

Addendum OP-5a-4

**Teagulf Sandy Loam
Description and Data**

TABLE OF CONTENTS

1.0	Introduction.....	3
2.0	Methods.....	3
3.0	Results.....	3
4.0	Evaluation of Soil Suitability	11

FIGURES

Figure 1	Teagulf Sandy Loam Sampling Sites
Figure 2a	Soil Profile of MU1PR13
Figure 2b	Soil Profile of MU1PR16
Figure 2c	Soil Profile of MU1PR23
Figure 3a	Field Data sheet for MU1PR13
Figure 3b	Field Data sheet for MU1PR16
Figure 3c	Field Data sheet for MU1PR23

TABLES

Table 1	Laboratory Analytical Results
---------	-------------------------------

1.0 Introduction

Along with the Order 1 soil survey of the Plant site, an Order 1 soil survey was also conducted in 2008 for Mine Unit 1, where mining disturbance is anticipated. The results of the Mine Unit 1 soils survey will be presented in a separate document. Three soil types were described and sampled in the Mine Unit 1 area. Two of the soil mapping units (SMUs) were also identified within the Plant site: the Poposhia Loam and the Pepal Sandy Loam. Because the Teagulf Sandy Loam was not identified within the Plant site, it is described here so that the WDEQ permit application provides a comprehensive reference of all soil types identified on the Lost Creek site to date.

2.0 Methods

The methods for the Order 1 soil survey outside the Plant site are identical to the Order 1 soil survey of the plant site. Please refer to OPS Attachment 4a Section 2 for more detail.

3.0 Results

Figure 1 shows pit and profile locations within the Teagulf Sandy Loam SMU from September 2008. The Teagulf Sandy Loam is described below. The SMU was identified based on comparable soils near the Permit Area that were officially surveyed and described by the National Resource Conservation Service (NRCS). The color of the SMU is described as moist, crushed and broken.

Teagulf Sandy Loam: This soil formed in calcareous loamy or sandy alluvium, and is influenced by sandstone, siltstone, and mudstone or shale bedrock. Comprising a small proportion of the study area, this shallow, well-drained soil occurs on side slopes and upland ridges of slightly dissected plains. Its slopes range from three to seven percent. Typically, the surface layer is about a three-inch-thick brown or dark yellowish brown loam. The subsoil is about a seven-inch-thick dark yellowish brown sandy clay loam or heavy sandy loam. The substratum is a brown or yellowish brown loamy coarse sand or coarse sand to a depth of 60 inches or more. Substrata consisting of silt loam or sandy clay loam also occur, but are less prevalent.

The laboratory results from Teagulf Sandy Loam samples are summarized in Table 1. The term “topsoil” in this report refers to soil horizons that occur at the surface of undisturbed soils. The term “subsoil” refers to soil horizons that occur below the topsoil. All topsoil and subsoil laboratory samples were within the Suitability Criteria for topsoil listed in WDEQ-LQD Guideline No. 1



Table 1 Laboratory Analytical Results

Profile Number	Sample Depth (inches)	Soil Horizon	LQD Topsoil Suitability Parameters						Additional Fertility Analyses					Texture Information			
			pH (standard units)	Electrical Conductivity (mmhos/cm)	Saturation (%)	Sodium Adsorption Ratio	Selenium (ppm)	Boron (ppm)	Lime as CaCO ₃ (%)	Calcium (meq/L)	Magnesium (meq/L)	Sodium (meq/L)	Organic Matter (%)	Sand (%)	Silt (%)	Clay (%)	Texture
Teagulf Sandy Loam (about 15% of Study Area)																	
MU1PR13	0-10	A, B	7.8	0.48	27.1	0.83	<0.002	0.23	0.8	3.22	1.03	1.20	1	66	16	18	SL
MU1PR23	0-10	A, B	7.3	0.55	31.7	0.52	0.005	<0.20	1.1	3.56	1.83	0.85	0.9	68	16	16	SL
	10-60	C	8.0	1.82	30.6	4.34	0.007	0.31	0.9	7.80	3.33	10.20	0.3	82	6	12	SL
LQD Topsoil Suitability Criteria ¹			5.5 - 8.5	0-8	25-80	0 - 10	<0.1	<5.0	--	--	--	--	--	--	--	--	--

¹ Suitability criteria are from LQD Guideline No. 1 (WDEQ-LQD, 1994). Per the August 28, 2008, e-mail from M. Moxley (see Attachment 1), particle size was not applied as a suitability criterion.

The analyzed topsoil samples had textures of sandy loam. The organic matter content in the topsoil ranged from 0.9 to 1.0 percent. Although organic matter is not a criterion, a higher organic matter content is, in general, directly related to revegetation potential. The saturation values ranged from 27 to 32 percent, which is at the lower end of the prescribed range.

The subsoil sample of the Teagulf SMU was a sandy loam from a depth interval of ten to sixty inches. The organic matter content was 0.3 percent, and not favorable to vegetation establishment. The percent saturation, 31 percent, of the subsurface sample was at the low end of the prescribed range.

Figures 2a, 2b, and 2c are photographs of the three profiles excavated in the Teagulf Sandy Loam.

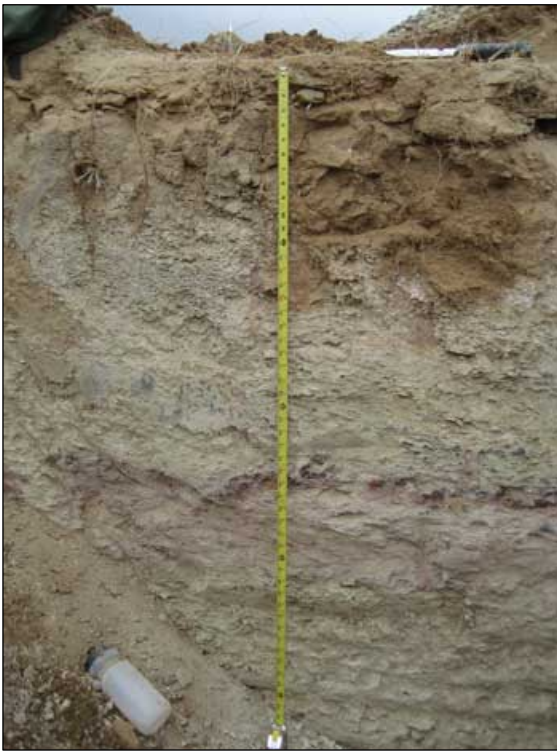


Figure 2a Soil Profile of MU1PR13

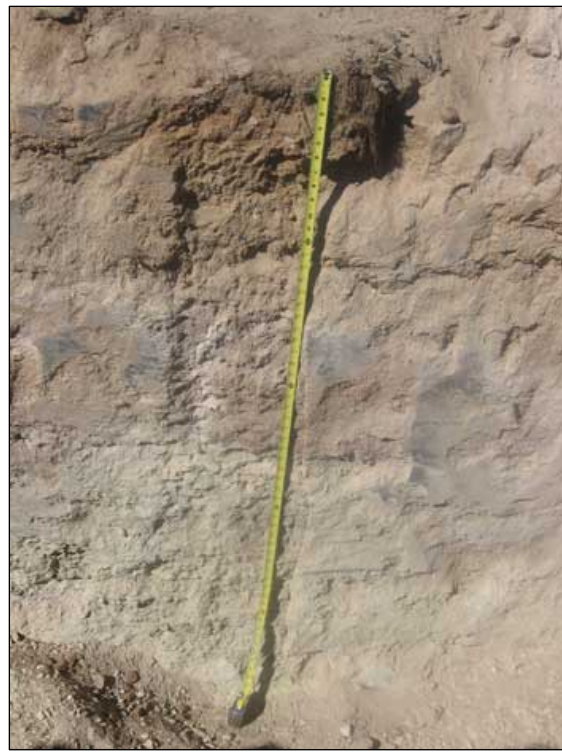


Figure 2b Soil Profile of MU1PR16

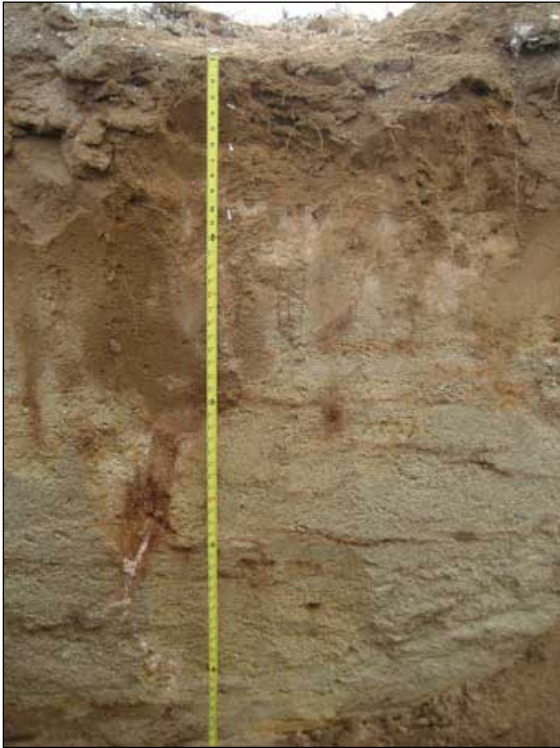


Figure 2c Soil Profile of MU1PR23

Soil Description: Location MU1PR13
 Site No. _____ Date _____ Time 3:05 Vegetation _____
 Elevation _____ Slope _____ Aspect _____ Geomorphic Surface _____
 Parent Material(s) _____ Described by _____

Depth (cm)	Horizon	Color		Structure	Gravel %	Consistence				Texture	pH	Clay films	Boundaries	notes
		moist	dry			Wet	Moist	Dry						
0-6		4/3		m vl gr sg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo vfr fr fl vfl ell	lo so sh h vh eh	S SICL LS SIL SL SI SCL SIC L C CL SC		v1 n pf 1 po 2 mk br 3 co 4 k coabr	a s o w g l d b	ef = p Loom ef = sl H, Loom	
6-12		4/4		m vl gr sg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo vfr fr fl vfl ell	lo so sh h vh eh	S SICL LS SIL SL SI SCL SIC L C CL SC		v1 n pf 1 po 2 mk br 3 co 4 k coabr	a s o w g l d b	ef = XV	
12-18		10 YR 5/14		m vl gr sg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo vfr fr fl vfl ell	lo so sh h vh eh	S SICL LS SIL SL SI SCL SIC L C CL SC		v1 n pf 1 po 2 mk br 3 co 4 k coabr	a s o w g l d b		
18-24		10 YR 5/4		m vl gr sg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo vfr fr fl vfl ell	lo so sh h vh eh	S SICL LS SIL SL SI SCL SIC L C CL SC		v1 n pf 1 po 2 mk br 3 co 4 k coabr	a s o w g l d b		
				m vl gr sg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo vfr fr fl vfl ell	lo so sh h vh eh	S SICL LS SIL SL SI SCL SIC L C CL SC		v1 n pf 1 po 2 mk br 3 co 4 k coabr	a s o w g l d b		
				m vl gr sg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo vfr fr fl vfl ell	lo so sh h vh eh	S SICL LS SIL SL SI SCL SIC L C CL SC		v1 n pf 1 po 2 mk br 3 co 4 k coabr	a s o w g l d b		
				m vl gr sg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo vfr fr fl vfl ell	lo so sh h vh eh	S SICL LS SIL SL SI SCL SIC L C CL SC		v1 n pf 1 po 2 mk br 3 co 4 k coabr	a s o w g l d b		

Figure 3a Field Data sheet for MU1PR13

Soil Description: Location MU1PR16 #16 G PS Recheck 9/4 point OK=16 location
 Site No. _____ Date 9/3 Time 4:45 pm Vegetation sparse Sage + grasses
 Elevation _____ Slope 5% Aspect SE Geomorphic Surface _____
 Parent Material(s) wind + water reworked alluvial fan Described by Cipra

Depth (cm)	Horizon	Color		Structure	Gravel %	Consistence			Texture	pH	Clay films	Bound-aries	notes
		moist	dry			Wet	Moist	Dry					
0-6		10YR 3/3		m vt gr eg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo lo vfr so fr sh fl h vfl vh eff eh	S SICL LS SIL SL SI SCL SIC L C CL SC	C	v1 n pf 1 po 2 mk br 3 co 4 k eobr	a s o w g l d b	EF-φ	
6-12		10YR 5/4		m vt gr eg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo lo vfr so fr sh fl h vfl vh eff eh	S SICL LS SIL SL SI SCL SIC L C CL SC	H C	v1 n pf 1 po 2 mk br 3 co 4 k eobr	a s o w g l d b	EF-φ	
12-18	YB	10YR 5/4		m vt gr eg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo lo vfr so fr sh fl h vfl vh eff eh	S SICL LS SIL SL SI SCL SIC L C CL SC	C	v1 n pf 1 po 2 mk br 3 co 4 k eobr	a s o w g l d b	EF-5L	
18-21	B	7.5YR 5/3		m vt gr eg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo lo vfr so fr sh fl h vfl vh eff eh	S SICL LS SIL SL SI SCL SIC L C CL SC	C	v1 n pf 1 po 2 mk br 3 co 4 k eobr	a s o w g l d b	EF-V	
		-----		m vt gr eg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo lo vfr so fr sh fl h vfl vh eff eh	S SICL LS SIL SL SI SCL SIC L C CL SC		v1 n pf 1 po 2 mk br 3 co 4 k eobr	a s o w g l d b	Note 9/8 SC PM is probably not alluvial	
		-----		m vt gr eg f pl 1 m pr 2 o cpr 3 vo abk abk	0 50 <10 75 10 >75 25	so po ss ps s p vs vp	lo lo vfr so fr sh fl h vfl vh eff eh	S SICL LS SIL SL SI SCL SIC L C CL SC		v1 n pf 1 po 2 mk br 3 co 4 k eobr	a s o w g l d b	rather sandstone- coarse grained	

Figure 3b. Field Data sheet for MU1PR16

Soil Description: Location PIT23
 Site No. _____ Date 9/4 Time 2:00 Vegetation Sage/grass very sparse
 Elevation _____ Slope 0% Aspect _____ Geomorphic Surface Pit located on a broad flat
 Parent Material(s) _____ Described by Cipra very sparse veg

Depth (cm)	Horizon	Color		Structure	Grewl %		Consistence			Texture	pH	Clay films	Bound-aries	notes
		moist	dry		Wet	Moist	Dry							
0-6		4/3		m vf gr eg f pl	0 50 <10 75	so po ss ps	lo lo vfr so	S SICL LS SIL		v1 n pf 1 po	a s o w	ef=0		
6-12		4/4		1 m pr 2 o cpr 3 vo abk sbk	10 >75 25	s p vs vp	fr sh fl h vfl vh eff eh	(SL) SI SCL SIC L C CL SC	H C	2 mk br 3 co 4 k cobr	g l d b	ef=0		
12-18		5/4		m vf gr eg f pl	0 50 <10 75	so po ss ps	lo lo vfr so	S SICL LS SIL		v1 n pf 1 po	a s o w	ef=V		
18-24		10YR 6/4		1 m pr 2 o cpr 3 vo abk sbk	10 >75 25	s p vs vp	fr sh fl h vfl vh eff eh	(SL) SI SCL SIC L C CL SC	H C	2 mk br 3 co 4 k cobr	g l d b	V		
24-30	gr	10YR 7/4		m vf gr eg f pl	0 50 <10 75	so po ss ps	lo lo vfr so	S SICL (LS) SIL		v1 n pf 1 po	a s o w	sl		
				1 m pr 2 o cpr 3 vo abk sbk	10 >75 25	s p vs vp	fr sh fl h vfl vh eff eh	SL SI SCL SIC L C CL SC		2 mk br 3 co 4 k cobr	g l d b			
30-36	Vgr			m vf gr eg f pl	0 50 <10 75	so po ss ps	lo lo vfr so	B SICL LS SIL		v1 n pf 1 po	a s o w	Vgr sl		
36-42	Vgr	2.5Y 6/4		1 m pr 2 o cpr 3 vo abk sbk	10 >75 25	s p vs vp	fr sh fl h vfl vh eff eh	SL SI SCL SIC L C CL SC		2 mk br 3 co 4 k cobr	g l d b	gr		
				m vf gr eg f pl	0 50 <10 75	so po ss ps	lo lo vfr so	S SICL LS SIL		v1 n pf 1 po	a s o w			
				1 m pr 2 o cpr 3 vo abk sbk	10 >75 25	s p vs vp	fr sh fl h vfl vh eff eh	SL SI SCL SIC L C CL SC		2 mk br 3 co 4 k cobr	g l d b			
				m vf gr eg f pl	0 50 <10 75	so po ss ps	lo lo vfr so	S SICL LS SIL		v1 n pf 1 po	a s o w			
				1 m pr 2 o cpr 3 vo abk sbk	10 >75 25	s p vs vp	fr sh fl h vfl vh eff eh	SL SI SCL SIC L C CL SC		2 mk br 3 co 4 k cobr	g l d b			

Figure 3b Field Data sheet for MU1PR23

4.0 Evaluation of Soil Suitability

The topsoil of the Teagulf Sand Loam provides a favorable medium for plant growth. The primary suitable characteristics are organic matter content and favorable water holding capacity due to texture. The Teagulf Sandy Loam provides approximately six to 15 inches of topsoil material favorable for plant growth. The salvage depth can be reliably observed in the field as a change in color from dark brown reddish-brown to very light brown or gray, accompanied by a change in texture from sandy clay loam or heavy sandy loam to loamy coarse sand or coarse sand. The stripping depth is somewhat variable, and should be guided by local conditions, as it has been during the exploration phase of the project.