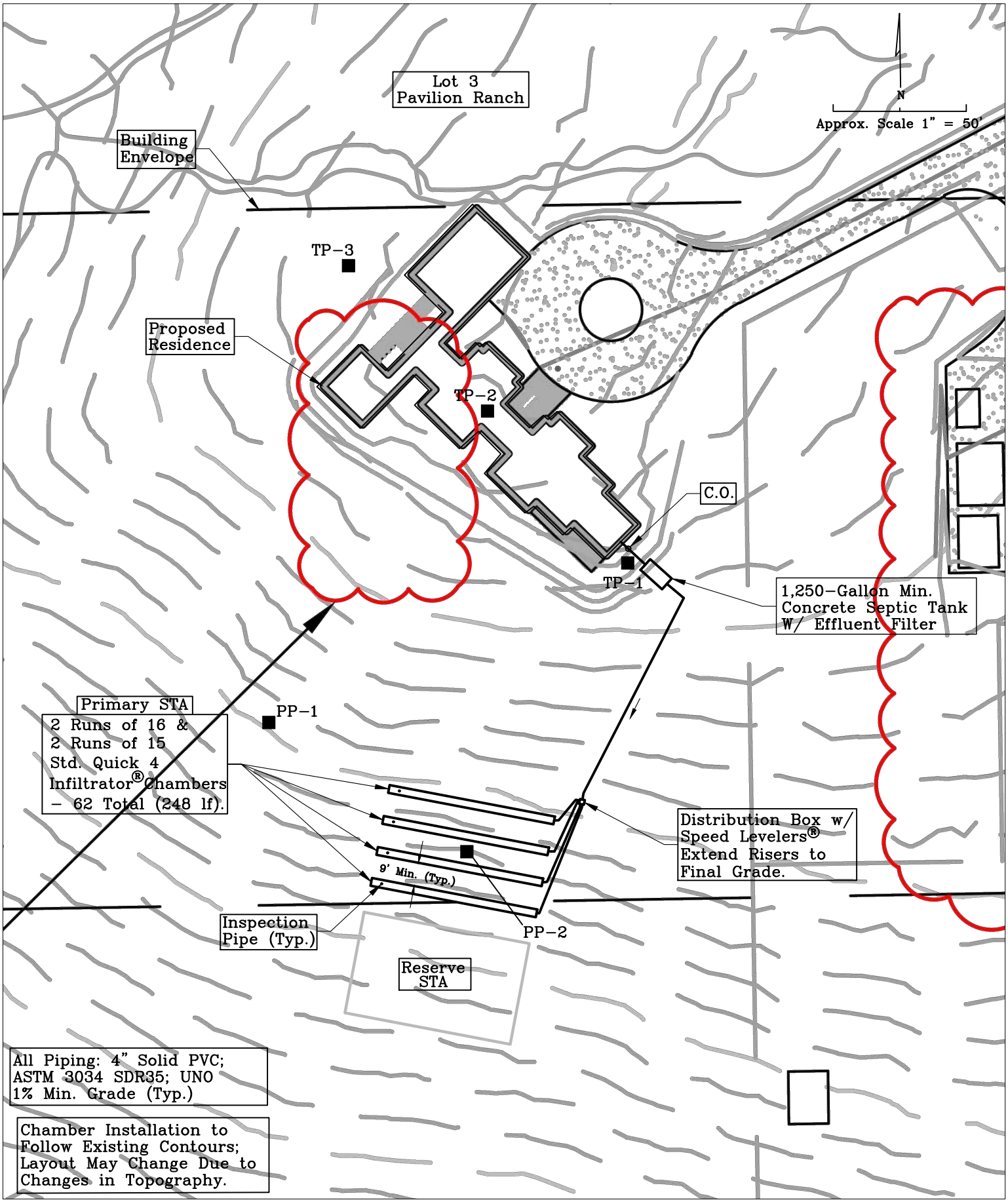
WSG appreciates the opportunity to be of service to you on this project. If you have any questions concerning the enclosed information or if we can be of further service to you in any way, please do not hesitate to contact us.

Very Truly Yours,
Western Slope Geotech, Inc.

Harold Schlicht, PE
Principal Engineer

OWTS VICINITY PLAN

Project Name: Proposed Williams Residence	WESTERN SLOPE GEOTECH STEAMBOAT SPRINGS COLORADO	
Location: Lot 3, Pavilion Ranch, Routt County, CO	Project No.: 23-1090	Drawn/Checked:HS
	Date: 3/6/24	Figure No.: 1



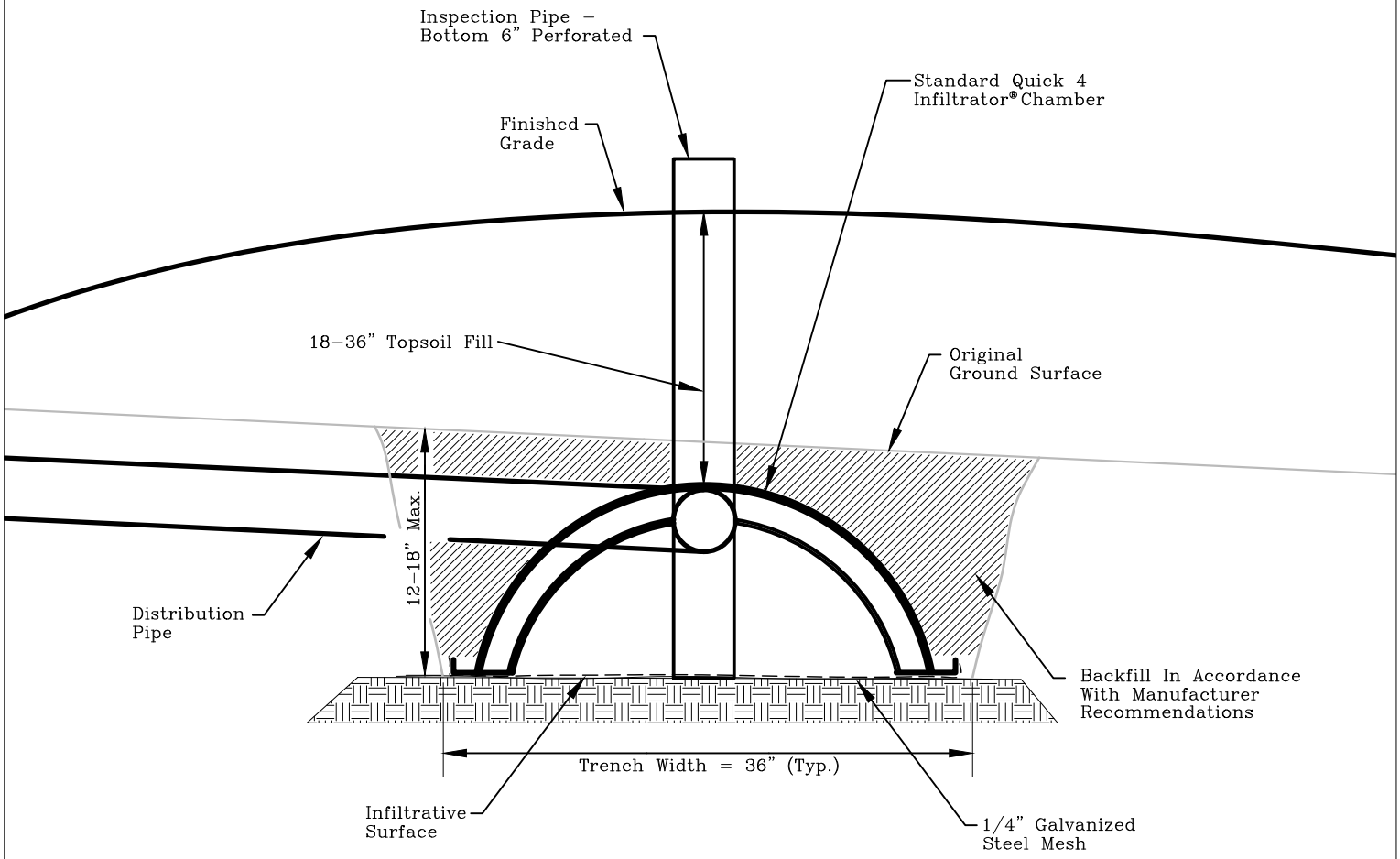
OWTS SITE PLAN

Project Name: Proposed Williams Residence

Location: Lot 3, Pavilion Ranch, Routt County, CO

WESTERN SLOPE GEOTECH STEAMBOAT SPRINGS COLORADO

Project No.: 23-1090	Drawn/Checked:HS
Date: 3/6/24	Figure No.: 2



*Note: Not to Scale.

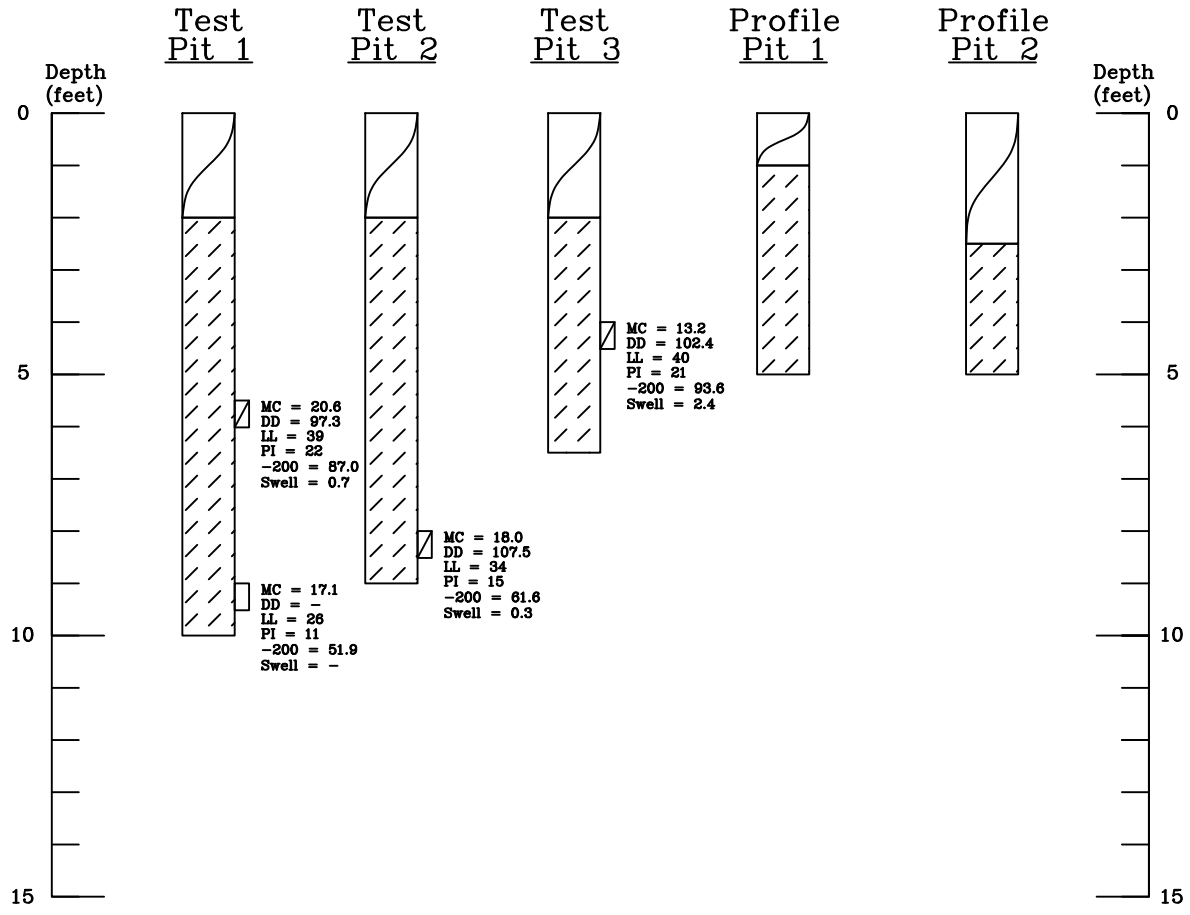
INFILTRATION CHAMBER SYSTEM – TYPICAL CROSS SECTION

Project Name: Proposed Williams Residence

WESTERN SLOPE GEOTECH STEAMBOAT SPRINGS COLORADO

Location: Lot 3, Pavilion Ranch, Routt County, CO

Project No.: 23–1090	Drawn/Checked:HS/HS
Date: 3/6/24	Figure No.: 3



Legend:

TOPSOIL/SILT LOAM.

LEAN CLAY: Slightly to very sandy with scattered gravel, low to moderately plastic, stiff, slightly to very moist and reddish brown.

Hand Drive Sample – California liner.

Small disturbed bag sample.

Notes:

1) Test pits were excavated on 11/10/23 with a Bobcat E55 trackhoe.

2) Locations of test pits were determined by taping from existing building envelope corners in the field and features shown on the site plan provided.

3) Test pit elevations were not determined and logs are drawn to the depths explored.

4) Lines between materials types are approximate and transitions may be gradual.

5) Groundwater measurements were made at the time of excavation and levels may vary.

MC = Natural Moisture Content (%)
DD = Natural Dry Density (pcf)
LL = Liquid Limit
PI = Plasticity Index
-200 = Percent Passing No. 200 Sieve
Swell = Percent Swell Under 500 or 1,000 psf surcharge

LOGS, LEGEND & NOTES

Project Name: Proposed Williams Residence

Location: Lot 3, Pavilion Ranch, Routt County, CO

WESTERN SLOPE GEOTECH STEAMBOAT SPRINGS COLORADO

Project No.: 23-1090	Drawn/Checked:HS/HS
Date: 3/6/24	Figure No. 4

APPENDIX A

DESIGN CALCULATIONS & SETBACK REQUIREMENTS

A. Sewage Volume Calculations

1. Residence – 4 Bedrooms: 525 gpd (per Table 6-1[1])
2. Design Flow: Q = 525 gpd

B. . System Sizing

1. Treatment Level: TL-1
2. Soil Treatment Area (STA) Sizing
    a. Soil Type 2A
    b. LTAR: 0.5 gpd/ft^2 (per Table 10-1[1])
    c. STA = Q/LTAR = 525/0.5 = 1,050 ft^2
    d. Adjustment Factor – Chambers = 0.70
    e. Adjustment Factor – Gravity Flow - Trench = 1.0
    f. STA (Adjusted) = 1,050 ft^2 x 0.70 x 1.0 = 735 ft^2
    g. Number of Chambers = 735 ft^2 /12.0 ft^2/chamber = 62. Use 62 chambers (248 LF)
    h. Contour Loading Rate (CLR) = 525 gpd/248 lf = 2.1 gpd/lf
    i. Septic Tank – 4-Bedroom Residence: 1,250 gallon minimum
    j. Effluent Filter: Yes
3. STA Setback Requirements
    a. Property Line: 10 ft.
    b. Water Supply Line: 25 ft.
    c. Water Well: 100 ft.

[1] Routt County Department of Environmental Health OWTS Regulations (2018)

APPENDIX B

SPECIFICATIONS

A. Installer and owner must comply with all requirements contained in CDPHE On-Site Wastewater Treatment System Regulation No. 43 and all Routt County regulations. Plumbing shall meet current plumbing code requirements.

B. OWTS components shall be installed at the approximate locations, depths and grades as indicated on the plans. Variations from the plans may be required due to variations in topography, building site location and elevation. If variations are necessary, WSG must be contacted for approval. A preconstruction meeting is strongly recommended to discuss system layout, construction and inspection requirements and to reduce potential changes to OWTS plans.

C. Engineer (WSG) must be contacted at least 24 hours in advance for necessary inspections/observations of installed OWTS components including:
    1. Building sewer, tank discharge and distribution piping;
    2. Septic tank, inlet and outlet Ts and effluent filter;
    3. Distribution piping, chambers and/or washed rock;
    4. Pressurized piping shall be pressure tested as directed by engineer;
    5. Approved mound fill – classification, depth and dimensions (when applicable);
    6. Approved pumping components and testing (when applicable);
    7. Approved mechanical filter units, automatic distribution valves and other mechanical components (when applicable);
    8. Contractor shall assist engineer in compiling as-constructed system information including product information and 2-point ties to permanent component and/or site features.

D. All system gravity piping shall consist of 4-inch solid or perforated PVC meeting or exceeding ASTM 3034/SDR35 requirements. Joints shall be watertight, cemented/bonded or gasketed.
    1. All piping shall be bedded and shaded with fine grained on-site or imported material. Bedding and shading will be installed such that it shall provide uniform support and protection to piping.
    2. Trenching and component backfill shall be uniformly compacted to at least 95% of the standard Proctor density near optimum moisture content, unless noted otherwise.
    3. Provide minimum 24 inches soil cover over all piping and components, unless otherwise noted. Provide cleanouts at min. 100’ intervals.

E. Infiltration chambers shall consist of Infiltrator® Quick 4 or other approved product. Manufacturer’s recommendations for installation and backfill shall be observed for all components. Inspection pipes shall be provided one per trench located near end of trench. Chamber trenches shall be constructed level with bases in natural soil.

F. Septic tank inlet and outlet piping shall be supported by compacted (Min. 80% Relative density (ASTM D4253/4254)) screened or washed rock fill (or other suitable structural fill) where piping enters and leaves the tank excavation limits. Risers and securable access ports shall be watertight and extend to or be exposed at final grades. Distribution box risers shall extend to final grade.

G. Absorption (STA) areas shall be fenced off from construction or other activity that contributes to disturbance or soil compaction. Absorption field (STA) construction shall not be commenced during periods of high soil moisture content to minimize disturbance and smearing of infiltrative surfaces.

H. Finished grading shall be sloped to provide positive drainage away from all STA surfaces. Surface and subsurface runoff, foundation drains and other sources of water located upslope of the absorption field shall be directed away from absorption field areas by grading, ditching, piping or use of subsurface drainage collection and discharge systems.

I. Pumping, mechanical systems and electrical systems and controls shall be installed by qualified installers and shall meet all applicable local plumbing and electrical code requirements.

J. Imported fill materials used for seepage beds and trenches, mound fill or other seepage and distribution related components shall be approved by WSG prior to transportation to the site.

K. It is the responsibility of the installer and owner to comply with and maintain all setback requirements throughout the life of the system.