VAL MORITZ VILLAGE

FEASIBILITY REPORT ON INDIVIDUAL ONSITE WASTEWATER SYSTEMS FOR FILING 2, BLOCK 5

Prepared by: Shannon Engineering, Inc.

FEASIBILITY REPORT ON INDIVIDUAL ONSITE WASTEWATER SYSTEMS FOR VAL MORITZ VILLAGE FILING 2, BLOCK 5

SCOPE

The homeowner's association of Val Moritz Village in Grand County, Colorado has investigated possible alternatives for handling the anticipated wastewater of individual homes on the 147 lots in the subdivision. Each lot is approximately 1 acre in size. The small size of the lots, high clay content soils, and some high groundwater situations complicate the use of individual wastewater systems in this subdivision. Consequently, the conventional individual onsite wastewater system (OWS) will not work here. A centralized community sewer system was explored, and although not impractical, it would be quite expensive and probably require adjudicating water issues. The traditional approach in dealing with these conditions by utilizing individual mound systems would work in many cases, but the slope of some lots, the area required for a mound, the negative aesthetic impacts, and the costs of imported materials make the mound an undesirable solution to the challenge at hand. Relatively recently however, advanced treatment and shallow dispersal technologies have become available that are affordable, reliable, and approved for use for individual homes. These treatment techniques sufficiently clean septic tank effluent to allow application at very shallow soil depths and into higher clay content soils exhibiting slow percolation rates.

The homeowner's association desires an engineering review of each lot in sufficient detail to determine the feasibility of employing advanced treatment technologies to provide individual onsite wastewater systems. It is understood that further detailed OWS designs will be required to complete the process for each lot prior to obtaining a building permit. Without specific details on the configuration of each house, it would be premature to design an OWS for a particular lot. Additionally, during the build-out of the subdivision, advanced treatment OWS technologies may improve; which might render early designs obsolete. Since each lot will have its own well, it is crucial that the placement of wells and OWS components be addressed from a multi-lot perspective. Otherwise, some lot owners may find that their neighbors have rendered a particular lot "un-build-able" due to setback conflicts.

GENERAL FINDINGS AND COMMENTS

In our investigation of the 23 lots in Block 2 of Filing 5 of the Val Moritz Subdivision we found no compelling reasons to preclude the use of onsite wastewater systems for each lot. These systems will require advanced treatment of the septic tank

> Page 1 12/12/2006

Shannon Engineering, Inc. PO Box 156, Galesburg, MI 49053-156 Phone: (269) 665-7440 Fax: (269) 665-7441 or PO Box 983, Kremmling, CO 80459 Phone & Fax: (970) 724-0247 effluent and application to the soil at shallow depths. However, several of the lots exhibited signs of moisture in the soil and lots 12 through 23 had site conditions or sufficient groundwater to warrant special consideration; such as, a raised drainfield or a curtain drain to dewater the area of the drainfield. Proper planning and the judicious location of each OWS will allow each lot to have individual wells and proper setbacks from the OWS components. Advanced treatment, though more expensive than conventional wastewater systems, will be more environmentally sound. In considering the subdivision as a whole, advanced treatment will reduce the levels of nitrogen introduced into the soils, and, in the long run, reduce the risks of well water contamination.

It is prudent that the homeowner's association adopted covenants that will reduce the potential wastewater loading for the entire subdivision by establishing a limit on the maximum number of bedrooms per lot. The principle at work: the lower the wastewater loading, the lower the risks of contamination. Since the number of bedrooms is the main indicator of potential wastewater flows, limiting the number of bedrooms will therefore limit the overall wastewater loading.

ADVANCED SEPTIC TANK EFFLUENT TREATMENT

As mentioned above, the site conditions at Val Moritz Village preclude the use of conventional onsite wastewater systems that employ only a septic tank and drain field. Development of the lots in this subdivision will take several years, and the OWS technology will improve over time. However, there are existing, economically viable systems for the advanced treatment of residential septic tank effluent that will allow application to an onsite drain field. There are several manufactures of these types of systems. We have had good success with the AdvanTex recirculating non-woven textile media filter system provided by Orenco Systems, Inc. (OSI). Several of these systems have been installed in Grand County, and the Board of Health has approved them for use on sites with difficult soil conditions. Appendix A outlines the advantages of this system. Although Aerobic Treatment Units are now approved for residential use in Grand County and may be somewhat less expensive than the AdvanTex system, we believe that the cost differences are outweighed by the long term operating advantages of the AdvanTex system. Appendix B provides comments on why the AdvanTex system is more desirable than some of the other types of treatment approaches that have historically been employed. As technology improves, we may find that other advanced treatment systems will prove to be superior to the AdvanTex system; however, our assertion that the residential wastewater for the lots in Val Moritz Village can be feasibly managed onsite is based upon achieving or surpassing the level of treatment provided by the OSI AdvanTex system. As a minimum, "advanced treatment" as used in this report means producing wastewater that exceeds the NSF secondary effluent standards and achieves a 50 to 70% reduction in nitrogen in the septic tank effluent stream.

SOIL ABSORPTION AND DISPERSAL

Page 2 12/12/2006

Shannon Engineering, Inc. PO Box 156, Galesburg, MI 49053-156 Phone: (269) 665-7440 Fax: (269) 665-7441 or PO Box 983, Kremmling, CO 80459 Phone & Fax: (970) 724-0247 The fundamental issue confronting the lot owners of Val Moritz Village is how to return their well water to the ground after it has been used for household needs. The soil in this subdivision is generally not receptive to typical septic tank effluent (STE). The organic materials and suspended solids in STE readily create an environment that clogs the minute pores in clay soils. By "cleaning up" the STE through advanced treatment, the same soil will accept the wastewater over years of service. Therefore, the first important factor is to apply only effluent that is sufficiently free of organics and suspended solids.

The second important factor is the use of shallow drain fields or drip irrigation to disperse the treated effluent back into the soil. A shallow drain field consists of a series of trenches approximately 1 ft. wide and 1 ft. deep with void space created by inverted sections of 12" diameter irrigation pipe cut in half. In this void space or chamber there are distribution lateral pipes of 1" to 1.5" diameter with orifices for dispersing the effluent evenly along the length of each trench. Typically we are designing these systems with 100 to 150 ft. of trench per bedroom. The length and layout of the trenches will depend upon the soil and the size of the home at that particular lot. Drip irrigation dispersal systems employ a bed of tubes with emitters that distribute the treated effluent directly into the soil over a relatively large area. On most lots, we have found that the upper soil horizon will readily accept the treated effluent. By applying the treated effluent in the upper soil horizon with high clay content.

- 1. The use of trenches or drip irrigation spreads the effluent over a much larger area than would a conventional infiltration bed.
- 2. The treated effluent will be polished further by the natural processes that occur as it flows through the upper soil horizon.
- 3. The treated effluent will spread out in the upper soil horizon before reaching the clay soil horizon. This effectively increases the area to which it is applied and lowers the application rate to the clay soil horizon.
- 4. The natural interface between the upper and clay soil horizons is not disturbed. Root penetrations and irregularities in this interface will greatly facilitate the movement of the effluent into the clay soil.
- 5. Vegetation rooted in the upper soil horizon will draw some of the moisture away from the clay soils below.
- 6. Shallow trenches are narrow and can be installed using smaller equipment. This results in less tree removal and less general disturbance to the lot.
- 7. Shallow drain fields are more economical to construct than deeper ones.
- 8. Advanced treatment coupled with shallow drain fields will allow for adequate separation in the case of higher groundwater.

The principal concern that we hear regarding shallow drain fields or drip irrigation systems is the fear of freezing. These systems are designed to drain at the end of each dosing cycle and have been used in climates that have more severe freezing problems than Grand County. In addition to shallow systems that have been functioning properly here for several winters, they have been successfully used in Alaska, Minnesota and Wisconsin. The third important factor is pressure micro dosing. Pressure dosing extends the life of the drain field by spreading out the organic loading over the entire filed. By applying small doses, saturated soil conditions are avoided. This enhances the further treatment of the effluent and increases the acceptance of the moisture into the clay soil horizon. It improves adsorption of phosphates by minimizing saturated flow and channeling in the soil pores.

This Feasibility Report addresses the 23 lots in Block 2 of Filing 5. Attached is soil profile information and upper soil horizon percolation or infiltration testing data. These indicate that it is feasible to apply AdvanTex filtrate, or wastewater cleaned to the same or better quality, in a shallow drain field or drip irrigation system. We have concern for those few areas where the upper more permeable soil horizons are less than 1'-4" in total depth. Particular care will be required on all lots during the installation of the shallow drain fields to insure that the bottoms of the trenches do not dive into the extremely low permeability soil horizon. If the more permeable upper soil horizon should prove to be too shallow in spots, the trenches will need to be kept in the permeable horizon and imported fill added over the trenches to provide proper top cover.

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David H. Shannon, P. E. Shannon Engineering, Inc. Colorado Registration Number 30183

Shannon Engineering, Inc. PO Box 156, Galesburg, MI 49053-156 Phone: (269) 665-7440 Fax: (269) 665-7441 or PO Box 983, Kremmling, CO 80459 Phone & Fax: (970) 724-0247 APPENDIX A: Orenco Systems, Inc AdvanTex System

A specific example of the type of advanced effluent treatment that is available today is the Orenco Systems, Inc. AdvanTex system. The AdvanTex system passed the National Sanitation Foundation ANSI/NSF Standard 40, Class 1 tests for treatment of residential wastewater. These systems are also approved for advanced treatment of septic tank effluent by the Grand County Board of Health.

The following table indicates the properties of residential wastewater and treated effluent from the proposed OSI AdvanTex system. It also gives figures for the requirements under Article IX of the Colorado ISDS regulations for dispersal of effluent in various ways.

As can be seen from these figures on the table below, the effluent from the AdvanTex system would be "clean" enough to dispose of on the surface if human contact were restricted and certainly sufficient to disperse in a sub-surface manner even where the soil is unsuitable for normal soil absorption bed.

	Typical	Surface	Surface	Sub-surface	OSI
	Screened	Disposal	Disposal	Disposal In	AdvanTex
	Septic Tank	Where	Protected	Unsuitable	System
	Residential	Human	From Human	Soils	Effluent
	Wastewater	Contact Is	Contact		
		Possible			
		- Article IX	- Article IX	- Article IX	-
BOD ₅ mg/l	130	<20	<20	<60	≤5
TSS mg/l	30	<40	<40	<40	≤5
Tot. N mg/l	65				≤32*
Coliform	10 ⁶	<25	<500		≈1000
cts/100ml					
Oil &	20				<10
Grease mg/l					

* The amount of nitrogen removal may be limited by the alkalinity of the water source. Table A-1 - Effluent Characteristics

It is documented in the literature that residential wastewater that has been treated in the OSI AdvanTex - AX system is relatively "clean." It surpasses secondary treatment criteria. However, the AdvanTex system will not remove sufficient fecal coliform to allow for discharge directly into streams or to the surface unprotected. This system will utilize

Page 5 12/12/2006

Shannon Engineering, Inc. PO Box 156, Galesburg, MI 49053-156 Phone: (269) 665-7440 Fax: (269) 665-7441 or PO Box 983, Kremmling, CO 80459 Phone & Fax: (970) 724-0247 shallow trenches or drip irrigation techniques for a sub-surface soil absorption field to remove the coliform still remaining in the filtrate effluent. Additionally, the level of nitrogen in the treated effluent is substantially reduced. The use of the AdvanTex units is expected to result in a substantial reduction in the total nitrogen in the wastewater stream of the subdivision. This is a definite environmental benefit.

OSI's system was selected because of their history of providing high quality systems for over 20 years. There are over 200 AdvanTex based onsite wastewater systems that have already been installed in Colorado and thousands more around the country. The ability of SCG Enterprises, Inc. of Conifer, Colorado to provide remote monitoring of the pump controls and tank high-level indicators gives confidence that we will have warning if the wastewater flows exceed design limits. Periodic onsite monitoring of the effluent quality by SCG's approved service provider for Grand County will give confidence that the system is performing properly.

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APPENDIX B: Onsite Wastewater Treatment Alternatives

Several alternatives for treatment were considered. Recirculating media filter technology is proven and has been used for decades. The OSI AdvanTex units are modular, facilitating installation flexibility. With these units, the quality of the media textile is controlled in the factory, and it may be easily cleaned as needed or replaced if it becomes necessary. They have passed NSF testing and are approved for use by the Colorado Department of Public Health and Environment and by the Grand County Board of Health.

The practicality of using a "package treatment plant" for clusters of homes was also considered. This type of OWS is relatively expensive for this level of wastewater flow. These systems typically require frequent monitoring by specially trained operators and often require attention to the many mechanical components. Seasonal shutdown/startup may also prove problematic.

The use of a recirculating or single pass sand filter to accomplish the pretreatment of the effluent was considered. The variability of the media, its cost, installation challenges, and the difficulty of replacing media when needed again directed us toward the textile media system.

Mound systems constructed from imported materials could also be employed for these lots. The mound systems have the same disadvantages as sand filters, but with increased difficulty of installation, and they tend to be unsightly.

Therefore, the AdvanTex approach has several advantages.

- 1. The treatment units are modular and compact requiring only a small footprint for installation. Disruption of the rest of the lot is kept to a minimum. The light weight units are easy to transport and install on difficult-to-access sites.
- 2. The quality of the filtration media is assured in the AdvanTex systems. Sand media of proper quality is difficult to find, expensive to haul, and requires skilled placement by the installing contractor in order to function properly.
- 3. Once installed, sand media can be serviced only by replacement. This is difficult and costly. The non-woven textile media in the AdvanTex modules can be easily removed for cleaning or replacement should it become necessary.
- 4. Sand filters and mounds are constructed onsite with locally available materials. The effectiveness of the treatment is greatly influenced by the knowledge and ability of the installing contractor. AdvanTex units are factory assembled and then installed by authorized service providers.

Peat is sometimes employed as a packed bed filter media. There are units commercially available that make use of this technology. However, there appears to be no particular

advantage, either economically or technologically, to using the peat filter units. Grand County has not been regularly approving peat systems as they have with the AdvanTex units, and there is no mechanism in place for ongoing maintenance agreements on these units. Grand County has not been regularly approving peat systems as they have with the AdvanTex units.

Another advanced treatment system that is available, but we believe to be inferior to the use on non-woven textile packed bed technology, is the aerobic treatment unit (ATU). The ATU works by using blowers to diffuse air in the septic tank to create an environment conducive to aerobic bacteriological processes. This enhances the level of treatment of the sewage. These units are sometimes less expensive than the AdvanTex units. However, field studies have indicated a problem with the reliability of the blowers, and therefore the reliability of the treatment process. There is a greater likelihood of suspended solids being discharged into the drainfield when the ATU is first started and each time the system is awakened from a period of non-use. The energy necessary to operate the blower is more than that required for the AdvanTex pumps. Also the blower wears out much more rapidly than the pumps, and periodic replacement costs can offset any initial installation savings. ATU's are now approved for use in Grand County and are an option for Val Moritz property owners. The dispersal field would typically be either shallow trenches or drip irrigation as with the AdvanTex systems.

Val Moritz Village, Filing 2, Block 5

	Avg.	CI	m of fall	cm of fall	cm of fall		
	Perc.	l ii	n Perc.	in Perc.	in Perc.		Avg.
Lot	(min./in.)	1 +	lole #1	Hole #2	Hole #3	Time	Depth
1			1.2	0.8	0.5	10	15
	35		21	32	51		
2			0.9	0.6	2.5	10	15
	27		28	42	10		
3			0.7	1.3	0.8	10	16
	29		36	20	32		
4			0.7	0.8	1.1	10	14
	30	_	36	32	23		
5		\perp	1.2	1.0	1.3	10	16
	22		21	25	20		
6			1.4	0.9	1.5	10	15
	21		18	28	17		10
			1.3	1.1	1.1	10	16
<u> </u>	22		20	23	23	10	15
0	10		1.2	1.0	1,4		15
<u> </u>	19		0.5	06	10	10	17
	43		51	42	36	10	
10			17	16	0.8	10	16
	21		1.7	16	32		10
11		+	0.9	0.8	0.6	10	15
	34	+	28	32	42		
12			12.2	10.2	5.2	10	17
	3		2	2	5		
13	1		3.5	3.2	Very Fast	10	17
	8		7	8	Very Fast		
14			1.2	4.8	3.3	10	17
	11		21	5	8		
15			3.4	4.0	3.8	10	16
	7		7	6	7		
16			2.2	4.0	8.9	10	13
	7		12	6	3		
1/			0.6	0.4	6.0	10	16
40	3/		42	64	4		
18		+	1.0	1.9	0.7	10	15
10	25		25	13	30		15
19		+	0.4	0.3	0.2	10	13
20	92		04	05	127	10	16
	35		<u>0.0</u> 32	51	1.1	10	10
21			0.4	25	31	10	16
	27	+	64	10	8		<u>+</u> −−−''
22	<u></u>	+	0.7	0.7	0.3	10	16
	52	-+	36	36	85		
23		-	0.3	0.7	0.6	10	16
	54	1	85	36	42		1

Profile Hole Observed: 7/1/2006

······			J.S.D.A. SOIL CLASSIFICAT	ON METHOD		
		DEPTH	0'-0" - 1'-0"	1'-0" - 1'-8"	<u>1'-8" - 4'-10"</u>	4'-10" - 8'-0"
TEVTUDE			lopsoil	0		
IEXTURE			Loam	Sandy Clay & Clay Loam	Sandy Clay & Clayey Sand	Clay
	** 0 1				- 000/	4024
HOCK FRAGMENTS	% HOCK		< 10%	< 10%	* 20%	< 10%
·····	Cine				T- 51	
	Size		·····		10.5	
	Snape			· ·	Sub-Ariguiar	
	Denne			<u> </u>		
SOIL STRUCTURE	Degree		Compound	Compound	Compound	Compound
	Shana		Sub-Apoular	Columnar	Sub-Angular Blooky	Sub Angular Blooky
	онаре		Sub-Angolai	Columna	Sub-Aligulai blocky	SUD-Aliguiai Diocky
	Grade		Moderate	Moderate	Weak to Moderate	Moderate to Strong
·			Hoderate	Moderate	Weak to Modelate	moderate to otrong
·						
	Size		Eine to Medium	Medium to Large	Fine to Medium	Fine
				modian to targe		
CONSISTENCE	Wet					
		Stickiness	Not Sticky	Sticky	Somewhat Sticky	Sticky
			· · · · · · · · · · · · · · · · · · ·			
		Plasticity	Non Plastic	Plastic	Somewhat Plastic	Plastic
	Moist		Friable	Friable	Friable	Friable
	Dry					
		Consistence	Moderate to Firm	Modeerate	Modeerate	Firm to Hard
		Cementation	None	None	None	None
COL 08	Mungall		10 VP 2/2	2.5 VP 6/2	10 VD 6/6	0 E V 7/0
0000	Description		Ven/ Dark Gravish Brown	Light Brownish Gray	Brownich Vollow	C.3 T //Z
	Jeachpilon		Tory Dain Grayian Diowit	Light Drownian Gray	DIOWNISH TENOW	Light Gray
			····			
	Mottling		None	None	Yes	Yes
OBSERVED MOISTURE			None	None	Moist	Moist

According to the U.S.D.A. S.C.S. Grand County Soll Survey - This area is likely to be: Cimmaron Loam

GROUND COVER: Grass, rabbit brush, shrubs, forbs.

SLOPE: 5% at a bearing of 105°

PERCOLATION RATE:

35 min./in. Avg Depth (in.) 15

NOTES: Profile hole on the property line with lots 1 & 2.

Profile Hole Observed: 7/1/2006

U.S.D.A. SOIL CLASSIFICATION METHOD								
		DEPTH	0'-0" - 1'-0"	1'-0" - 1'-8"	1'-8" - 4'-10"	4'-10" - 8'-0"		
			Topsoil					
TEXTURE			Loam	Sandy Clay & Clay Loam	Sandy Clay & Clayey Sand	Clay		
BOCK FRAGMENTS	% Bock		< 10%	< 10%	≈ 20%	< 10%		
	Sizo				To 5"			
	Chapa				Sub-Angular			
	Shape				Sub Pingulai			
	Demos		Company of	Company	Compound	Compound		
SUIL STRUCTURE	Degree		Compound	Compound	Compound	Compound		
					O h A su h Bissis	Out Annulas Disatas		
	Shape		Sub-Angular	Columnar	SUD-Angular Biocky	Sub-Angular Blocky		
	Grade		Moderate	Moderate	Weak to Moderate	Moderate to Strong		
	Size		Fine to Medium	Medium to Large	Fine to Medium	Fine		
CONSISTENCE	Wet				1 1			
		Stickiness	Not Sticky	Sticky	Somewhat Sticky	Sticky		
		Plasticity	Non Plastic	Plastic	Somewhat Plastic	Plastic		
		i lustiony		1 Iustic				
	Maint		Friabla	Friable	Friablo	Friable		
	MOISE		Filable	t hable	Thable	1 nable		
					 			
······								
	Dry							
		Consistence	Moderate to Firm	Moderate	Modeerate	Firm to Hard		
		Cementation	None	None	None	None		
COLOR	Munseli		10 YR 3/2	2.5 YR 6/2	10 YR 6/6	2.5 Y 7/2		
	Description		Very Dark Grayish Brown	Light Brownish Gray	Brownish Yellow	Light Gray		
	Mottling		None	None	Yes	Yes		
OBSERVED MOISTURE	1		None	None	Moist	Moist		

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Cimmaron Loam

GROUND COVER: Grass, rabbit brush, shrubs, forbs.

SLOPE: 5% at a bearing of 105°

PERCOLATION RATE: 27 min./in. Avg Depth (in.) 15

NOTES: Profile hole on the property line with lots 1 & 2.

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Profile Hole Observed: 7/1/2006

			U.S.D.A. SUIL CLASSIFIC	ATION METHOD		<u></u>
					4	
		DEPTH	0'-0" - 0'-11"	0'-11" - 1'-10"	1'-10" - 5'-2"	5'-2" - 8'-0"
			Topsoil			
TEXTURE			Loam	Clay	Sandy Clay	Clay
ROCK FRAGMENTS	% Rock		< 10%	< 10%	≈ 15%	< 10%
					Sandstone	
	Size				To 6"	
	Shape			· · · · · · · · · · · · · · · · · · ·	Sub-Angular	
	- Ondpo		····=			
	Dearea		Compound	Compound	Compound	Compound
JOIL STRUCTURE	Degree		Compound	Compound	Compound	Сопровна
	Change		Cub Angular Plasta	Calveras	Cab Annulas Diasta	C. h. Annulas Display
	Snape		SUD-Angular Blocky	Columnar	SUD-Angular Blocky	Sub-Angular Blocky
	 					
	Grade		Moderate	Moderate	Moderate to Strong	Moderate to Strong
	Size		Fine to Medium	Medium to Large	Fine to Medium	Fine
CONSISTENCE	Wet					1
		Stickiness	Not Sticky	Sticky	Sticky	Sticky
					1	1
		Plasticity	Not Plastic	Plastic	Plastic	Plastic
	1					
	1				· · · · · · · · · · · · · · · · · · ·	
	Moist		Friable	Eriable	Eriable	Friable
	11			······	1	
	Drv					
		Consistence	Moderate	Moderate to Firm	Moderate to Firm	Moderate to Hard
						inductate to thate
		Componention	Nono	Nono	Nono	Nana
		Cemerkation	NOTE	None	NOTE	INOTIE
COLOR	Nuncell		10 VP 4/2	10 VB 7/4	7.5 VP 6/6	25 VD 5/2
	RIGHSEN		10 11 4/2	10 11 7/4	7.5 11 0/0	Light Olive Prover with some
	Description		Dork Craviah Brown	Von Bala Brown	Boddish Vellow	Milito
	Description		Dark Grayish Drown	Very Fale DIUWII	neousi reilow	AALNIG.
	tt	·			.	
			NI			
	Mottling		None	None	Yes	Yes
	l				+	
OBSERVED MOISTURE	I		None	None	Slight	Moist

4

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Cimmaron Loam

GROUND COVER: Grass, rabbit brush, shrubs, forbs.

SLOPE: 7% at a bearing of 140°

PERCOLATION RATE: 29 min./in. Avg Depth (in.) 16

NOTES: Profile hole on the property line with lots 3 & 4.

Profile Hole Observed: 7/1/2006

	r		S.D.A. SOIL CLASSIFICAT	ION METHOD	r	
		OF OT O				CI 01 01 01
	↓ ↓		0-00-11-	0-1)" - 1'-10"	1-10-5-2	5-2 - 8-0
TEXTURE			logm	Clay	Sandy Clay	Clay
	├ ────		EUam	Ciay	Salidy Clay	Cidy
ROCK ERAGMENTS	% Bock		< 10%	< 10%	≈ 15%	< 10%
HOURTHAUMENTO					Sandstone	
	Size				To 6"	
	Shape				Sub-Angular	
SOIL STRUCTURE	Degree		Compound	Compound	Compound	Compound
	× -					
	Shape		Sub-Angular Blocky	Columnar	Sub-Angular Blocky	Sub-Angular Blocky
	Grade		Moderate	Moderate	Moderate to Strong	Moderate to Strong
			· · · · · · · · · · · · · · · · · · ·			
	Size		Fine to Medium	Medium to Large	Fine to Medium	Fine
00100751105						
CONSISTENCE	19W	Culture	Net Offeter	<u> </u>	Otiobus	Olista
		Stickiness	NOT STICKY	Sticky	SIRCKY	Баску
		Placticity	Not Plastic	Plantio	Plastic	Plantin
	<u>} </u>	FRASHCILY	NULTIASUC	i i lastic	Trashc	riasiic
	łł	h				· · · · · · · · · · · · · · · · · · ·
	Moist		Friable	Friable	Friable	Friable
					l	
	Dry					
		Consistence	Moderate	Moderate to Firm	Moderate to Firm	Moderate to Hard
			· · · · · · · · · · · · · · · · · · ·			
		Cementation	None	None	None	None
001.00			10.100 4/0	40.00 7/4	7.5.10.00	0.5.10.500
COLOH	Munsell		10 YH 4/2	10 YH //4	7.5 11 6/6	2.5 YH 5/3
	Description		Dark Gravich Brown	Vany Pale Brown	Boddich Vollow	Light Onve Brown with
	Description				neuclisin renow	Some mine
		H			·	······
	Mottling		None	None	Yes	Yes
					·····	1
OBSERVED MOISTURE			None	None	Slight	Moist

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Cimmaron Loam

GROUND COVER: Grass, rabbit brush, shrubs, forbs.

SLOPE: 7% at a bearing of 140°

PERCOLATION RATE: 30 min./in. Avg Depth (in.) 14

NOTES: Profile hole on the property line with lots 3 & 4.

SHANNON ENGINEERING, INC.

Profile Hole Observed: 7/1/2006

U.S.D.A. SOIL CLASSIFICATION METHOD								
		DEPTH	0'-0" - 0'-6"	0'-6" - 8-0"				
			Topsoil					
TEXTURE			Loam	Clay				
ROCK FRAGMENTS	% Rock		< 10%	< 10%				
	Size							
	Shape							
SOIL STRUCTURE	Degree		Compound	Compound				
		·····		·····				
	Shape		Sub-Angular	Sub-Angular Blocky				
	Grade		Moderate	Moderate to Strong				
			<u> </u>					
	Size		Fine	Fine				
CONSISTENCE	Wet							
		Stickiness	Not Sticky	Sticky				
		Plasticity	Not Plastic	Plastic				
	Moist		Friable	Friable				
	Dry							
		Consistence	Moderate	Firm				
		Cementation	None	None				
COLOR	Munsell		10 YR 4/2	10 YR 6/4				
	Description		Dark Grayish Brown	Light Yellowish Brown				
	Mottling		None	None				
OBSERVED MOISTURE			None	None				

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Cimmaron Loam

GROUND COVER: Grass, sagebrush, and forbs.

SLOPE: 10% at a bearing of 115°

PERCOLATION RATE: 22 min./in. Avg Depth (in.) 16

NOTES: This profile hole is on the property line of lots 5 & 6.

Profile Hole Observed: 7/1/2006

	U.S.D.A.	SOIL CLASSIFIC	ATION METHOD	
		DEPTH	0'-0" - 0'-6"	0'-6" - 8-0"
			Topsoil	
TEXTURE			Loam	Clay
ROCK FRAGMENTS	% Rock		< 10%	< 10%
	Size			
	Shape			
SOIL STRUCTURE	Degree		Compound	Compound
······	Snape		Sub-Angular	Sub-Angular Blocky
	Crada		Madarata	Madazata ta Chrana
	Grade			Moderate to Strong
······			<u></u>	······································
	Siza		Fine	Fine
	- Oile		7 1110	1 1112
CONSISTENCE	Wet			
		Stickiness	Not Sticky	Sticky
			· · · · · · · · · · · · · · · · · · ·	
		Plasticity	Not Plastic	Plastic
	Moist		Friable	Friable
	Dry			
		Consistence	Moderate	Firm
		Cementation	None	None
	Muncall		10 VP 4/2	
COLOR	Description		Dark Gravish Brown	Light Vellowish Brown
	1			
	Mottling		None	None
OBSERVED MOISTURE			None	None

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Cimmaron Loam

GROUND COVER: Grass, sagebrush, and forbs.

SLOPE: 10% at a bearing of 115°

PERCOLATION RATE: 21 min./in. Avg. Depth (in.): 15

NOTES: This profile hole is on the property line of lots 5 & 6.

U.S.D.A. SOIL CLASSIFICATION METHOD 2'-4" - 6'-6" DEPTH 0'-0" - 0'-10" 0'-10" - 2'-4" 6'-6" - 8'-0" Topsoil Gravelly Clayey Sand TEXTURE Clay Loam Sandy Clay & Sandy Clay Clay ≈ 25% < 10% < 10% < 10% ROCK FRAGMENTS % Rock To 16" Size Shape Sub-Angular SOIL STRUCTURE Compound Compound Compound Compound Degree Shape Sub-Angular Blocky Sub-Angular Blocky Sub-Angular Blocky Sub-Angular Blocky Grade Moderate Moderate to Strong Moderate to Strong Moderate to Strong Fine Size Fine Fine Fine - Medium CONSISTENCE Wet Stickiness Not Sticky Sticky Somewhat Sticky Sticky Plasticity Not Plastic Plastic Somewhat Plastic Plastic Friable Moist Friable Friable Friable Dry Moderate Firm to Hard Consistence Moderate Moderate Cementation None None None None 7.5 YR 7/1 10 YR 6/4 7.5 YR 4/6 COLOR 10 YR 4/2 Munsell Light Yellowish Brown Description Dark Grayish Brown Strong Brown Light Gray Mottling None None None Yes OBSERVED MOISTURE Moist None Moist None

1

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Cimmaron Loam

GROUND COVER: Grass, sagebrush, and forbs.

Profile Hole Observed: 7/1/2006

SLOPE: 8% at a bearing of 90°

PERCOLATION RATE: 22 min./in. Avg. Depth (in.): 16

NOTES: This profile hole is on the property line of lots 7 & 8.

SHANNON ENGINEERING, I	INC.
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						··
	1	,	U.J.D.A. JUIL CLASSIFIC		· · · · · · · · · · · · · · · · · · ·	· ································
	<u> </u>	DEPTH	0'-0" - 0'-10"	0'-10" - 2'-4"	2'-4" - 6'-6"	6'-6" - 8'-0"
			Topsoil		1	
	1	• • • • • • • • • • • • • • • • • • •			Gravelly Clayey Sand &	
TEXTURE			Clay Loam	Sandy Clay	Sandy Clay	Clay
ROCK FRAGMENTS	% Rock		< 10%	< 10%	≈25%	< 10%
						· · · · · · · · · · · · · · · · · · ·
	Size				To 16"	
	Shape				Sub-Angular	
		L				
SOIL STRUCTURE	Degree		Compound	Compound	Compound	Compound
			Cub Annulas Dia 1	Cub Annulas Discis	Cub Angulas Olgalar	Cub Appular Diache
	Shape	↓	Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular Blocky	SUD-Angular Blocky
[<u>├</u>	······································			
	Grade	+	Moderate	Moderate to Strong	Moderate to Strong	Moderate to Strong
	01806	<u> </u>	NUCCIDIC	stoder are to ourong	moderate to onotig	
	Size		Fine	Fine	Fine - Medium	Fine
				1		
CONSISTENCE	Wet	1		1		
		Stickiness	Not Sticky	Sticky	Somewhat Sticky	Sticky
		Plasticity	Not Plastic	Plastic	Somewhat Plastic	Plastic
						<u></u>
	Moist		Friable	Friable	Friable	Friable
				······································		
			·····		i	
		Consistence	Moderate	Moderate	Moderate	Eirm to Hard
······	<u>† </u>			woodrate	inoder allo	
		Cementation	None	None	None	None
COLOR	Munsell		10 YR 4/2	10 YR 6/4	7.5 YR 4/6	7.5 YR 7/1
	Description		Dark Grayish Brown	Light Yellowish Brown	Strong Brown	Light Gray
	I					
					L	
	Mottling		None	None	None	Yes
			Mana			Maint
UBSERVED MUISTURE	1	L	None	i None	MOISI	MOISI

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Cimmaron Loam

19 min./in.

GROUND COVER: Grass, sagebrush, and forbs.

SLOPE: 8% at a bearing of 90°

PERCOLATION RATE:

Profile Hole Observed: 7/1/2006

NOTES:

Avg. Depth (in.): 15

2

Profile Hole Observed: 7/1/2006

	U.S.D.A. SOIL CLASSIFICATION METHOD							
		DEDTU	0.0. 0.10.	0' 10" - 2' 4"	2' 4" - 6' 6"	6".6", 9".0"		
	··		Topsoil	0-10-3-4	3-4-0-0	0-0-0-0		
TEXTURE			Loam	Clay Loam	Clay	Clay		
ROCK FRAGMENTS	% Rock		< 10%	< 10%	< 10%	< 10%		
	Size							
	Shape							
CON STRUCTURE	Damma		Compared	Compound	Company	Compound		
SUL STRUCTURE	Degree		Compound	Compound	Compound	Сопролю		
	Shane		Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular Blocky		
	Citope		Coortiguar bioory	Out / Ingular Diebity	Colo rangonal Elicolity	Cub ringula bicony		
					1	······································		
	Grade		Moderate	Moderate	Moderate to Strong	Moderate to Strong		
			·····					
	Size		Fine	Fine to Medium	Fine	Fine		
CONCIETENCE	197-2							
CONSISTENCE	AAAI	Stickinger	Not Sticky	Somewhat Sticky	Sticky	Sticky		
		Juckinoss	Not Sucky	OUTTERNAL OUCKY	Ginny			
		Plasticity	Not Plastic	Somewhat Plastic	Plastic	Plastic		
	Moist		Friable	Friable	Friable	Friable		
	Dra				<u> </u>	· · · · · · · · · · · · · · · · · · ·		
	Uly	Consistence	Modecrate	Moderate	Firm to Hard	Firm to Hard		
	}	Consistence		Woodciate	i will to Habe			
	·	Cementation	None	None	None	None		
COLOR	Munsell		10 YR 4/2	10 YR 5/2	10 YR 6/4	10 YR 6/8 to 2.5 Y 8/1		
	Dependention		Dark Oraciah Bur	Orrectate Descus		Brownish Yelow to		
	Description		Dark Grayish Brown	Grayisn brown	LIGHT YEllowish Brown	wnne		
			<u>}</u>					
	Mottlina		None	None	None	Yes		
OBSERVED MOISTURE			None	None	Moist	Moist		

3

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Cimmaron Loam

GROUND COVER: Grass, sagebrush, and forbs.

SLOPE: 18% at a bearing of 115°

PERCOLATION RATE: 43 min./m. Avg. Depth (in.): 17

NOTES: This profile hole is on the property line of lots 9 & 10.

Profile Hole Observed: 7/1/2006

U.S.D.A. SOIL CLASSIFICATION METHOD							
		DEPTH	0'-0" - 0'-10"	0'-10" - 3'-4"	3'-4" - 6'-6"	6'-6" - 8'-0"	
			Topsoii				
TEXTURE	ļ		Loam	Clay Loam	Liay	Glay	
ROCK FRAGMENTS	% Rock		< 10%	< 10%	< 10%	< 10%	
	Size						
	Shape						
SOIL STRUCTURE	Døgree		Compound	Compound	Compound	Compound	
	Shape		Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular Blocky	
	ļ						
	Grade		Moderate	Moderate	Moderate to Strong	Moderate to Strong	
	Size		Fine	Fine to Medium	Fine	Fine	
CONSISTENCE	Wet						
		Stickiness	Not Sticky	Somewhat Sticky	Sticky	Sticky	
	l	Plasticity	Not Plastic	Somewhat Plastic	Plastic	Plastic	
			C.deble	Fri-hit-	Filebia		
	MOISU		Friable	i inable	Fnable	rnable	
				<u> </u>	·····	ł	
	Deri						
		Consistence	Modeerate	Moderate	Eim to Hard	Firm to Hard	
			WOUGEIAIC	Wideraic		cannio naid	
	t f	Comentation	None	None	None	None	
	<u>+</u>	Contractions			None	113110	
COLOR	Munsell		10 YR 4/2	10 YB 5/2	10 YB 6/4	10 YB 6/8 to 2.5 Y 8/1	
	Description		Dark Gravish Brown	Gravish Brown	Light Yellowish Brown	Brownish Yelow to White	
······································	1	· · · · · · · ·		······		1	
	11					*	
	Mottling		None	None	None	Yes	
OBSERVED MOISTURE	1		None	None	Moist	Moist	

4

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Cimmaron Loam

GROUND COVER: Grass, sagebrush, and forbs.

SLOPE: 18% at a bearing of 115°

PERCOLATION RATE: 21 min./in. Avg. Depth (in.): 16

NOTES: This profile hole is on the property line of lots 9 & 10.

Profile Hole Observed: 7/1/2006

U.S.D.A. SOIL CLASSIFICATION METHOD							
				01.401 01.401			
			<u>0'-0' - 0'-12"</u>	0-12 - 2-10-	2-108-0	8-0 - 9-0	
TEXTUDE			lopsoll	Clautoam	Clay	Clay	
TEATORE	ł		Loam	Ciay Loan	Ciay	Ciay	
POCK EDACHENTS	W Rook		- 109/	< 109/	< 108/	< 10%	
NUCK FRAGMENTS	70 NUCK		<10%	< 10.76	< 10 %	< 10 %	
	Size			· · · · · · · · · · · · · · · · · · ·			
	Shana						
	Chape					· · · · · · · · · · · · · · · · · · ·	
SOIL STRUCTURE	Degree		Compound	Compound	Compound	Compound	
3012 01110010112	Ucyloc		Compound	Compound	Compound		
	Shape		Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular Blocky	
	1	1	j				
	Grade		Moderate	Moderate	Moderate to Strong	Moderate to Strong	
	Size		Fine	Fine to Medium	Fine	Fine	
CONSISTENCE	Wet						
		Stickiness	Not Sticky	Sticky	Sticky	Sticky	
		Plasticity	Not Plastic	Plastic	Plastic	Plastic	
	Moist		Friable	Friable	Friable	Fnable	
	<u> </u>			· · · · · · · · · · · · · · · · · · ·			
			·····	·····	<u>-</u>		
		Consistence	Modoarate	Moderate	Firm to Hard	Firm to Hard	
	11	GUISISterice	Withdeerate	Withdefale	Find to that		
	t	Cementation	None	None	None	Nope	
	{ <u>{</u>	- OCHIGHIGH					
COLOR	Munsell		10 YR 4/2	10 YR 7/2	10 YR 5/4	10 YR 6/1 to 10 YR 7/6	
	Description		Dark Gravish Brown	Light Gray	Yellowish Brown	Gray to Yellow	
				····			
	Mottling		None	Yes	Yes	None	
OBSERVED MOISTURE			None	None	None	Water at 8'	

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Cimmaron Loam

GROUND COVER: Grass, sagebrush, and forbs.

SLOPE: 20% at a bearing of 90°

34 min./in.

Avg. Depth (in.): 15

5

NOTES:

PERCOLATION RATE:

Profile Hole Observed: 7/1/2006

U.S.D.A. SOIL CLASSIFICATION METHOD						
		DEPTH	0'-0" - 1'-0"	<u> </u>	7'-0" - 9'-0"	
			Topsoil			
TEXTURE			Sandy Clay	Clay & Sandy Clay	Sandy Clay & Sandstone	
				l		
ROCK FRAGMENTS	% Rock		< 10%	< 10%	< 10%	
	Size					
	Shape					
					1	
SOIL STRUCTURE	Dearee		Compound	Compound	Compound	
				1		
	Shape		Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular Blocky	
				a		
	Grade		Moderate	Moderate	Moderate	
				induciate		
	<u>├</u>		<u> </u>			
	Sizo		Fine	Fine	Fine	
	JILE			1 1116	1 110	
CONSISTENCE	Wet		<u> </u>		+	
CONSISTENCE		Stickinge	Not Sticky	Somewhat Sticky	Sticky	
			- Hot Oldery	Conternational	Onony	
	<u>├</u>	Diagticity	Not Plastic	Somewhat Plastic	Plastic	
		1 idditity		Comentari Mane	1 100	
	Moist		Friable	Firm	Firm	
		H				
	Drv					
······	D,	Consistence	Medium	Medium	Medium to Firm	
		Consistence	- Mediani			
		Comentation	None	None	None	
· · · · · · · · · · · · · · · · · · ·	····· ··· ··· ··· ··· ··· ··· ··· ···	Octionation	None	Hone	1 None	
COLOB	Munsell		10 YB 4/2	10 YB 4/2	10 YB 6/8	
502011	Description		Dark Gravish Brown	Dark Gravish Brown	Brownish Yellow	
			Can diagon brown		2.0	
				·····	<u>+</u>	
	Mottling		None	Some	None	
	mouning	·	- None			
OBSERVED MOISTURE	· · · · · -		None	None	None	

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Lake Creek Loam

GROUND COVER: Grass, sagebrush, and forbs.

SLOPE: 8% at a bearing of 320°

PERCOLATION RATE:

Avg. Depth (in.): 17

NOTES: This profile hole is on the property line of lots 12 & 13.

3 min./in.

Profile Hole Observed: 7/1/2006

		U.S.D.A. SOIL	CLASSIFICATION METHO	D	
	I	I			
		DEPTH	0'-0" - 1'-0"	1'-0" - 7'-0"	7'-0" - 9'-0"
			Topsoil		
TEXTURE			Sandy Clay	Clay & Sandy Clay	Sandy Clay & Sandstone
ROCK FRAGMENTS	% Rock		< 10%	< 10%	< 10%
	Size				
	Shape				
SOIL STRUCTURE	Degree		Compound	Compound	Compound
	Shape	1	Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular Blocky
	Grade		Moderate	Moderate	Moderate
		ll ll			
	Size		Fine	Fine	Fine
CONSISTENCE	Wet				
		Stickiness	Not Sticky	Somewhat Sticky	Sticky
		Plasticity	Not Plastic	Somewhat Plastic	Plastic
	Moist		Friable	Firm	Firm
			·····		
· · · · · · · · · · · · · · · · · · ·	Dry				
		Consistence	Medium	Medium	Medium to Firm
		H			
		Cementation	None	None	None
COL OB	Munnall		10 VD 4/0	10 VD 4/2	10 10 6/2
COLOR	Description		Dod: Grouish Brown	Dock Crowish Brown	IU TH 0/6
	Description	{	Dark Grayish Drown	Jan Grayish Diown	DIOWINSITTERIOW
	Mottling	<u> </u>	None	Some	None
	mouning			Joine	110/10
OBSERVED MOISTURE	}		None	None	None

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Lake Creek Loam

GROUND COVER: Grass, sagebrush, and forbs.

SLOPE: 8% at a bearing of 320°

PERCOLATION RATE: 8 min./in.

Avg Depth (in.) 17

NOTES: This profile hole is on the property line of lots 12 & 13.

Profile Hole Observed: 7/1/2006

U.S.D.A. SOIL CLASSIFICATION METHOD							
		DEPTH	0'-0" - 1'-6"	1'-6" - 4'-2"	4'-2" - 8'-0"		
			Topsoil				
TEXTURE			Loam	Sandy Clay	Rocky Clay		
ROCK FRAGMENTS	% Rock		< 10%	< 10%	≈ 60%		
					Granite		
	Size				To 18"		
	Shape				Angular & Sub-Angular		
SOIL STRUCTURE	Degree		Compound	Compound	Compound		
	Shape		Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular		
					· · · · · · · · · · · · · · · · · · ·		
	Grade		Moderate	Moderate	Moderate		
	Size		Fine	Fine	Fine		
CONSISTENCE	Wet						
		Stickiness	Not Sticky	Sticky	Somewhat Sticky		
				·			
		Plasticity	Not Plastic	Plastic	Somewhat Plastic		
	Moist		Friable	Friable	Friable		
	Dry						
		Consistence	Modeerate	Moderate to Firm	weak to moderate		
	<u> </u>	Comentation	Nana	Nana	Nega		
		Cementation	ivone	None	None		
COLOR	Muncali		10 VB 2/2	10 VB 4/4	10 VB 4/4		
COLUR	Description		Very Dark Gravish Proven	Dark Vellowich Brown	Dark Vollowich Brown		
	Description		Very Dark Grayish Brown	Dark renowish DIOWI	Dark Tellowish DIOWIT		
	Mottling		None	Voc	Vas		
	moting		Hong	103	103		
OBSERVED MOISTURE	<u>├</u>		None	None	None		

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Lake Creek Loam

GROUND COVER: Grasses, forbs, sagebrush, rabbit brush, willow bushes.

SLOPE: 25% at a bearing of 325°

PERCOLATION RATE: 11 min./in. Avg. Depth (in.): 17

NOTES: This profile hole is on the property line of lots 14 & 15.

Profile Hole Observed: 7/1/2006

U.S.D.A. SOIL CLASSIFICATION METHOD							
		DEPTH	0'-0" - 1'-6"	1'-6" - 4'-2"	4'-2" - 8'-0"		
			Topsoil				
TEXTURE			Loam	Sandy Clay	Rocky Clay		
ROCK FRAGMENTS	% Rock		< 10%	< 10%	≈ 60%		
					Granite		
	Size				To 18"		
	Shape				Angular & Sub-Angular		
			·····				
SOIL STRUCTURE	Degree		Compound	Compound	Compound		
				······································			
	Shape		Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular		
	I				<u></u>		
	11						
	Grade		Moderate	Moderate	Moderate		
······································	· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·			
	Size		Fine	Fine	Fine		
CONSISTENCE	Wet						
		Stickiness	Not Sticky	Sticky	Somewhat Sticky		
		Plasticity	Not Plastic	Plastic	Somewhat Plastic		
		* [
	Moist		Friable	Friable	Friable		
	Dry						
		Consistence	Modeerate	Moderate to Firm	Weak to Moderate		
		Cementation	None	None	None		
COLOR	Munsell		10 YR 3/2	10 YR 4/4	10 YR 4/4		
	Description		Very Dark Grayish Brown	Dark Yellowish Brown	Dark Yellowish Brown		
	Mottling		None	Yes	Yes		
OBSERVED MOISTURE			None	None	None		

1

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Lake Creek Loam

GROUND COVER: Grasses, forbs, sagebrush, rabbit brush, willow bushes.

SLOPE: 25% at a bearing of 325°

PERCOLATION RATE: 7 min./in. Avg. Depth (in.): 16

NOTES: This profile hole is on the property line of lots 14 & 15.

Profile Hole Observed: 7/1/2006

U.S.D.A. SOIL CLASSIFICATION METHOD					
		DEPTH	0'-0" - 0'-10"	0'-10" - 8'-0"	
			Topsoil		
TEXTURE			Loam	Rocky Sandy Clay	
ROCK FRAGMENTS	% Rock		< 10%	≈ 15-40%	
				Shale & Sandstone	
	Size			To 12"	
	Shape			Sub-Angular & Platy	
SOIL STRUCTURE	Degree		Compound	Compound	
	Shape		Sub-Angular Blocky	Sub-Angular Blocky	
	Grade		Moderate	Moderate	
	Size		Fine	Fine to Medium	
CONSISTENCE	Wet				
		Stickiness	Not Sticky	Sticky	
		Plasticity	Not Plastic	Plastic	
	Moist		Friable	Friable	
	Dry				
		Consistence	Modeerate	Moderate to Firm	
		Cementation	None	None	
COLOR	Munsell		10 YR 4/1	10 YR 5/2	
	Description		Dark Gray	Grayish Brown	
	Mottling		None	None	
				L	
OBSERVED MOISTURE			None	None	

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Lake Creek Loam

GROUND COVER: Grasses, forbs, sagebrush, and rabbit brush.

SLOPE: 15% at a bearing of 335°

PERCOLATION RATE:

7 min./in.

Avg. Depth (in.): 13

NOTES: This profile hole is on the property line of lots 16 & 17.

Curtain drain recommended above the drainfield.

SHANNON ENGINEERING, INC.

Profile Hole Observed: 7/1/2006

U.S.D.A. SOIL CLASSIFICATION METHOD						
		DEPTH	<u>0'-0" - 0'~10"</u>	0'-10" - 8'-0"		
			Topsoil			
TEXTURE			Loam	Rocky Sandy Clay		
ROCK FRAGMENTS	% Rock		< 10%	≈ 15-40%		
				Shale & Sandstone		
	Size			To 12"		
	Shape			Sub-Angular & Platy		
SOIL STRUCTURE	Degree		Compound	Compound		
	Shape		Sub-Angular Blocky	Sub-Angular Blocky		
	Grade		Moderate	Moderate		
	T					
	Size		Fine	Fine to Medium		
CONSISTENCE	Wet					
		Stickiness	Not Sticky	Sticky		
		Plasticity	Not Plastic	Plastic		
	Moist		Friable	Friable		
	Dry					
		Consistence	Modeerate	Moderate to Firm		
		Cementation	None	None		
COLOR	Munsell		10 YR 4/1	10 YR 5/2		
	Description		Dark Gray	Grayish Brown		
	Mottling		None	None		
OBSERVED MOISTURE			None	None		

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Lake Creek Loam

GROUND COVER: Grasses, forbs, sagebrush, and rabbit brush.

SLOPE: 15% at a bearing of 335°

PERCOLATION RATE:

Avg. Depth (in.): 16

NOTES: This profile hole is on the property line of lots 16 & 17.

37 min./in.

Profile Hole Observed: 7/1/2006

DEPTH 0'-0" - 2'-9" 2'-9" - 6'-0" 6'-0" - 8'-0	
Торѕоі	
TEXTURE Loam & Clay Sandy Cla	<u> </u>
ROCK FRAGMENTS % Rock < 10%	
Size Size	
Shape	
SOIL STRUCTURE Degree Compound Compound Compound	
Shape Sub-Angular Blocky Sub-Angular Blocky Sub-Angular Blocky	ocky
Grade Moderate Moderate to Strong Moderate to S	rong
Size Fine to Medium Fine Fine	
CONSISTENCE Wet	
Stickiness Somewhat Slicky Slicky Slicky	
Plasticity Somewhat Plastic Plastic Plastic Plastic	····
MOIST Friable Friable Friable	
Dry Consistence Medasata Firm to Hard Firm to Ha	
Consistence Moderate Planto hard Planto hard	
Camentation None None None	
Cementation Note Note Note	· · · · · ·
COLOR Munsell 10 YB 4/1 10 YB 7/2 10 YB 5/1 to 10	/R 5/8
Description Dark Grav Light Grav Grav to Yellowist	Brown
Mottling None None None	
OBSERVED MOISTURE None None Moist	

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Lake Creek Loam or Cimmaron Loam

GROUND COVER: Grasses, rabbit brush.

SLOPE: 10% at a bearing of 330°

PERCOLATION RATE: 25 min./in. Avg. Depth (in.): 15

NOTES: This profile hole is on the property line of lots 18 & 19.

Profile Hole Observed: 7/1/2006

U.S.D.A. SOIL CLASSIFICATION METHOD						
	<u> </u>	DEPTH	0'-0" - 2'-9"	2'-9" - 6'-0"	6'-0" - 8'-0"	
TEVNIDE					0	
IEXIURE			Loam & Clay Loam	Clay	Sandy Clay	
	0(Deels		10%	100/	100/	
HUCK FRAGMENTS	% HOCK		< 10%	< 10%	< 10%	
	Cina		{			
	Size			l		
	Snape					
CON STRUCTURE	Dearra		Compound	Compound	- Comment	
SOIL STRUCTURE	Degree		Compound	Сотроила	Compound	
	Shana		Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular Blocky	
	Shape		Sub-Angular Blocky	Sub-Aliguiai blocky	Sub-Aligulai Blocky	
	Grade		Moderate	Moderate to Strong	Moderate to Strong	
	Giade		Woderate	Moderate to Strong	Widdenate to Strong	
	<u></u>					
	Size		Fine to Medium	Fine	Fine	
CONSISTENCE	Wet					
	1	Stickiness	Somewhat Sticky	Sticky	Sticky	
	1					
		Plasticity	Somewhat Plastic	Plastic	Plastic	
	Moist		Friable	Friable	Friable	
	Dry					
		Consistence	Modeerate	Firm to Hard	Firm to Hard	
	L	Cementation	None	None	None	
COLOR	Munsell		10 YR 4/1	10 YR 7/2	10 YR 5/1 to 10 YR 5/8	
	Description		Dark Gray	Light Gray	Gray to Yellowish Brown	
	BR - Million and					
	Motting		None	None	None	
	<u> </u>		Nines	NI		
UBSERVED MUISTURE	l		None	None	Moist	

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Lake Creek Loam or Cimmaron Loam

GROUND COVER: Grasses, rabbit brush.

SLOPE: 10% at a bearing of 330°

PERCOLATION RATE:

Avg. Depth (in.): 15

NOTES: This profile hole is on the property line of lots 18 & 19.

92 min./in.

Profile Hole Observed: 7/1/2006

	U.S.D.A. SOIL CLASSIFICATION METHOD						
	_	DEPTH	0'-0" - 2'-4"	2'-4" - 8'-0"			
			Topsoil				
TEXTURE			Clay Loam	Rocky Clay			
ROCK FRAGMENTS	% Rock		< 10%	≈ 25%			
	Size			To 2'			
	Shape			Sub-Angular			
SOIL STRUCTURE	Degree		Compound	Compound			
	Shape		Sub-Angular Blocky	Sub-Angular Blocky			
	Grade		Moderate	Moderate to Strong			
	Size		Fine	Fine to Medium			
CONSISTENCE	Wet						
		Stickiness	Sticky	Sticky			
		Plasticity	Plastic	Plastic			
	Moist		Friable	Friable			
	· · · · · · · · · · · · · · · · · · ·						
	Dry						
		Consistence	Modeerate	Moderate to Hard			
	l						
		Cementation	None	None			
COLOR	Munsell		10 YR 3/1	2.5 YR 7/2 to 7.5 YR 5/8			
	Description		Very Dark Gray	Light Gray to Strong Brown			
				······			
	Mottling		None	Yes			
	·						
UBSERVED MOISTURE	L		None	Yes at 4'			

Lake Creek Loam or

Avg. Depth (in.): 16

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Cimmaron Loam

GROUND COVER: Grasses, forbs, and rabbit brush.

SLOPE: 6% at a bearing of 325°

PERCOLATION RATE:

NOTES: This profile hole is on the property line of lots 20 & 21. Groundwater at 4'

35 min./in.

SOIL PROFILE INFORMATION Val Moritz Village

Filing 2, Block 5, Lot 21

Profile Hole Observed: 7/1/2006

	U.S.D.A.	SOIL CLASSIFIC	ATION METHOD	
		DEPTH	0'-0" - 2'-4"	2'-4" - 8'-0"
			Topsoil	
TEXTURE			Clay Loam	Rocky Clay
ROCK FRAGMENTS	% Rock		< 10%	≈ 25%
	Size			To 2'
	Shape			Sub-Angular
SOIL STRUCTURE	Degree		Compound	Compound
	Shape		Sub-Angular Blocky	Sub-Angular Blocky
	Grade		Moderate	Moderate to Strong
	Size		Fine	Fine to Medium
CONSISTENCE	Wet			
		Stickiness	Sticky	Sticky
		Plasticity	Plastic	Plastic
	Moist		Friable	
	ļ			
	0		· · · · · · · · · · · · · · · · · · ·	
· · · · · · · · · · · · · · · · · · ·	Ury	Consistence	Madaarata	Moderate to Hard
		Consistence	Modeerale	
		Comentation	None	None
		Cementation	None	inone
COLOR	Munsell		10 YB 3/1	2.5 YB 7/2 to 7.5 YB 5/8
	Description		Very Dark Gray	Light Gray to Strong Brown
				<u>, , , , , , , , , , , , , , , , , , , </u>
·····	·····			
	Mottling		None	Yes
OBSERVED MOISTURE			None	Yes at 4'

Lake Creek Loam or

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Cimmaron Loam

GROUND COVER: Grasses, forbs, and rabbit brush.

SLOPE: 6% at a bearing of 325°

PERCOLATION RATE:

27 min./in.

Avg. Depth (in.): 16

NOTES: This profile hole is on the property line of lots 20 & 21. Groundwater at 4' Curtain drain recommended above the drainfield.

Profile Hole Observed: 7/1/2006

U.S.D.A. SOIL CLASSIFICATION METHOD 0'-0" - 0'-7" 1'-11" - 5'-0" 5'-0" - 8'-0" DEPTH 0'-7" - 1'-11" Topsoil Loam TEXTURE Sandy Clay & Clay Loam Sandy Clay & Clay Clay ≈ 10% < 10% ROCK FRAGMENTS % Rock < 10% < 10% To 4" Size Shape Sub-Angular SOIL STRUCTURE Degree Compound Compound Compound Compound Sub-Angular Sub-Angular Blocky Sub-Angular Blocky Sub-Angular Blocky Shape Moderate to Strong Moderate Moderate Moderate to Strong Grade Fine to Medium Fine Fine to Medium Fine Size CONSISTENCE Wet Stickiness Not Sticky Sticky Sticky Sticky Plasticity Plastic Plastic Non Plastic Plastic Friable Friable Moist Friable Friable Dry Modeerate Moderate to Firm Firm to Hard Hard Consistence Cementation None None None None 10 YR 5/2 10 YR 6/8 COLOR Munsell 7.5 YR 3/1 10 YR 7/2 Brownish Yellow Description Very Dark Gray Light Gray Gray Mottling None Yes Yes None Moist Moist OBSERVED MOISTURE Moist None

According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Lake Creek Loam or Cimmaron Loam

GROUND COVER: Grass, rabbit brush, shrubs, forbs.

SLOPE: 5% at a bearing of 40°

PERCOLATION RATE: 52 min./in.

NOTES: Profile hole on the property line with lots 22 & 23.

Avg. Depth (in.): 16

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Profile Hole Observed: 7/1/2005

U.S.D.A. SOIL CLASSIFICATION METHOD								
		DEPTH	0'-0" - 0'-7"	0'-7" - 1'-11"	1'-11" - 5'-0"	5'-0" - 8'-0"		
			Topsoil					
TEXTURE			Loam	Sandy Clay & Clay Loam	Sandy Clay & Clay	Clay		
ROCK FRAGMENTS	% Rock		< 10%	< 10%	≈ 10%	< 10%		
	Size		• · · · · · · · · · · · · · · · · · · ·	1	To 4"			
	Shape				Sub-Angular			
SOIL STRUCTURE	Degree		Compound	Compound	Compound	Compound		
3012 31110010112	Degree		Compositio	Compositu	Compedia	Compound		
	Shano		Sub-Anguiar	Sub-Angular Blocky	Sub-Angular Blocky	Sub-Angular Blocky		
······································	энаре			Sub-Aliguial blocky	Sub-Angular Diocky	Sub-Angular blocky		
	·		l	l				
	Crada		Madarata	Moderate	Moderate to Stress	Moderate to Stress		
	Gnade		Moderale	Moderate	Moderate to Strong	Moderate to Strong		
				l		· · · · · · · · · · · · · · · · · · ·		
	Size		Fine to Medium	Fine	Fine to Medium	Fine		
0.0110/07771107								
CONSISTENCE	Wet							
		Stickiness	Not Sticky	Sticky	Sticky	Sticky		
		Plasticity	Non Plastic	Plastic	Plastic	Plastic		
	Moist		Friable	Friable	Friable	Friable		
	Dry							
		Consistence	Modeerate	Moderate to Firm	Firm to Hard	Hard		
	[]							
		Cementation	None	None	None	None		
COLOR	Munsell		7.5 YR 3/1	10 YR 7/2	10 YR 6/8	10 YR 5/2		
	Description		Very Dark Gray	Light Gray	Brownish Yellow	Gray		
				11				
	Mottling		None	Yes	Yes	None		
OBSERVED MOISTURE			None	Moist	Moist	Moist		

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According to the U.S.D.A. S.C.S. Grand County Soil Survey - This area is likely to be: Lake Creek Loam or Cimmaron Loam.

GROUND COVER: Grass, rabbit brush, shrubs, forbs.

SLOPE: 5% at a bearing of 40°

PERCOLATION RATE:

54 min./in. Avg. Depth (in.): 16

NOTES: Profile hole on the property line with lots 22 & 23..

Curtain drain recommended above the drainfield.

SHANNON ENGINEERING, INC.



