

September 21, 2016

Molly McClure  
29560 Hinton Lane  
Oak Creek, CO 80467

Job Number: 16-10531

Subject: On-Site Wastewater System  
Design, McClure Residence, 29560  
Hinton Lane, Routt County, Colorado.

Dear Molly,

This report presents the results of an On-site Wastewater System (OWS) design for the McClure Residence located at 29560 Hinton Lane in Routt County, Colorado. This 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 the Routt County Board of Health.

**Existing Construction and OWS Evaluation:** It is our understanding, based on our conversations with the client that the existing OWS is failing. The existing residence consists of a total of two bedrooms. The existing OWS was constructed in 1971 or 1972 and consisted of a concrete septic tank with an aeration system and small soil absorption field. NWCC understands that the aeration system is not functioning and the absorption field area is occasionally saturated and has an odor.

The owner is proposing to construct a new OWS, with a new septic tank and new soil treatment area placed 400 to 450 feet east-northeast of the existing residence.

**Site Conditions:** The property is situated northwest of the intersection of Hinton Lane and County Road 14 in Routt County, Colorado. Potable water is supplied to the residence by a well located approximately 200 feet south-southwest of the residence.

The proposed new OWS soil treatment area will be located approximately 400 to 450 feet east-northeast of the existing residence and 100 feet east-southeast of an existing pond. The vegetation in this area consists of grasses, weeds, deciduous brush, scrub oaks and aspen trees. A drainage is located east of the proposed septic tank and flows to the existing pond. The topography in the area of the proposed OWS soil treatment area is variable and generally slopes gently to moderately down to the north on the order of 3 to 10 percent.

A site plan showing the overall site and approximate locations of the existing structures and proposed OWS is provided in Figure #1. Detailed site plans showing the existing structures along with the proposed OWS and alternate OWS are shown in Figures #2 and #5.

**Subsurface Conditions:** Two profile pits were excavated in the area of the new soil treatment area on September 8, 2016. The subsurface conditions encountered in the profile pits consisted of approximately 30 to 36 inches of topsoil and organic materials overlying natural clays to the maximum depth investigated, 8 feet below the existing ground surface (bgs). The clays were slightly sandy to sandy, fine-grained, low to moderately plastic, stiff to very stiff, moist to slightly moist and brown to light brown in color. Groundwater was not encountered in the profile pits at the time of excavation and no evidence of a seasonal groundwater table was observed.

Percolation testing was not conducted in the area of the new OWS. Based on our experience in this area, the upper topsoil and organic materials will likely exhibit percolation rates of 20 to 40 minutes per inch. Based on the assumed percolation rate of the topsoil and visual soil classification of the soils encountered in the profile pits, NWCC has classified the natural topsoil and organic materials as soil type 2A in accordance with Table 10-1 of the Regulations.

**OWS Design:** Based on the soils encountered at the site and our understanding of the proposed construction, NWCC recommends the OWS design consist of a bed or trench soil treatment system constructed in the upper 2 to 12 inches of natural topsoil and organic materials.

The OWS design presented below is based on the total number of bedrooms (2) for the existing residence, as well as the classification for the natural topsoil and organic materials. Considering the anticipated construction, NWCC has determined, using Table 6-1 of the Regulations, an effluent design flow of 300 gallons per day (gpd) for a two bedroom system.

**Gravel Bed System:** Based on the soil type, design effluent flow, a Long Term Acceptance Rate (LTAR) of 0.5 gpd/ft<sup>2</sup> (Treatment Level 1) and size adjustment factors of 1.2 for a gravity distribution bed (Table 10-2) and 1.0 for gravel distribution media (Table 10-3), a minimum gravel bed area of 720 square feet is required for the residence. Therefore, a gravel distribution bed, at least 12 feet wide and 60 feet long will be required for the system. If the owner opts to use a dosing system in the construction of the system, the size of the soil treatment area required can be reduced. NWCC must be contacted to provide the reduction in sizing of the soil treatment area if a dosing system is used.

The natural topsoil and organic materials exposed below the gravel bed should be scarified a minimum of 4 inches prior to placement of the washed gravels. A minimum of 18 inches of soil cover is required over the gravel bed. All finished surfaces should have a minimum of 3 inches of topsoil materials and seeded to prevent erosion.

**Trench/Chamber System:** An alternate OWS to the gravel bed design presented above would be to use a trench absorption system utilizing Standard Infiltrator Chambers. Based on the soil type, design effluent flow, a Long Term Acceptance Rate (LTAR) of 0.5 gpd/ft<sup>2</sup> (Treatment Level 1) and size adjustment factors of 1.0 for a gravity trench system (Table 10-2) and 0.7 for chambers (Table 10-3), a minimum trench absorption area of 420 square feet is required for the residence.

Using information provided by Infiltrator System, Inc., an absorption area of 12ft<sup>2</sup>/Quick-4 Standard Infiltrator chamber was used in the design. This results in a minimum of thirty-five (35) Quick-4 Standard Infiltrator chambers. The natural topsoil and organic materials must be scarified a minimum of 4 inches prior to placement of the Infiltrator chambers. A distribution box, with flow equalizers, must be used to ensure equal flow to all of the trenches. The distribution box lid must be exposed at final grades. Extensions or an access manhole should be used as needed to reach final grades. Insulated lids are required to prevent freezing. A minimum of 18 inches of soil cover must be placed over the chambers in accordance with the manufacturer's recommendations. All finished surfaces should have a minimum of 3 inches of topsoil materials and seeded to prevent erosion.

The bases and sides of the chambers must be wrapped with a ¼-inch galvanized steel or synthetic mesh to help prevent rodent intrusion. NWCC also recommends that the system be fenced off to livestock. If the system is not activated within 30 days of installation or if extended periods of inactivity occur at the residence, the Infiltrator chambers must be periodically flooded with water, every 30 days, to prevent rodents from nesting and burrowing in the chambers, which could result in another premature failure of the system.

As noted above, if a dosing system is used, the minimum soil treatment area required can be reduced and NWCC must be consulted to determine the required chambers.

Septic Tank and Dosing System: A septic tank with a minimum capacity of 1,000-gallons is required for a two bedroom residence. Due to the subsurface conditions encountered at the site, we recommend that a concrete septic tank be used.

A Biotube effluent filter (Orenco FT W0444-36) must be installed in the outlet 'T' of the septic tank. NWCC recommends a filter monitor system be installed in the downstream compartment of the septic tank to warn the owner in the event of a filter clog. 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 construction of an access road to allow for pumping the septic tank may be required.

The system design for the gravel bed system is presented in Figures #2 through #4 and the alternate design for the Infiltrator trench system is presented in Figures #5 through #6. Typical septic 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.

Abandonment of Existing OWS: The existing septic tank must be removed or properly abandoned per the Regulation. The tank must be pumped to remove as much waste as possible. The bottom of the tank must be broken so the tank cannot float or fill with water. The top of the tank must be collapsed into the tank. The sides of the tank can be broken into the void and the remaining void must be filled with compacted soil and graded to above the surroundings to account for settlement.

**Operation and Maintenance:** Observing the operation and performing routine maintenance of the OWS 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 Tank:** The scum and sludge accumulation in the septic tank 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 Filter:** The effluent filter at the septic tank outlet should be cleaned when the septic tank is inspected or as required.
- 3) **Soil Treatment Area:** Soil treatment area should be fenced off to livestock. The surface area around the soil treatment area should be observed monthly for signs of failure, such as lush vegetation growth or ponding. Liquid levels within the gravel bed or 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 OWS. The chemical and hydraulic loading from the backwash of these treatment systems may be detrimental to the OWS. 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 OWS.
- 5) **General Notes:** The owner should be aware that the operation of the OWS 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 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, 2013. The OWS 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 OWS design will also most likely change. It should also be noted that all on-site wastewater systems 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.



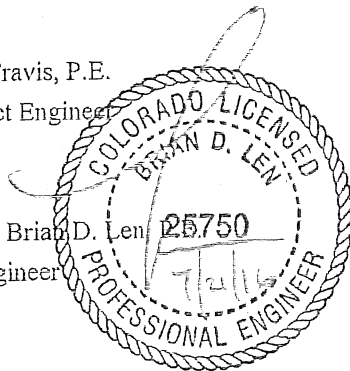
Please be advised that Colorado law requires that a permit must be obtained prior to construction, alteration or use of an on-site wastewater system. In addition, this office must be retained by the client to observe the construction/installation of the OWS and to provide an as-built report to the Routt 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.

Timothy S. Travis, P.E.  
Senior Project Engineer

Reviewed by Brian D. Len  
Principal Engineer



Title: O.W.S.-OVERALL SITE PLAN

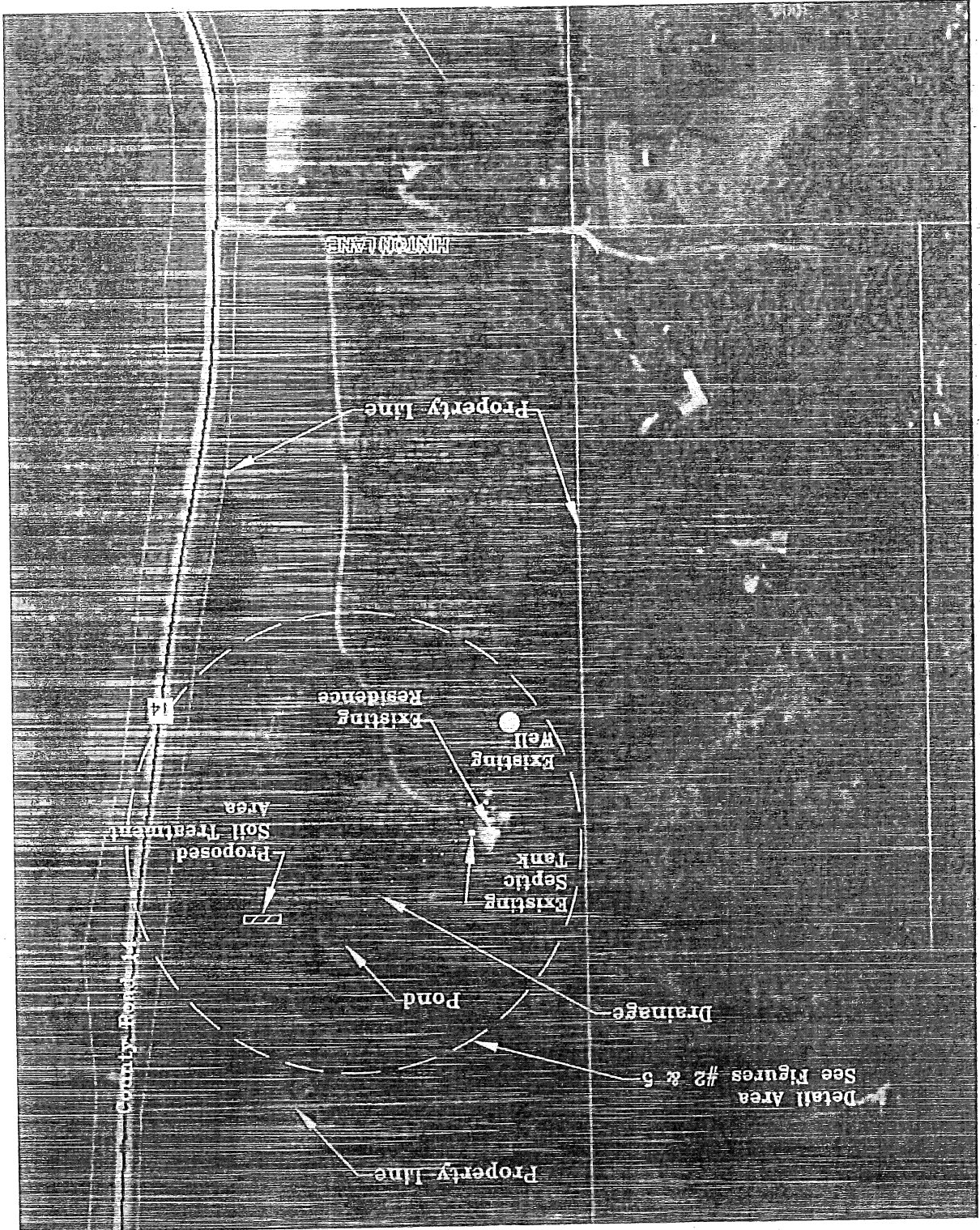
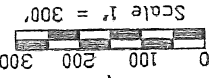
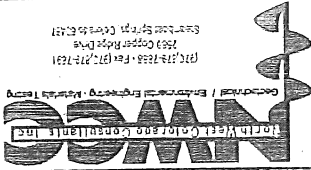
Job Name: McClure Residence

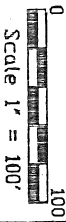
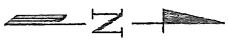
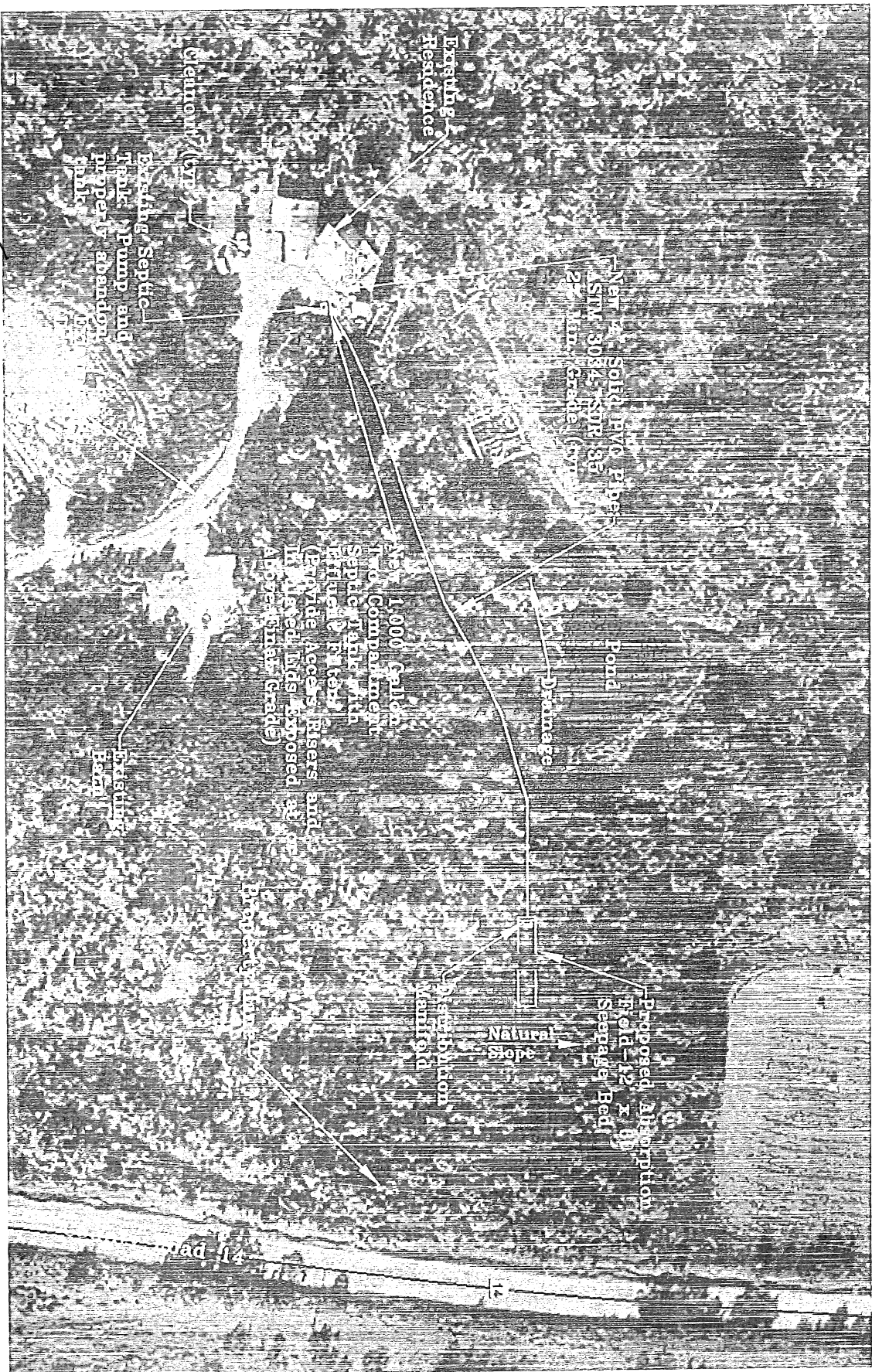
Location: 29560 Hinton Lane, Routt County, Colorado

Date: 9/19/16

Job No. 16-10531

Figure #1



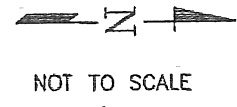


Lot 11  
 Morrison Divide  
 Ranch Subdivision  
 Construct drainage swale  
 or drain into natural  
 soils around uphill side  
 of absorption field.  
 Pump and properly  
 abandon tank.

# O.W.S. - GRAVEL BED SITE PLAN

Title:	Date:	9/19/16
Job Name:	Job No.	16-10531
LOCATION:	Figure	#2

McClure Residence  
 29560 Hinton Lane, Routt County, Colorado



From Tank  
4" Solid PVC  
Pipe: ASTM 3034;  
SDR 35- 2% Min.  
Grade (typ.)

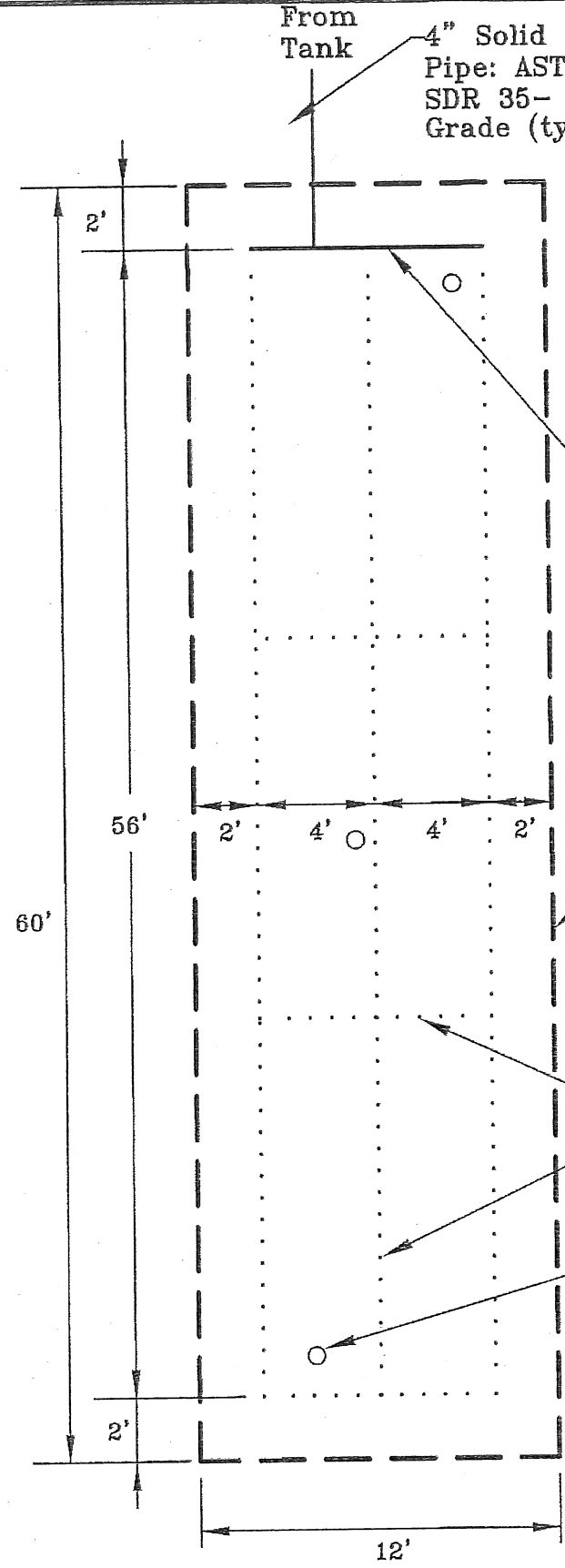
Natural  
Slope →

Distribution  
Manifold  
4" Solid PVC  
ASTM 3034; SDR35  
Set Level

Limits of  
Gravel Bed

4" Diameter  
Perforated  
PVC Pipe

Inspection  
Pipe (typ.)



Title: GRAVEL DISTRIBUTION BED PLAN

Job Name: McClure Residence

Location: 29560 Hinton Lane, Routt County, Colorado

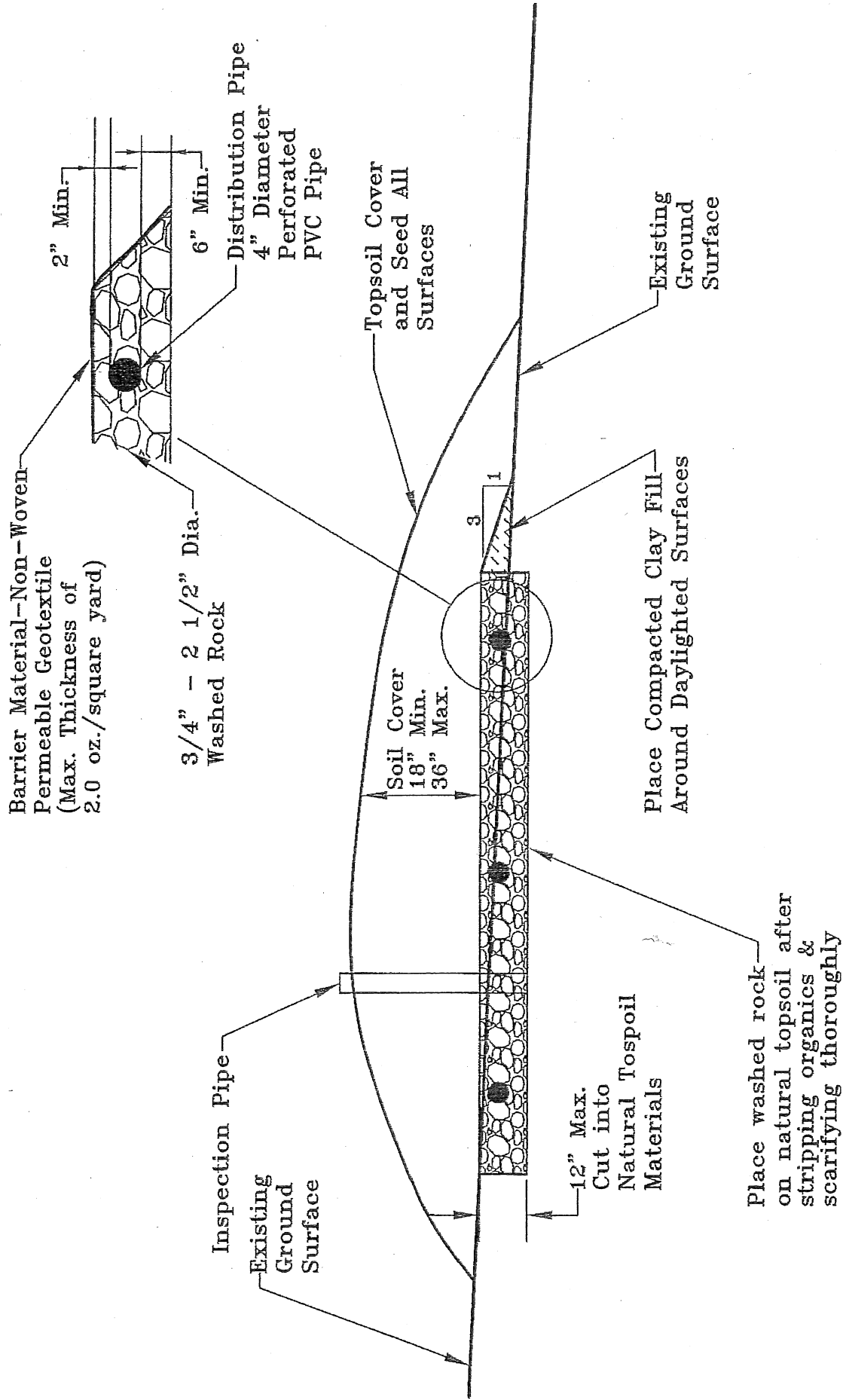
Date: 9/19/16

Job No. 16-10531

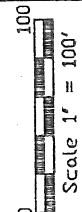
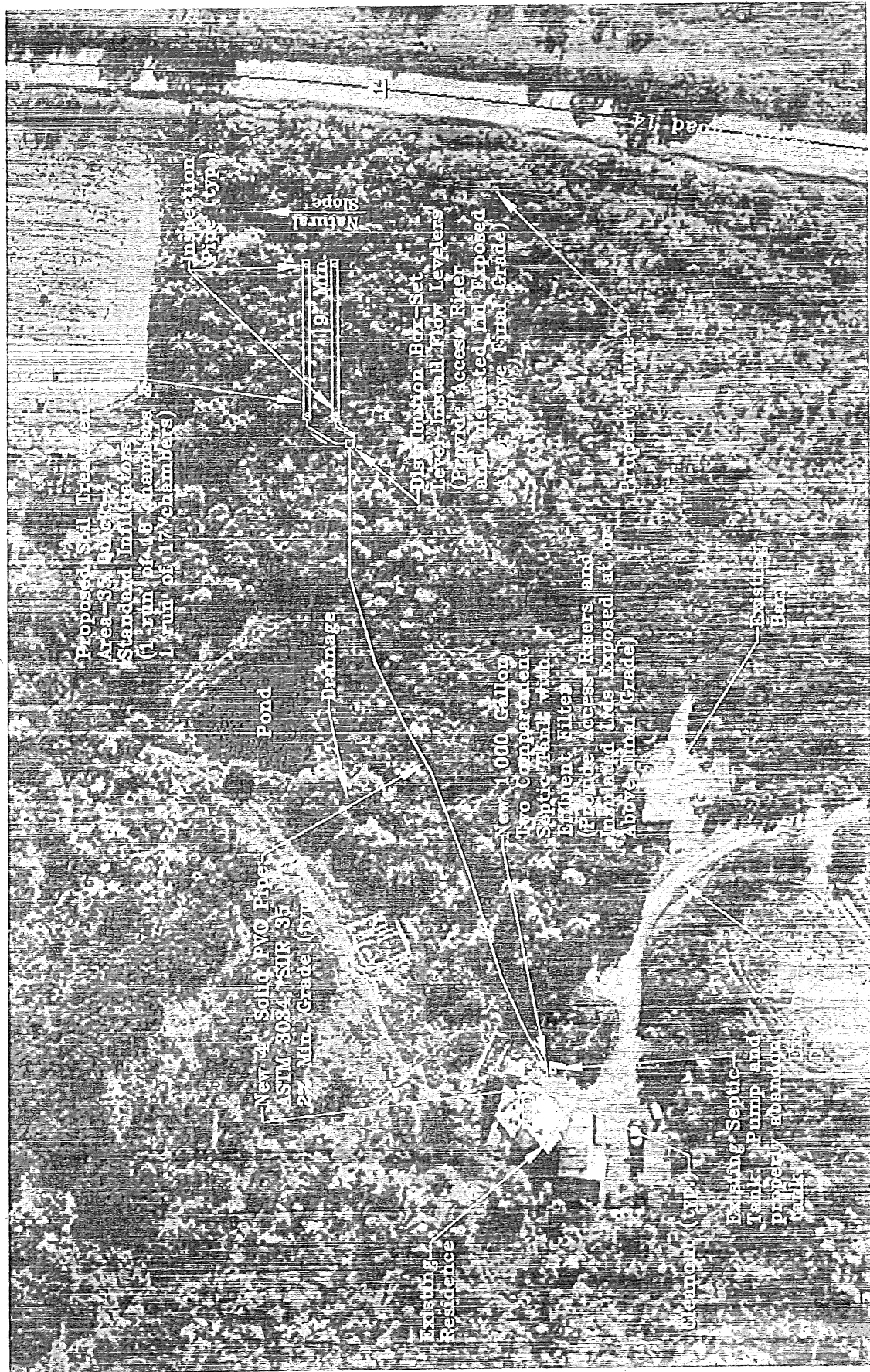
Figure #3

**NWCC**  
North West Colorado Consultants, Inc.  
Geotechnical / Environmental Engineering - Material Testing  
(970) 879-7838 - Fax (970) 879-7831  
2580 Copper Ridge Drive  
Steamboat Springs, Colorado 80437





Title: <b>GRAVEL DISTRIBUTION BED CROSS SECTION</b>		Date: 9/19/16	
Job Name: McClure Residence		Job No. 16-10531	
LOCATION: 29560 Hinton Lane, Routt County, Colorado		Figure #4	

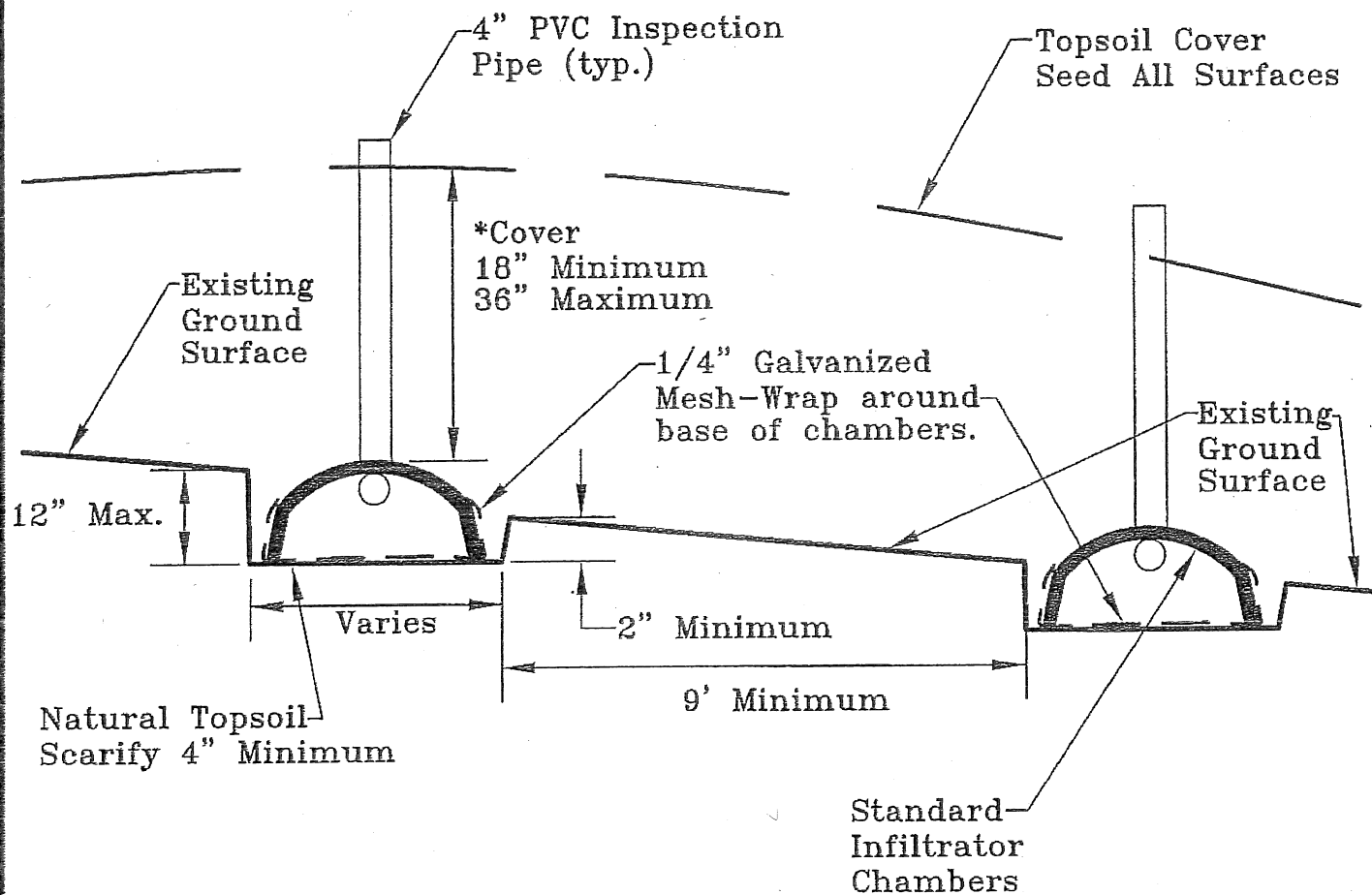


Lot 11  
 Morrison Divide  
 Ranch Subdivision  
 Construct drainage swale  
 or drain into natural  
 soils around uphill side  
 of absorption field.  
 Pump and properly  
 abandon tank.

<b>ALTERNATE O.W.S.-INFILTRATOR SITE PLAN</b>		Date: 9/19/16
Job Name: McClure Residence		Job No. 16-10531
LOCATION: 29560 Hinton Lane, Routt County, Colorado		Figure #5

**RWCE**  
 R. W. C. Engineering  
 2500 Canyon Ridge Drive  
 Steamboat Springs, Colorado 80487  
 (970) 875-1000 • Fax (970) 875-2001

\* The chambers should be backfilled in accordance with the manufacturer's recommendations.



Title: INFILTRATOR SYSTEM CROSS SECTION

Date: 9/19/16

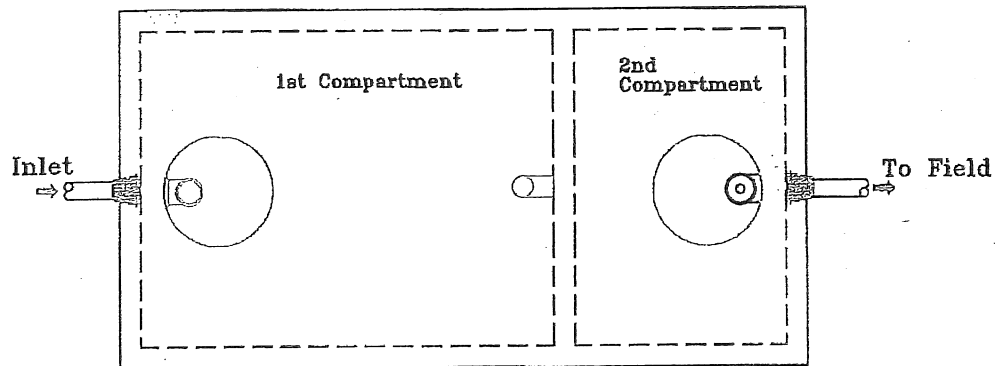
Job Name: McClure Residence

Job No. 16-10531

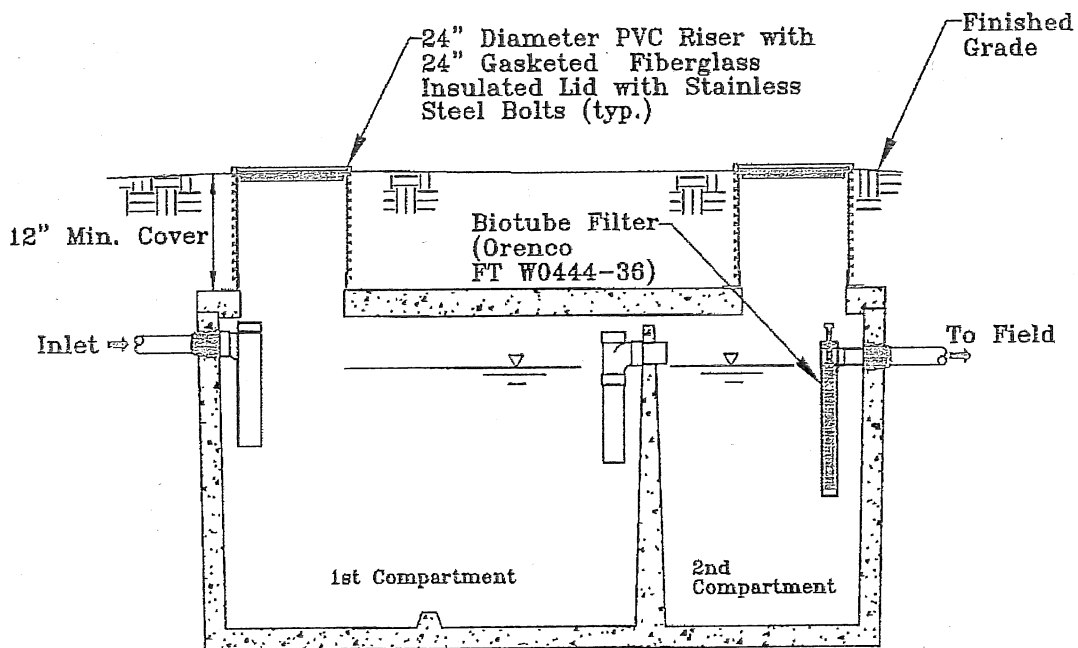
Location: 29560 Hinton Lane, Routt County, Colorado

Figure #6



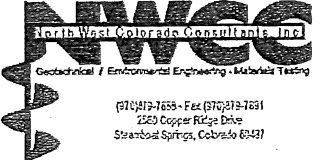


Top View



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: <b>O.W.S.-SEPTIC TANK DETAILS</b>	Date: <b>9/19/16</b>	
Job Name: <b>McClure Residence</b>	Job No. <b>16-10531</b>	
Location: <b>29560 Hinton Lane, Routt County, Colorado</b>	Figure <b>#7</b>	



## APPENDIX A

### SUMMARY OF DESIGN CALCULATIONS

#### A. Sewage Volume Calculations

- 1) Number of Bedrooms:.....2 Bedrooms
- 2) Design Flow (Regulations Table 6-1) .....Q = 300 gpd

#### B. System Sizing

- 1) Soil Type 2A (Table 10-1)
- 2) Minimum soil treatment area =  $Q/LTAR = 300 \text{ gpd}/0.5\text{gpd}/\text{ft}^2 = 600 \text{ ft}^2$
- 3) Gravel bed area =  $900 \text{ ft}^2 \times 1.2$  (Gravity Bed-Table 10-2)  $\times 1.0$  (Rock-Table 10-3) =  $720 \text{ ft}^2$ .
- 4) Designed gravel bed area (12'x 60' bed) =  $12' \times 60' = 720 \text{ ft}^2$ .
- 5) Infiltrator Area =  $600 \text{ ft}^2 \times 1.0$  (Gravity Trench-Table 10-2)  $\times 0.7$  (Chambers-Table 10-3) =  $420 \text{ ft}^2$ .
- 6) Number of Quick-4 Standard. Infiltrator Chambers:  $420 \text{ ft}^2/12.0 \text{ ft}^2/\text{chamber} = 35.0$  chambers => use 35 Standard Quick-4 chambers.
- 7) Septic Tank - 1,000-gallon septic tank minimum for a two-bedroom residence (Table 9-1).
- 8) Minimum well, spring or cistern setback, per Table 7-2 = 100 feet
- 9) Minimum water body (Pond, Wetlands, Irrigation Ditch) setback, per Table 7-2 = 50 feet
- 10) Minimum water supply line, dry drainage setback, per Table 7-2 = 25 feet
- 11) Minimum property line setback, per Table 7-2 = 10 feet

## 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 washed gravel and perforated PVC pipe or chambers, prior to backfilling.
  - c. Upon final completion of the project.
- 3) The 4-inch PVC pipe shall conform to ASTM 3034/SDR 35 or better quality. The perforated pipe in the gravel distribution bed should be constructed level.
- 4) Soils beneath the pipes entering and leaving a septic or aeration 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. Cast iron pipe or 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 absorption field 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 or chambers. 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 and berms shall be covered with topsoil and heavily seeded. Heavy farm equipment and livestock should be fenced or kept off of the absorption field.
- 9) Washed rock shall be covered with synthetic filter fabric (Mirafi 140N) barrier material before overlying soils layers are placed. The washed rock will consist of gravel from 0.75 to 2.5 inches in size.
- 10) Inspection pipes to be constructed of PVC pipe with the portion of the pipe penetrating the gravel being perforated. Inspection pipes must be extended to infiltrative surface at bottom of gravel or allow observation of the infiltrative surface at the bottom of the chambers. Cleanouts must be placed in the solid distribution line upstream of the septic tank at maximum intervals of 100' or above any pipe bends 45 degrees or greater.
- 11) It is the responsibility of the owner and the installer to comply with all of the minimum setback requirements in the Regulations.

# Item # 1000T-2CP

## 1000 Gallon Top Seam Two Compartment

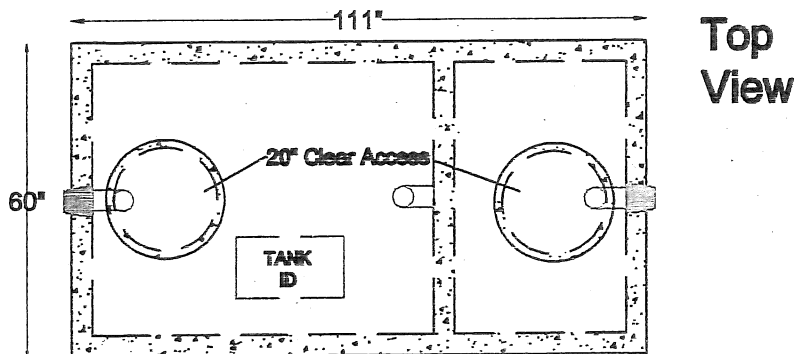
### DESIGN NOTES

- Design per performance test per ASTM C1227
- Top surface area 46.25 ft<sup>2</sup>
- f'c @ 28 days; concrete = 6,000 PSI Min.

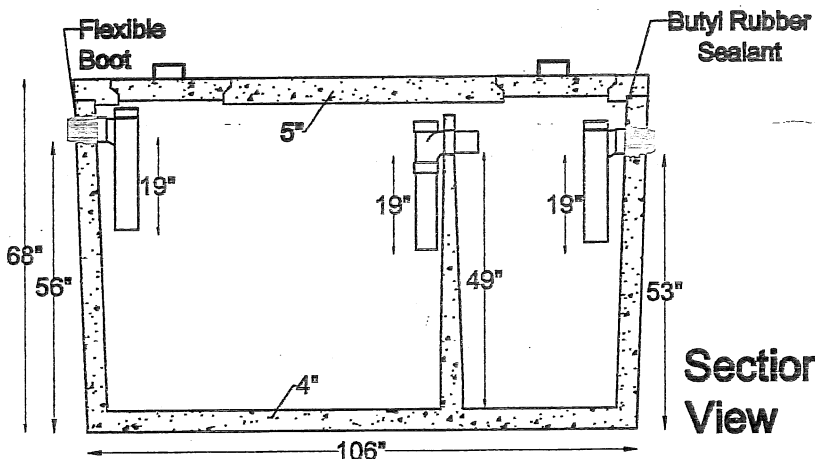
### Installation:

- Tank to be set on 5" min. sand bed or pea gravel
- Tank to be backfilled uniformly on all sides in lifts less than 24" and mechanically compacted
- Excavated material may be used for backfill, provided large stones are removed
- Excavation should be dewatered and tank filled with water prior to being put in service for installation with water table less than 2' below grade
- Meets C1644-06 for resilient connectors
- Inlet and Outlet identified above pipe
- Delivered complete with internal piping
- PVC or concrete risers available
- Secondary safety screen available with PVC riser
- Option of pump or siphon installed

ALLOWABLE BURY (Based on Water Table)	
WATER TABLE	ALLOWABLE EARTH FILL
0' - 0"	2' - 0"
1' - 0"	3' - 0"
2' - 0"	3' - 0"
3' - 0"	4' - 0"
DRY	4' - 0"



Top View



Section View

+ Set Sec  
+ 1' Bt Hole Riser 2x

Digging Specs	Invert		Dimensions			Net Capacity			Net Weight		
13' Long x 8' Wide	Inlet	Outlet	Length	Width	Height	Inlet Side	Outlet	Total	Lid	Tank	Total
56" below inlet	56"	53"	111"	60"	68"	687 gal	323 gal	1010 gal	2620 lbs	9380 lbs	12000 lbs



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