Grassy Mountain Gold Project
Wastewater Facilities

Preliminary Engineering Report

Prepared for

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RENEWS:
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SPF WATER ENGINEERING

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1. COMPLETE DESCRIPTION OF THE PROPOSAL

Paramount Gold Nevada Corporation has proposed to construct a gold mine in Malheur County, Oregon. A large soil absorption system (LSAS) is proposed for treating up to 3,920 gallons per day (gpd) of domestic wastewater. The LSAS will also receive backwash water from the potable water treatment system. The total daily design flow for the LSAS including arsenic treatment backwash water is 4,320 gpd.

The collection system of the domestic flows includes gravity sewer service lines and gravity mains. The water treatment backwash collection system includes a 4-foot diameter manhole, effluent pumps, and 100 feet of force main to the gravity system. See the Wastewater System Plans in Appendix A.

The primary treatment system includes a two-compartment septic tank. The 8,800-gallon septic tank has been oversized with the capacity to hold two days of storage in the event of a prolonged power outage. The second chamber of the septic tank holds two effluent pumps which provide pressurized doses to the absorption fields.

The proposed treatment system is a LSAS with 3,600 linear feet soil absorption trenches divided into 4 cells, each consisting of 6 trenches. Each dose pressurizes two of the trenches during a cycle. A distribution valve rotates the receiving trench after each pumping cycle.

2. LOCATION OF THE PROJECT

Location of the project, adjacent facilities, and waterways on a USGS topographic map. Include the location and latitude/longitude for all UIC wastewater systems on this map. Also provide a tax lot map for the project.

The Project is located in Malheur County, Oregon, approximately 22 miles south-southwest of Vale (Figure 1) and consists of two areas: The Mine and Process Area and the Access Road Area (Permit Area) (Figure 2).

The Mine and Process Area is located on three patented lode mining claims and unpatented lode mining claims that cover an estimated 886 acres. These patented and unpatented lode mining claims are part of a larger land position that includes 419 unpatented lode mining claims and nine mill site claims on lands administered by the Bureau of Land Management (BLM) (Figure 2). All proposed mining would occur on the patented claims, with some mine facilities on unpatented claims. The Mine and Process Area is in all or portions of Sections 5 through 8, Township 22 South, Range 44 East (T22S, R44E) (Willamette Meridian).

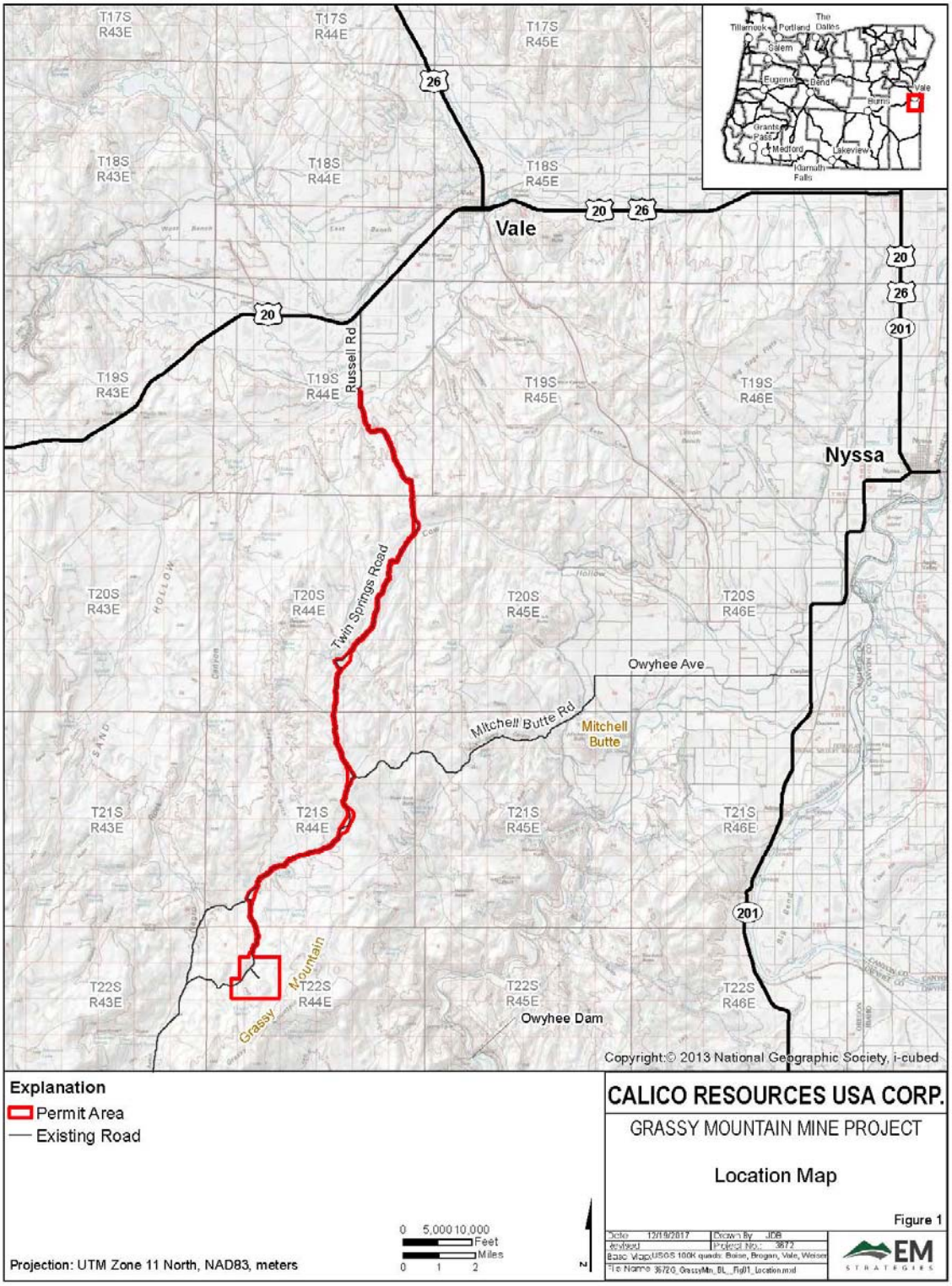


Figure 1. Project Location

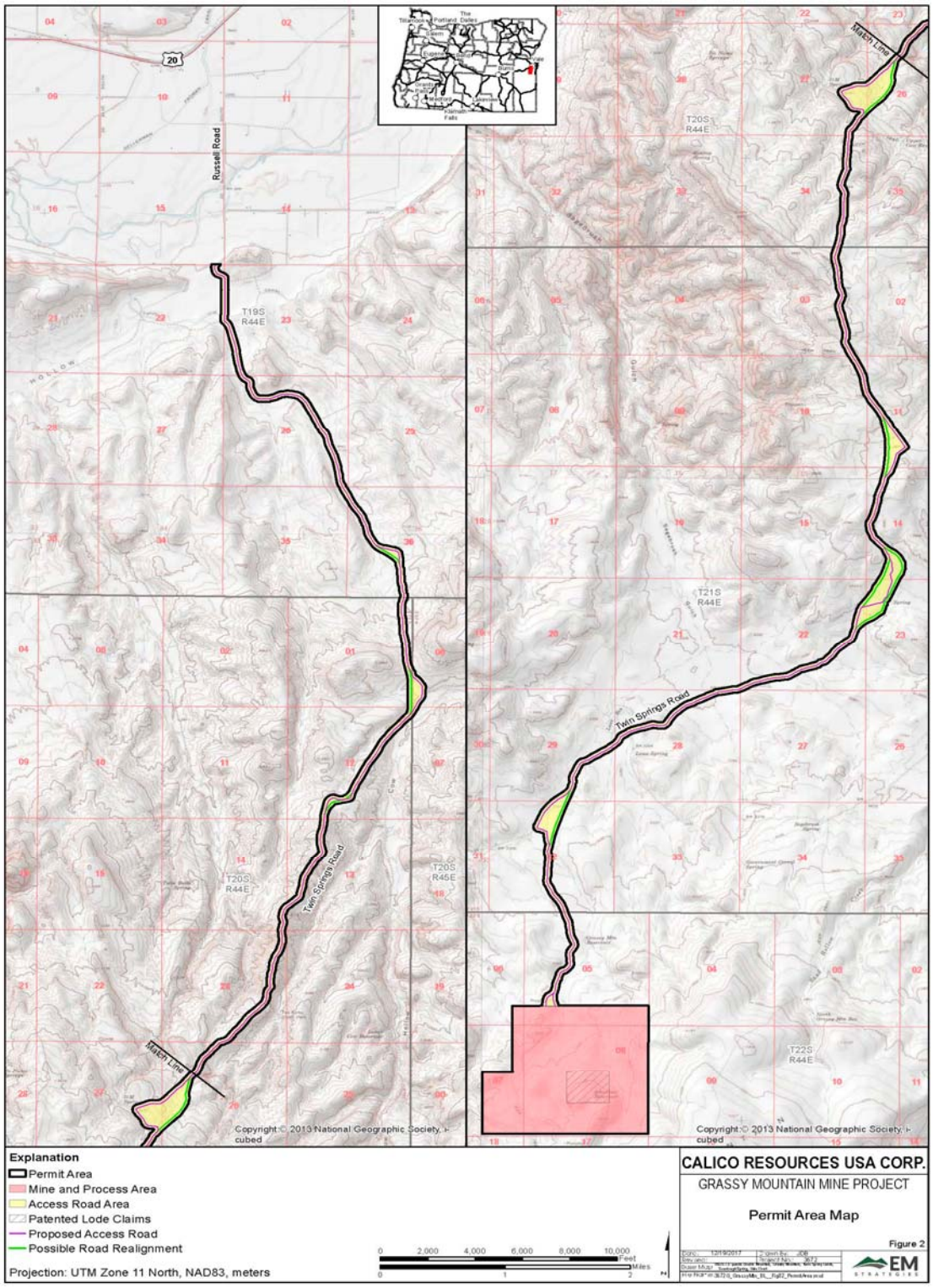


Figure 2. Permit Area

The Access Road Area is located on public land administered by the BLM, and private land controlled by others (Figure 2). A portion of the Access Road Area is a Malheur County road named Twin Springs Road. The Access Road Area extends north from the Mine and Process Area to Russell Road, a paved Malheur County road. The Access Road Area is in portions of Section 5, T22S, R44E, Sections 3, 10, 11, 14, 15, 21 through 23, 28, 29, and 32, T21S, R44E, Sections 1, 12 through 14, 23, 26, 27, and 34, T20S, R44E, Sections 6 and 7, T20S, R45E, and Sections 22, 23, 26, 35, and 36, T19S, R44E (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline) to accommodate possible minor widening or rerouting, and a potential powerline adjacent to the access road. There are several areas shown that are significantly wider than 300 feet on the Permit Area Map (Figure 2), which are areas where the final alignment has not yet been determined. The final engineering of the road will be consistent throughout, and within the Permit Area. The Access Road Area also includes a buffer on either side of the proposed road width for the collection of environmental baseline data. The road corridor will be approximately 30 feet wide, which includes a 20-foot wide road travel width (10 feet on either side of the road centerline), two-foot wide shoulders on each side of the road, minimum one-foot wide ditches on each side of the road, and appropriate cut and fill. The Access Road Area totals approximately 876 acres.

The Mine and Process Area is within two taxlots (Figure 3). The Calico Resources USA owns Taxlot 22S44E00101, while the Primary and Replacement Drainfield Areas are located within Taxlot 22S44E00101, which is owned by USA and administered by BLM.

The UIC wastwewater systems found on this project site include the Primary and Replacement LSAS Drainfield Areas. The latitude /longitude of these corners are provided in Table 1.

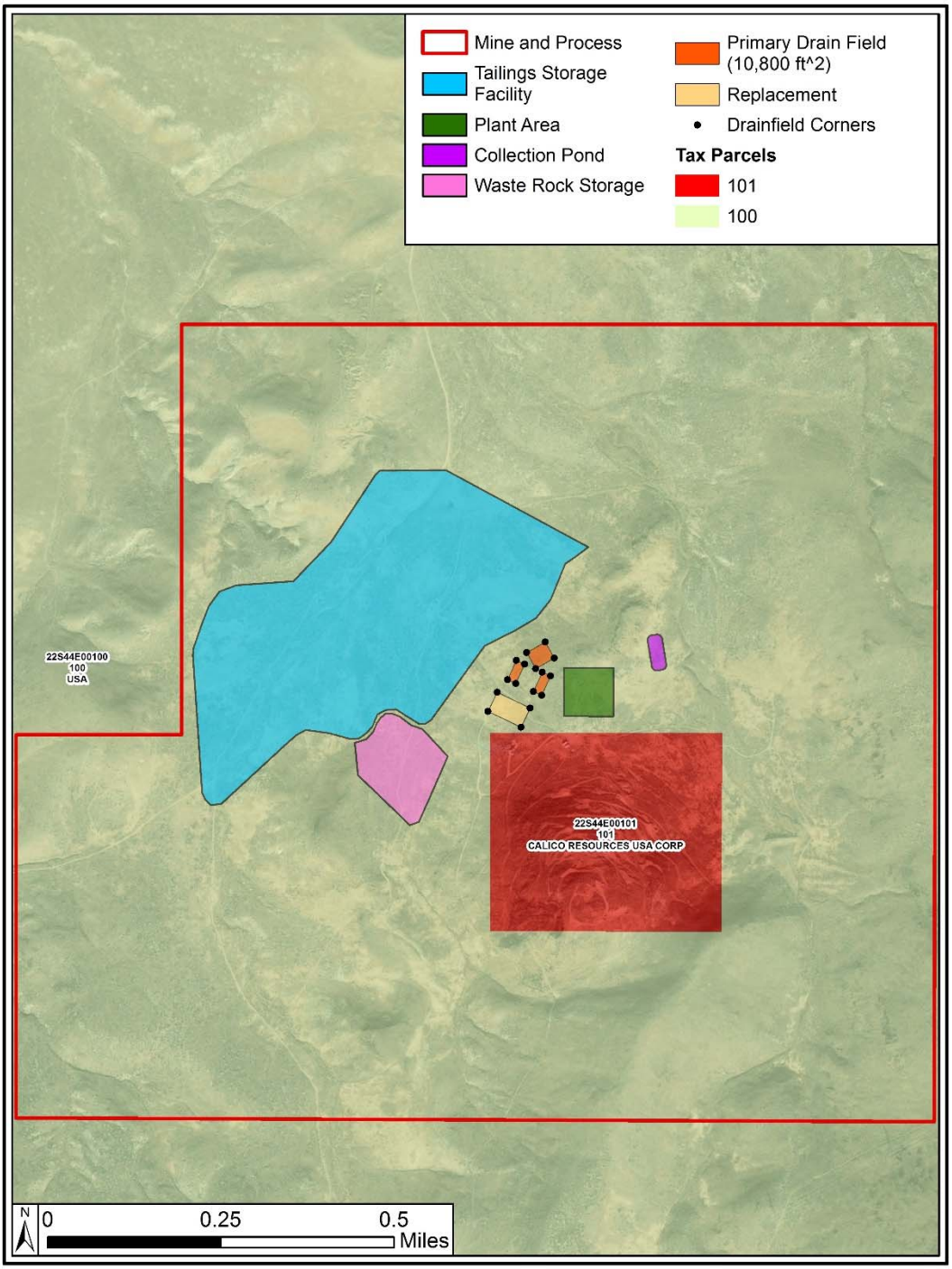


Figure 3. Taxlot and Drainfield Location Map

Table 1. UIC Locations

Primary Drainfield Corners		
Site 1		
P1	43.6746812°	-117.3605409°
P2	43.6743477°	-117.3602779°
P3	43.6741280°	-117.3608108°
P4	43.6744615°	-117.3610730°
Site 2		
P5	43.6742967°	-117.3613719°
P6	43.6742181°	-117.3611314°
P7	43.6738123°	-117.3613829°
P8	43.6738918°	-117.3616231°
Site 3		
P9	43.6740504°	-117.3606215°
P10	43.6739723°	-117.3603799°
P11	43.6735664°	-117.3606343°
P12	43.6736434°	-117.3608720°
Replacement Drainfield Corners		
R1	43.6736275°	-117.3619200°
R2	43.6732969°	-117.3609639°
R3	43.6728941°	-117.3612281°
R4	43.6732263°	-117.3621821°

3. SCHEDULE FOR DEVELOPMENT

Schedule for development, including future expansion plans if applicable.

Once the mine site is developed as proposed, there are no immediate plans for future expansion of the facility. The system is planned for installation TBD after permitting approval.

4. SCHEMATIC DIAGRAMS

Schematic diagrams of waste streams and treatment/disposal facilities. Include the source and quality of drinking water and water used for processing or manufacturing.

The schematic of the waste streams, treatment, and disposal facilities is shown in Figure 4.

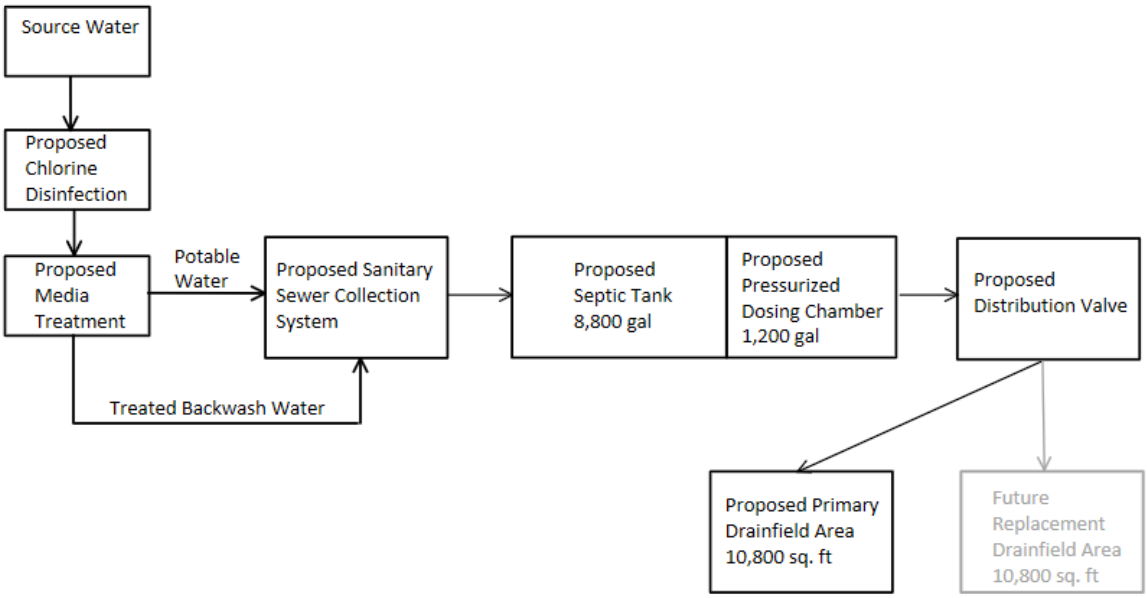


Figure 4. Schematic Diagram

The source water is pumped from a well field located approximately 2 miles north of the Mine Process Area. Representative source water quality results are shown in Table 2.

Potable water is produced by disinfecting with sodium hypochlorite and removing arsenic through adsorption via Bayoxide E33 media. The arsenic will be adsorbed and retained in the media. The treated backwash water quality is proposed to be similar to the raw water with the following exceptions; arsenic levels are expected to be approximately 0.01 mg/L and as a secondary effect of the adsorption process the iron/manganese quantity will also be significantly reduced.

Table 2. Source Water Quality

Analytes in mg/L unless noted. If result is <#, it is less than the MDL. If the result is blank, it was not tested. **Bold** results are over secondary MCL. **Red bold** results are over primary MCL.		GW-4							
Analytes	**MCL**	**3/14/13**	**6/17/13**	**8/6/13**	**11/21/13**	**11/21/13**	**3/18/14**	**6/27/14**	**9/11/14**
Aluminum, dissolved	**0.05**	0.03	0.04	0.04	0.04	0.05	0.06	0.07	0.05
Aluminum, total	**0.05**	1.68	0.95	0.68	1.13	0.84	1.09	0.6	0.83
Antimony, dissolved	**0.006**	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Antimony, total	**0.006**	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Arsenic, dissolved	**0.010**	0.0119	0.0115	0.012	0.0118	0.0119	0.0109	0.0109	0.0109
Arsenic, total	**0.010**	0.0118	0.0118	0.0126	0.0116	0.0113	0.0111	0.0114	0.0116
Barium, dissolved	**2**	<0.003	0.005	<0.003	0.005	0.005	<0.003	<0.003	<0.003
Barium, total	**2**	0.01	0.006	0.006	0.008	0.007	0.009	0.003	0.004
Beryllium, dissolved	**0.004**	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	<0.00005
Beryllium, total	**0.004**	0.00028	0.00014	0.00011	0.00013	0.00009	0.00014	0.00008	0.0001
Bicarbonate as CaCO3	NA	179	178	179	177	177	162	155	189
Bismuth, dissolved	NA	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Bismuth, total	NA	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Boron, dissolved	NA	0.126	0.16	0.14	0.15	0.16	0.12	0.14	0.14
Boron, total	NA	0.13	0.14	0.15	0.14	0.14	0.14	0.14	0.13
Cadmium, dissolved	**0.005**	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cadmium, total	**0.005**	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	NA	3.6	4	3.7	3.6	3.5	3.1	3.5	3.4
Calcium, total	NA	4.8	4.2	4.2	4.2	4	4.1	3.9	4
Carbonate as CaCO3	NA	16	16	14	14	14	9	11	14.9
Chloride	**250**	28.5	28.7	29	27	27	26.9	26.7	25.4
Chromium, dissolved	**0.1**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium, total	**0.1**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt, dissolved	NA	0.00024	0.00121	0.00009	0.00011	0.00007	0.00047	0.00038	0.0004
Cobalt, total	**NA**	0.00015	0.00009	0.00007	0.00009	0.00008	0.00008	0.00006	0.00008
Conductivity @25C (umhos/cm)	NA	673	681	682	665	666	696	671	660
Copper, dissolved	**1.3**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Copper, total	**1.3**	<0.0005	0.0006	<0.0005	<0.0005	0.0006	<0.0005	<0.0005	<0.0005
Cyanide, total	**0.2**	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Cyanide, WAD	**0.2**	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Fluoride	**4**	2.47	2.3	2.3	2.21	2.21	2.23	2.21	2.13
Gallium, dissolved	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Gallium, total	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hardness as CaCO3	NA	9	11	9	9	9	8	9.6	9.7
Hardness as CaCO3 (dissolved)	NA								
Hardness as CaCO3 (total)	NA								
Hydroxide as CaCO3	NA	<2	<2	<2	<2	<2	<2	<2	<2
Iron, dissolved	**0.3**	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	0.02	0.02
Iron, total	**0.3**	0.59	0.36	0.28	0.42	0.33	0.41	0.25	0.36
Lead, dissolved	**0.015**	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lead, total	**0.015**	0.0012	0.0008	0.0006	0.0008	0.0007	0.0009	0.0006	0.0008
Lithium, dissolved	NA	0.09	0.1	0.09	0.09	0.09	0.078	0.09	0.091
Lithium, total	NA	0.09	0.09	0.09	0.09	0.09	0.094	0.09	0.091
Magnesium, dissolved	NA	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	0.2	0.3
Magnesium, total	NA	0.3	<0.2	0.2	0.2	<0.2	<0.2	0.2	0.5
Manganese, dissolved	**0.05**	0.0046	0.0071	0.0048	0.0056	0.0054	0.0055	0.0055	0.0052
Manganese, total	**0.05**	0.0147	0.0115	0.0098	0.0129	0.0116	0.0101	0.0088	0.0122
Mercury, dissolved (ng/L)	**2000**	<0.4	0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2
Mercury, total (ng/L)	**2000**	4	2	1	1.1	0.5	0.8	0.8	0.6
Molybdenum, dissolved	NA	0.0088	0.0093	0.0094	0.0099	0.0097	0.009	0.0083	0.0096
Molybdenum, total	NA	0.0105	0.0099	0.01	0.0088	0.0088	0.0093	0.0087	0.0099
Nickel, dissolved	NA	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Nickel, total	NA	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Nitrate as N, dissolved	**10**	<0.02	<0.02	<0.02					
Nitrate/Nitrite as N	**10**			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrate/Nitrite as N, dissolved	**10**	<0.02	<0.02	<0.02					
Nitrite as N, dissolved	**1**	<0.01	<0.01	<0.01					
Nitrogen, ammonia	NA	0.08	0.09	0.1	0.07	<0.05	<0.05	<0.05	<0.05
pH (standard units)	NA	8.7	8.7	8.7	8.6	8.7	8.5	8.6	8.6
pH measured at (°C)	NA	21	23	21	21	21	21	22	19.2

Table 2. Source Water Quality (Continued)

Analytes in mg/L unless noted. If result is <#, it is less than the MDL. If the result is blank, it was not tested. **Bold** results are over secondary MCL. **Red bold** results are over primary MCL.		GW-4							
Analytes	**MCL**	**3/14/13**	**6/17/13**	**8/6/13**	**11/21/13**	**11/21/13**	**3/18/14**	**6/27/14**	**9/11/14**
Phosphorus, total	NA	0.03	0.02	0.01	0.02	0.02	0.07	0.02	0.02
Potassium, dissolved	NA	0.7	0.9	0.5	0.7	0.7	0.4	0.7	0.7
Potassium, total	NA	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.9
Total Dissolved Solids	500	420	380	416	400	410	260	390	390
Total Suspended Solids	NA	46	23	22	21	12	33	14	18
Scandium, dissolved	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Scandium, total	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Selenium, dissolved	0.05	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, total	0.05	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silver, dissolved	0.10	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silver, total	0.10	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	<0.00005
Sodium, dissolved	NA	147	156	151	145	146	129	141	144
Sodium, total	NA	154	150	152	148	149	152	146	144
Strontium, dissolved	NA	0.02	0.03	0.02	0.02	0.02	0.019	0.018	0.019
Strontium, total	NA	0.03	0.03	0.03	0.03	0.03	0.029	0.021	0.023
Sulfate	250	95.81	93.9	94.9	89.1	89.1	88.3	86.8	81.6
Thallium, dissolved	NA	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Thallium, total	NA	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin, dissolved	NA	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001
Tin, total	NA	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0006	0.0001
Titanium, dissolved	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Titanium, total	NA	0.013	0.01	0.007	0.012	0.01	0.013	0.006	0.012
Total Alkalinity	NA	195	194	193	191	191	172	166	204
Uranium, dissolved	0.030		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Uranium, total	0.030		0.0004	0.0002	0.0003	0.0002	0.0003	0.0002	0.0002
Vanadium, dissolved	NA	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0004
Vanadium, total	NA	0.0006	0.0004	0.0002	0.0003	0.0003	0.0005	0.0003	0.0003
Zinc, dissolved	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc, total	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

5. WASTEWATER CHARCTERIZATION

The daily average domestic wastewater design flow is estimated to be 3,920 gpd. This value assumes 112 workers at the mine per day and an average day potable water demand of 35 gpd (based on OAR 340-071-0220 for factories with shower facilities). The plant and mine offices and associated change houses are expected to include showers, wash basins, and toilets. There will not be on-site laundry facilities.

The effluent entering the LSAS will consist of typical residential strength sewage from workers at the mine site. The LSAS will also receive backwash water from the potable water treatment system. The total daily design flow for the LSAS including treatment system backwash water is 4,320 gpd. Currently, one (1) drainfield is proposed, with a replacement area (Figure 3). The drainfield is sized based on a dosing rate of 0.4 gallons per square foot per day for type C soils.

6. PLANS FOR DISPOSAL OF SOLID WASTE AND SLUDGES

Trash will be deposited in dumpsters and hauled away to a permitted landfill by a local commercial garbage service. Septage will be pumped and hauled to a permitted facility by a Department of Environmental Quality licensed pumper.

7. SITE EVALUATION REPORT

Site evaluation report prepared as outlined by OAR 340-071-0150 (onsite sewage disposal or graywater reuse and disposal systems only.)

A site evaluation report (Appendix B) was prepared by Larry Brown of DEQ Eastern Region in May of 2019. The evaluation concluded the absorption are to be Class C soils suitable for a pressurized LSAS to accommodate the proposed design flows. At the time of the evaluation, there was not enough information to determine if pretreatment would also be required. A Water Quality Impact Assessment (WQIA) (Appendix C) was prepared by SPF which concludes that pretreatment will not be required.

8. GROUNDWATER INFORMATION

Groundwater information for all areas where wastewater or sludge will be stored or disposed.

The WQIA (Appendix C) provides detailed groundwater information. The location of the proposed drainfield is north of the mine and approximately 200 feet west and northwest of monitoring wells 59762 and GMW17-31. The geologist lithology log from GMW17-31 shows overburden for the top 8 feet, interbedded sandstone, siltstone, clay, and conglomerate from 8 to 60 feet, clay from 60 to 147 feet, then interbedded arkose, sandstone, siltstone, clay, and tuff from 147 to the bottom at 520 feet. The lithology noted traces of silicification 41 to 60 feet and 92 to 107 feet and indicated the majority of the bore was silicified from 147 feet to the bottom of the bore. Once completed with a screened interval of 458 to 498 feet, GMW17-31 had no measurable water in the well. Overtime, water has seeped into the well to an elevation of approximately 3,222 feet above meal sea level, roughly 500 feet below ground.

Near the proposed Grassy Mountain mine, due to the nature of the silicification and compartmentalization of the aquifer due to faulting, there tends to be deeper water levels. Downgradient of the proposed mine, the silicification decreases. The proposed drainfield is also downgradient of the faulting causing the compartmentalization near the proposed mine. It is expected the effluent from the drainfield will initially migrate downward until reaching less permeable siltstones, clays, or silicified sediments which will cause horizontal movement in the downgradient and down dip (northwest) direction. Once the effluent reaches the water table, estimated to be 3,450 feet above mean sea level, it will travel downgradient in the

northwest direction flowing into the areas with less silicification. The water table is expected to be approximately 100 to 200 feet below ground surface in the vicinity of the drainfield.

A list of wells, locations, construction details, measurement protocols, water level data, and hydrographs are presented in the groundwater baseline report. Well construction details are summarized in Table 3. The location of all the monitoring wells is shown on Figure 5.

Table 3. Well Construction Table

Calico Well ID	OWRD Well Tag Number	OWRD Name	Alternate Name	Drill Method	Depth of First Water (ft)	Well Const. Depth (ft)	Screened Interval (ft)	Well Casing Diameter (in)	TOC Elevation[4]	Elevation Screened Interval (ft)	Water Level Elevation (9/26/2018)	Production (gpm)[2]	Screened Lithology[1]
59760	107462	MALH 2974	Middle Sweizer, TW-1	air rotary	160	203	163-203	6	3762.1	3599-3559	3673.43	+10	fractured basalt
59761	109400	MALH 2993	Lower Sweizer, MW-2	air rotary	100	118	97-117	4	3762.2	3665-3645	3673.48	+50	fractured basalt
59762	109371	MALH 2976, 2985	MW-3	air rotary	626	700	550-660	4	3724.8	3175-3065	3103.4	<1	siltstone
59763	109356	MALH 2994	TW-4	air rotary	277	323	293-323	6	3519.4	3226-3196	3239.03	+5	fractured volcanics
59764	107466	MALH 2986	MW-5	air rotary	270	300	279-299	4	3511.9	3233-3213	3238.24	+10	fractured sandstone
59765		MALH 2979	MW-6	air rotary	29	36	28-36	4	3446.5	3418-3410	dry	dry	shallow sandstone
59766	107468	MALH 2980	MWS-8	air rotary	only damp when drilled	45	25-45	4	3459.7	3435-3415	3426.68	+10	shallow sandstone
59767		MALH 2995	MWS-9	air rotary	dry	40	20-40	4	3495.3	3475-3455	dry	dry	shallow sandstone
59768		MALH 54197	MWS-10	air rotary	21	25	10-25	4	3480.6	3471-3456	3463.46	0.5	shallow sandstone
59770		MALH 2983	MW-11	air rotary	dry when drilled	424	374-424	4	3389.0	3015-2965	3241.71	+0.5	volcanic tuff
59772	109352	MALH 2984	Upper Sweizer, MWS-13	air rotary	125	207	165-205	4	3768.2	3603-3563	3673.5	+50	fractured basalt
26-092-915	109354	MALH 54071		unknown	unknown	915	228-268	2	3710.0	3482-3442	3633.55	unk	unk
57-1		MALH 54195		unknown	unknown	765	108-138	1.25	3770.6	3663-3633	3699.1	unk	unk
57-10		MALH 54196		unknown	unknown	500	126-156	1	3681.1	3555-3525	3635.67	unk	unk
89-2	109360	MALH 54072		unknown	200	425	386-406	2	3293.5	2907-2887	3235.54	unk	unk
Bishop	None	MALH 54046	Rye Field	cable	unknown	482	135-145	12	3391.5	3257-3247	3281	50	coarse gravel
BLM	109398	MALH 2277	Owyhee Ridge	cable	unknown	175	159-166	6	3579.6	3421-3414	3423.95	+12	white sand
GMW17-31	125168	MALH 54404		air rotary	dry when drilled	498	458-498	5	3722.0	3262-3222	3222.6	0	siltstone, sinter, clay
GMW17-32	125169	MALH 54405		air rotary	244	718	678-718	5	3702.1	3026-2986	3082.1	<1	Arkose, siltstone, Clay
GMW17-33	125170	MALH 54406		air rotary	243	338	238-338	5	3702.7	3465-3365	3452.16	<30	sinter, siltstone, tuff
GMW18-34	130031	MALH 54437		air rotary	dry	950	830-890	5	3953.3	3127-3067	dry	dry	Arkose, siltstone, Clay
GW-1	107469	MALH 2281	47-1	air rotary	140	155.5	135.5-155.5	4	3709.1	3573.5-3553.5	3654.18	60	gravel
GW-2	109357	MALH 2279	47-2	air rotary	dry when drilled	325	290-320	4	3827.5	3537-3507	3662.91	0	blue and grey clay
GW-3	107467	MALH 2278	47-3	air rotary	dry when drilled	350	320-350	4	3633.6	3314-3284	3401.68	<1	blue and grey clay
GW-3A		MALH 2579		air rotary	dry	420	380-420	2	3655	3275-3235	dry	dry	silt and clay
GW-3B		MALH 2576		air rotary	dry	340	80-100	2	3626	3546-3526	dry	dry	clay
GW-4	107460	MALH 54073		unknown	50	370	280-350	4	3342.7	3063-2993	3260.85	100	sandstone, congl, clay
GW-5		MALH 54194		air rotary	unknown	265	204-224	2	3413.0	3209-3189	3221.45	<1	tuff, clay
GW-6	109368	MALH 2578		air rotary	145	340	300-340	2	3377.3	3077-3037	3236.16	3-4	sandstone, congl, clay
Prod 1	107457	MALH 2275, 2511		air rotary	145	425	145-255, 325-355, 380-420	6	3436.4	3291-3181, 3111-3081, 3056-3016	3436.41	30-100[3]	sandstone, blue clay, and hard sandstone
PW-1	109353	MALH 2276		air rotary	320	520	320-340, 400-420	6	3709.1	3389-3369, 3309-3289	3654.66	25-35[3]	brown clay and sand; coarse sandstone
PW-4	109351	MALH 2206		air rotary	280	375	280-300, 340-360	6	3341.4	3061-3041, 3001-2981	3261.39	175-250[3]	sandstone and conglomerate

1 - as reported on the drillers log
2 - based on short-term testing by driller during or following construction
3 - based on long-term test pumping
4 - surveyed with the exception of GW-3A, GW-3, GMW-17-31, GMW17-32, GMW17-33, and GMW18-34

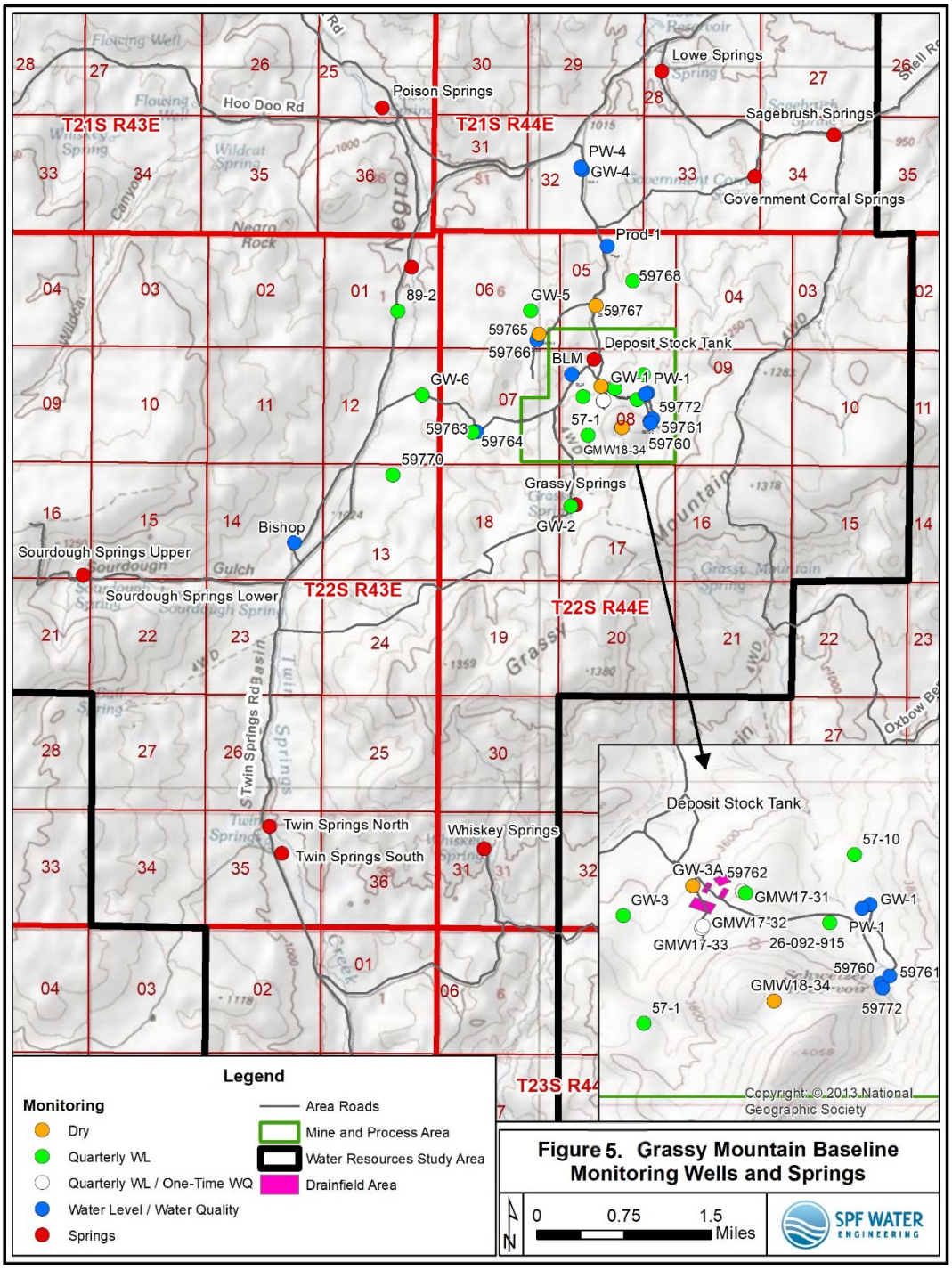


Figure 5. Grassy Mountain Baseline Monitoring Wells and Springs

9. EVAUATION OF GROUNDWATER AND SURFACE WATER IMPACTS

Evaluation of groundwater and surface water impacts and the steps that will be taken to prevent impacts from occurring.

The Level 1 nitrate balance evaluation, WQIA (Appendix C), predicts an increase of 1.76 mg/L in the groundwater nitrate concentration downgradient of the Grassy Mountain Mine Permit Area boundary. The model is based on limited site-specific data and necessary simplifying assumptions. There currently are no drinking water wells in the area. The proposed wells to be used for potable use are or will be located more than 1.6 miles from the drainfield in deeper confined sand layers. A model sensitivity assessment has been performed to address model uncertainty.

Based on the results of the Level 1 nitrate balance evaluation, SPF recommends proceeding with the proposed drainfield design rate of 3,920 gpd of wastewater and a daily design flow of 4,320 to accommodate the estimated monthly water treatment system backflush water. Should new or additional data be collected in support of the design and implementation, refinement of the nitrate balance study and conclusions presented in this report may be warranted.

10. OPERATION AND MAINENANCE PLAN

Operation and maintenance plan that specifies the normal operation parameters of the system.

An Operation and Maintenance (O&M) Manual for the proposed system has been prepared as a separate document for submission, review, and approval with the WPCF permit application. The O&M Manual is included in Appendix D.

Appendix A
Wastewater System Plans

SEPTIC TANK
SEE SHEET C508

123°

0+00

MH – 1
STA: 0+00

MH – 2
STA: 0+84

151°

1+00

10' MIN.
SEPARATION

TRANSPORT LINES

3700.00

STOCKPILE &
RECLAIM AREA

SEWER SERVICE CLEANOUT
SEE SHEET DETAIL 4
SHEET C506

3708.00

4" SANITARY SEWER
SERVICE LINE

135°

0+00

2+00

135°

MH – 3
STA: 0+00

MH – 3
STA: 2+01

3710.00

ABSORPTION TRENCH
AREA BOUNDARY
SEE SHEET C401

10' MIN.
SEPARATION

3+00

GRINDING AREA

CRUSHING AREA

4" SANITARY SEWER
SERVICE LINE

10' MIN.
SEPARATION

1+00

1+91

MH – 3A
STA: 1+91

3-SEWER SERVICE
CONNECTIONS
SEE SHEET DETAIL 5
SHEET C504

3-SEWER SERVICE CROSSINGS
SEE SHEET DETAIL 5 SHEET C506

ELUTION AREA

GOLD ROOM

REAGENT AREA

CIL AREA

3706.00

3704.00

3702.00

WATER SERVICE AREA

MH – 5A
STA: 0+88

SEWER SERVICE CROSSINGS
SEE SHEET DETAIL 5 SHEET C506

FM

FM

10' MIN.
SEPARATION

4+00

5+00

90°

MH – 4
STA: 3+67

MH – 5
STA: 5+65

6+00

TRUCK WASH

3706.00

3710.00

3720.00

3724.00

SEWER SERVICE CONNECTION
SEE SHEET DETAIL 5 SHEET C504

TRUCK WORKSHOP
& WAREHOUSE

4" SANITARY SEWER
SERVICE LINE

TSS

MH – 6
STA: 6+86

6+86

SEWER SERVICE CLEANOUT
SEE SHEET DETAIL 4 SHEET C506

MINE OFFICE &
CHANGE HOUSE

3728.00

20 0 20 40
SCALE OF FEET

CONSTRUCTION NOTES

1. PROPOSED PAD ELEVATIONS ARE BASED ON THE LANDXML SURFACE PROVIDED TO SPF ON 8/20/2019 BY AUSENCO. IF FINAL PAD ELEVATIONS DIFFER FROM THE ASSUMED ELEVATIONS, CONTRACTOR SHALL ADJUST FINAL MANHOLE AND GRAVITY SANITARY SEWER PIPES ACCORDINGLY. GRADE AREA AROUND EACH MANHOLE TO DIVERT SURFACE WATER AWAY.

SPF WATER ENGINEERING
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GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

SEWER COLLECTION SYSTEM SITE PLAN

REGISTERED PROFESSIONAL ENGINEER
MATTHEW W. RASMUSSEN
21703
8/22/2019
OREGON
MAR. 13, 2015
RENEWS: 12/31/2020

ITEM	DESCRIPTION	DATE
0	FINAL PERMIT SET	8/22/19

REVISIONS

VERIFY SCALE
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BAR MEASURES ONE-INCH ON FULL SIZE DRAWING.

PROJECT:	1294.0050
DESIGNED:	EH/SM/JL
DRAWN:	JL/SM/KN
CHECKED:	JT

C400

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Xref Filename: | X-TITLE | X-LINEWORK | X-PLANT SITE BASE_7-23-19 | X-TITLE (2) |

CONSTRUCTION NOTES

1. CONTRACTOR SHALL FOLLOW OAR 340-071-0520 RULES AND REGULATIONS.
2. THIS SYSTEM SHALL BE INSTALLED UNDER DRY SOIL CONDITIONS TO REDUCE SMEARING. IF SMEARING OCCURS, THE SMEARED AREAS SHALL BE RAKED.
3. THE SITE OF DISTURBANCE MUST BE RE-SEEDED.
4. BOTH THE INITIAL AND REPLACEMENT ABSORPTION TRENCH AREAS ARE TO BE PROTECTED FROM TRAFFIC, COVER, DEVELOPMENT OR OTHER POTENTIAL DISTURBANCE OF NATURAL SOIL CONDITIONS.
5. THE ABSORPTION TRENCH AREAS MUST NOT BE SUBJECTED TO EXCESSIVE SATURATION DUE TO: BUT NOT LIMITED TO; ARTIFICIAL DRAINAGE OF GROUND SURFACES, ROADS, DRIVEWAYS AND BUILDING DOWN SPOUTS.
6. IF ROADS ARE CUT DOWNSLOPE OF THE ABSORPTION TRENCH AREAS THE CONTRACTOR SHALL PROVIDE A MINIMUM SETBACK OF 50-FT.
7. ABSORPTION TRENCHES SHALL NOT BE CONSTRUCTED WITHIN 100-FT OF A WELL.
8. ALL WORK IN ABSORPTION TRENCH AREAS SHALL BE DONE WITH TRACK MACHINERY. NO WHEELED MACHINERY SHALL BE ALLOWED IN THE ABSORPTION TRENCH AREAS.
9. NO STOCKPILING OF MATERIALS SHALL BE ALLOWED WITHIN THE ABSORPTION TRENCH AREAS.
10. ALL HOLES IN LATERALS SHALL BE ORIENTED DOWN.
11. PROPOSED PAD ELEVATIONS ARE BASED ON THE LANDXML SURFACE PROVIDED TO SPF ON 8/20/2019 BY AUSENCO. IF FINAL PAD ELEVATIONS DIFFER FROM THE ASSUMED ELEVATIONS, CONTRACTOR SHALL ADJUST FINAL MANHOLE AND GRAVITY SANITARY SEWER PIPES ACCORDINGLY. GRADE AREA AROUND EACH MANHOLE TO DIVERT SURFACE WATER AWAY.

ABSORPTION TRENCHES

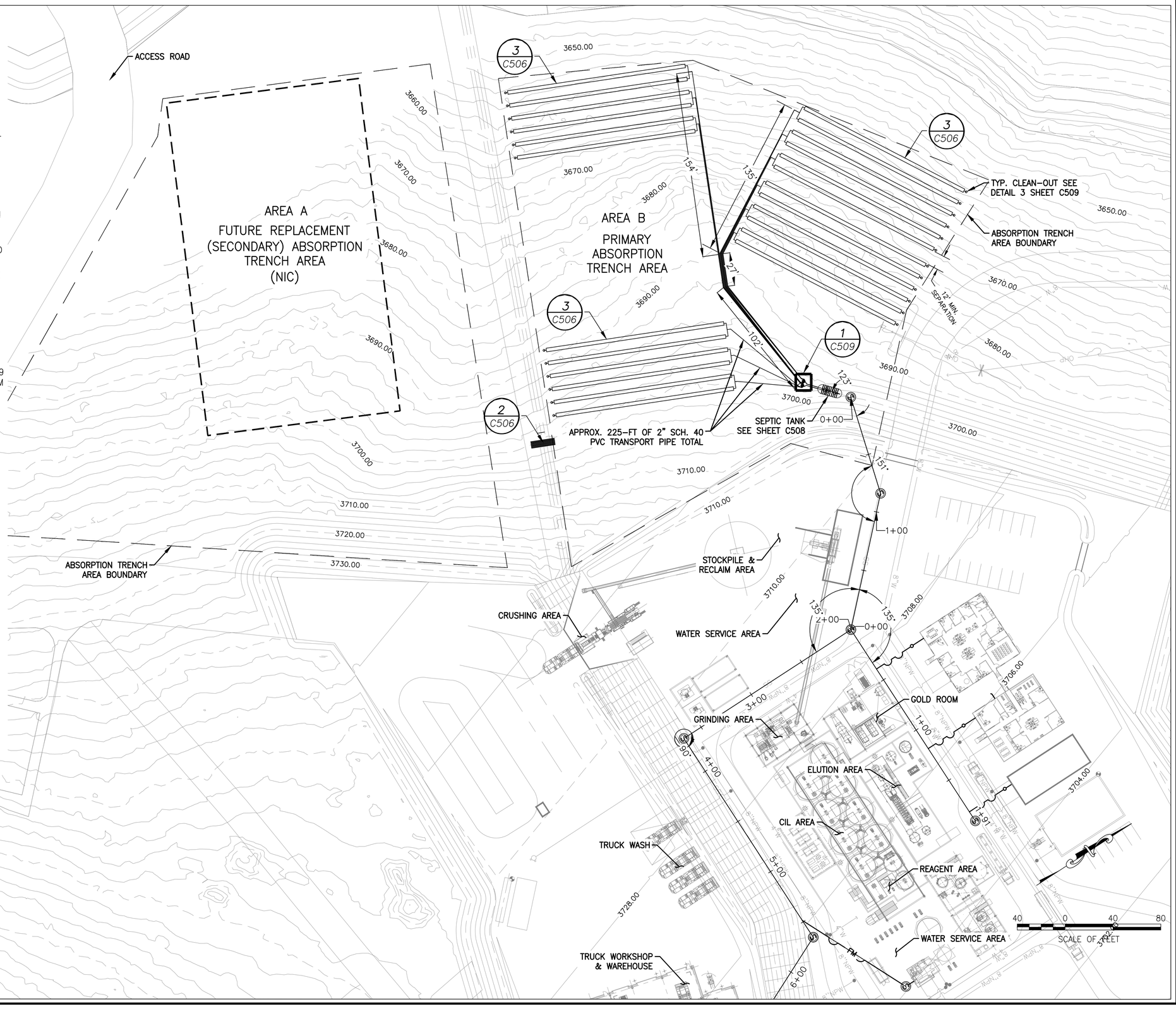
- 150'L X 3'W (24), 10,800 SF
- (4) ZONES PER AREA, 12-FT SPACING BETWEEN ZONES, 6 LATERALS PER ZONE, 2 LATERALS DISCHARGING PER DOSE, 11-FT SPACING BETWEEN LATERALS
- 1/8" DIA. ORIFICES, 4-FT SPACING, 38 ORIFICES PER LATERAL, 228 PER ZONE
- PLAN FOR 5-FT RESIDUAL HEAD AT END OF EACH LATERAL
- FLOW RATE PER ZONE = 60 GPM

PIPING AND VALVES

- TRANSPORT PIPING = 2" SCH. 40, 3168-FT
- MANIFOLD = 2" SCH. 40., 11-FT EACH, 132-FT
- LATERALS = 2" SCH. 40., 150-FT EACH, 3,600-FT

DUPLEX EFFLUENT PUMPS

- OPERATING POINT = 60 GPM @ 60-FT HEAD, APPROX.
- ALTERNATE BETWEEN DOSES
- AT LEVEL BETWEEN "PUMP OFF" AND HIGH LEVEL ALARM, BOTH PUMPS TURN ON
- DOSE ≈ 180 GALLONS, 6 TIMES PER DAY



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GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

ABSORPTION TRENCH & REPLACEMENT AREAS SITE PLAN

REGISTERED PROFESSIONAL ENGINEER
OREGON
MATTHEW W. RASMUSSON
MAR. 13, 2015
8/22/2019
RENEWS: 12/31/2020

ITEM	DESCRIPTION	DATE
0	FINAL PERMIT SET	8/22/19

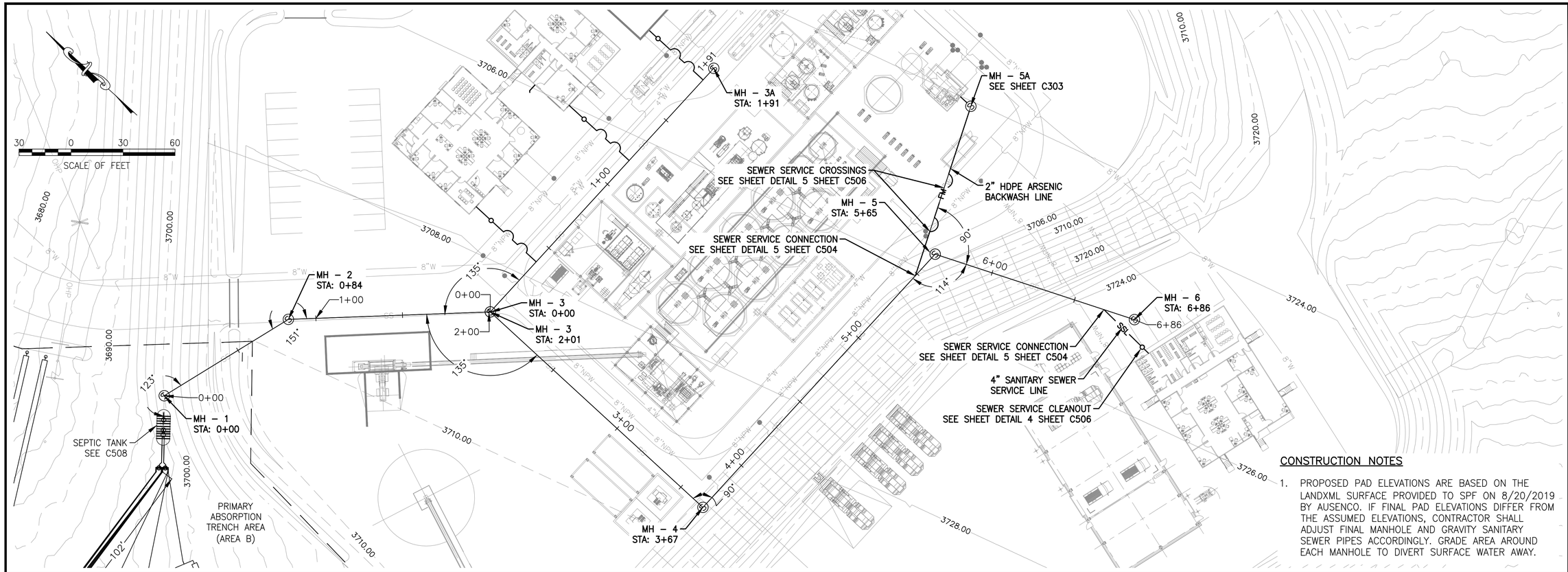
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PROJECT:	1294.0050
DESIGNED:	EH/SM/JL
DRAWN:	JL/SM/KN
CHECKED:	JT

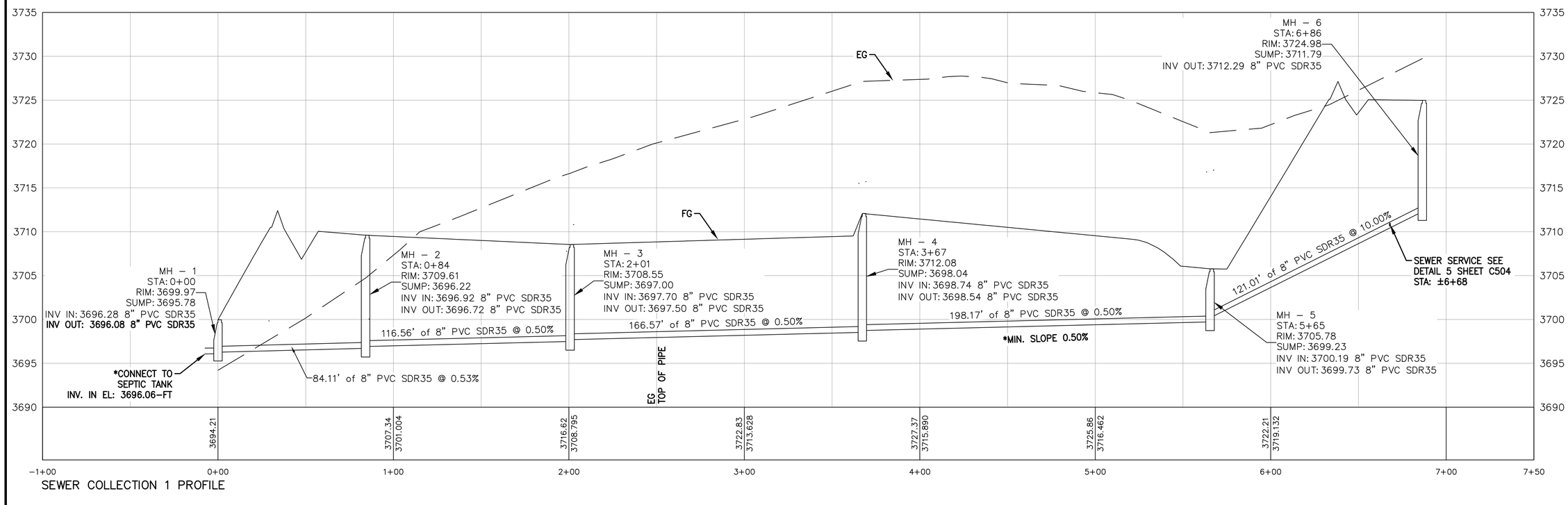
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Plot date: Aug 22, 2019-01:01:14pm CAD User: HWhite.
Filename: GRASSY MTN_SEWER C400-C404



CONSTRUCTION NOTES

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GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

SEWER COLLECTION 1

REGISTERED PROFESSIONAL ENGINEER
MATTHEW W. RASMUSSON
OREGON
MAR. 13, 2015
RENEWS: 12/31/2020

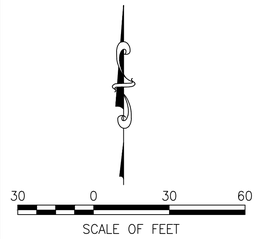
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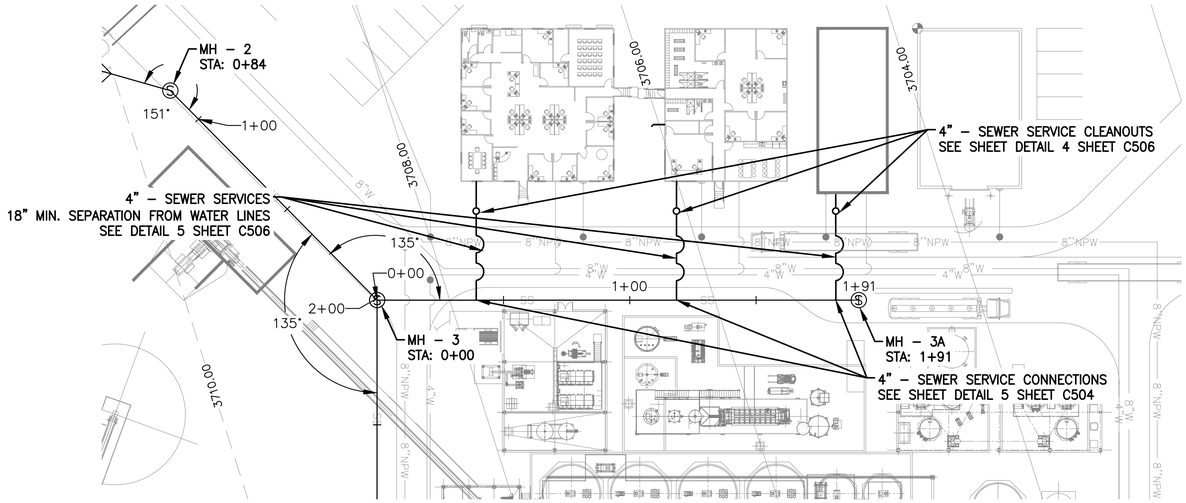
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CHECKED:	JT

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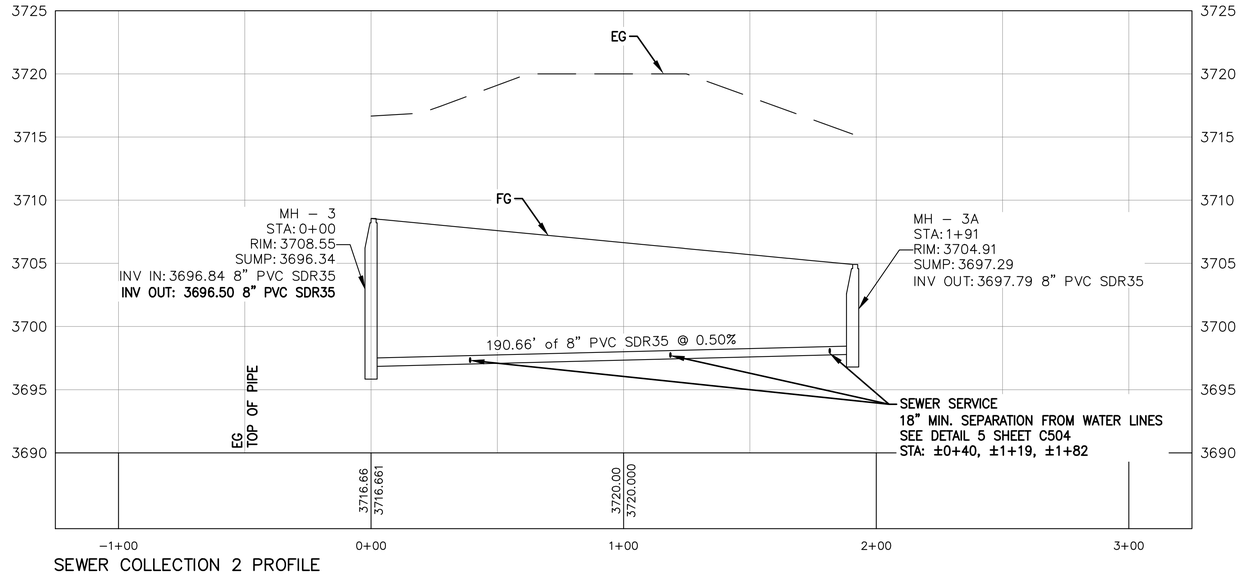
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CONSTRUCTION NOTES

1. PROPOSED PAD ELEVATIONS ARE BASED ON THE LANDXML SURFACE PROVIDED TO SPF ON 8/20/2019 BY AUSENCO. IF FINAL PAD ELEVATIONS DIFFER FROM THE ASSUMED ELEVATIONS, CONTRACTOR SHALL ADJUST FINAL MANHOLE AND GRAVITY SANITARY SEWER PIPES ACCORDINGLY. GRADE AREA AROUND EACH MANHOLE TO DIVERT SURFACE WATER AWAY.



SEWER COLLECTION 2 PROFILE

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Boise, Idaho 83706
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GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

SEWER COLLECTION 2

REGISTERED PROFESSIONAL ENGINEER
MATTHEW W. RASMUSSON
No. 17872
OREGON
MAR. 13, 2015
8/22/2019
RENEWS: 12/31/2020

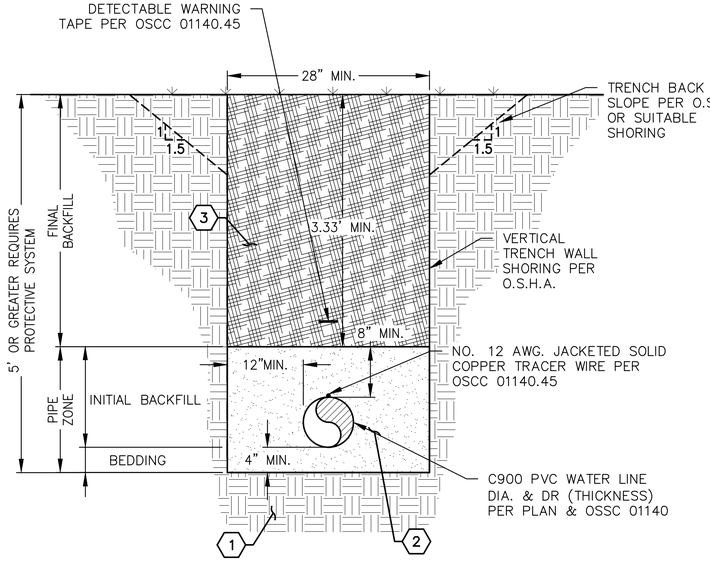
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CHECKED:	JT

C403

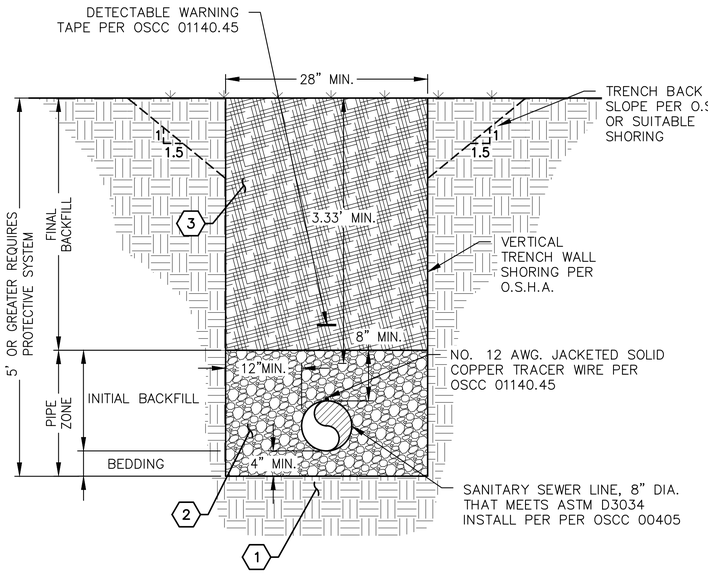
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1 WATER LINE TRENCH DETAIL
NOT TO SCALE

LEGEND

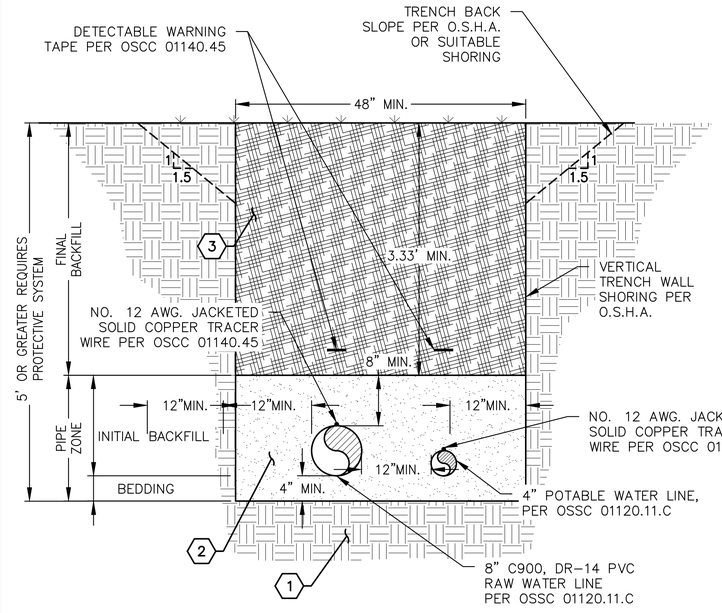
1. UNSTABLE SUBGRADE SHALL BE EXCAVATED AND BACKFILLED WITH APPROVED PIPE BEDDING MATERIAL AND COMPACTED PER OSCC 00405.44
2. PIPE BEDDING & INITIAL BACKFILL SHALL BE REASONABLY WELL-GRADED, FROM MAXIMUM SIZE TO DUST, SAND WITH 100% PASSING THE 3/8" SIEVE. BEDDING & INITIAL BACKFILL SHALL BE COMPACTED ACCORDING TO ASTM-D698 (STANDARD PROCTOR)
3. FINAL BACKFILL SHALL BE CLASS A BACKFILL ACCORDING TO OSCC 00405.14.A. FINAL BACKFILL SHALL BE 3" MINUS, FREE OF ORGANIC MATERIAL, FREE OF FROST CHUNKS, AND FREE OF TOXIC WASTE AND HAZARDOUS CHEMICALS. SEE OSCC 00405.12 FOR WET CONDITIONS



2 SANITARY SEWER TRENCH DETAIL
NOT TO SCALE

LEGEND

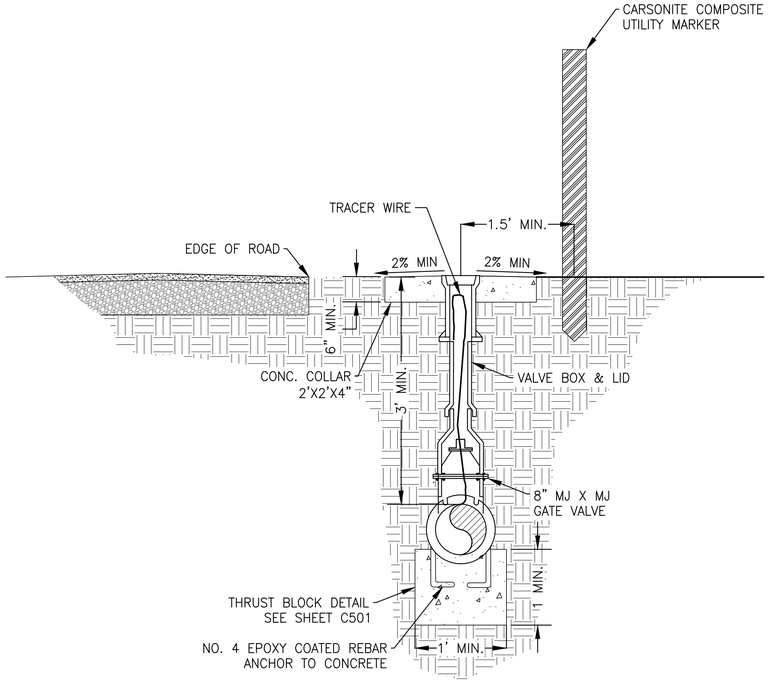
1. UNSTABLE SUBGRADE SHALL BE EXCAVATED AND BACKFILLED WITH APPROVED PIPE BEDDING MATERIAL AND COMPACTED PER OSCC 00405.44
2. PIPE BEDDING & INITIAL BACKFILL SHALL BE COMMERCIALLY AVAILABLE 3/8" ROCK CHIPS.
3. FINAL BACKFILL SHALL BE CLASS A BACKFILL (NATIVE BACKFILL) ACCORDING TO OSCC 00405.14.A. FINAL BACKFILL SHALL BE 3" MINUS, FREE OF ORGANIC MATERIAL, FREE OF FROST CHUNKS, AND FREE OF TOXIC WASTE AND HAZARDOUS CHEMICALS. SEE OSCC 00405.12 FOR WET CONDITIONS



3 JOINT TRENCH DETAIL
NOT TO SCALE

LEGEND

1. UNSTABLE SUBGRADE SHALL BE EXCAVATED AND BACKFILLED WITH APPROVED PIPE BEDDING MATERIAL AND COMPACTED PER OSCC 00405.44
2. PIPE BEDDING & INITIAL BACKFILL SHALL BE REASONABLY WELL-GRADED, FROM MAXIMUM SIZE TO DUST, SAND WITH 100% PASSING THE 3/8" SIEVE. BEDDING & INITIAL BACKFILL SHALL BE COMPACTED ACCORDING TO ASTM-D698 (STANDARD PROCTOR)
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4 TYP. GATE VALVE & VALVE BOX
NOT TO SCALE

SPF WATER ENGINEERING
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GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

TRENCH DETAILS

REGISTERED PROFESSIONAL ENGINEER 17236 7-31-19 OREGON MAY. 10, 2016 JUSTIN P. LEHARS
EXPIRES: 12-31-20

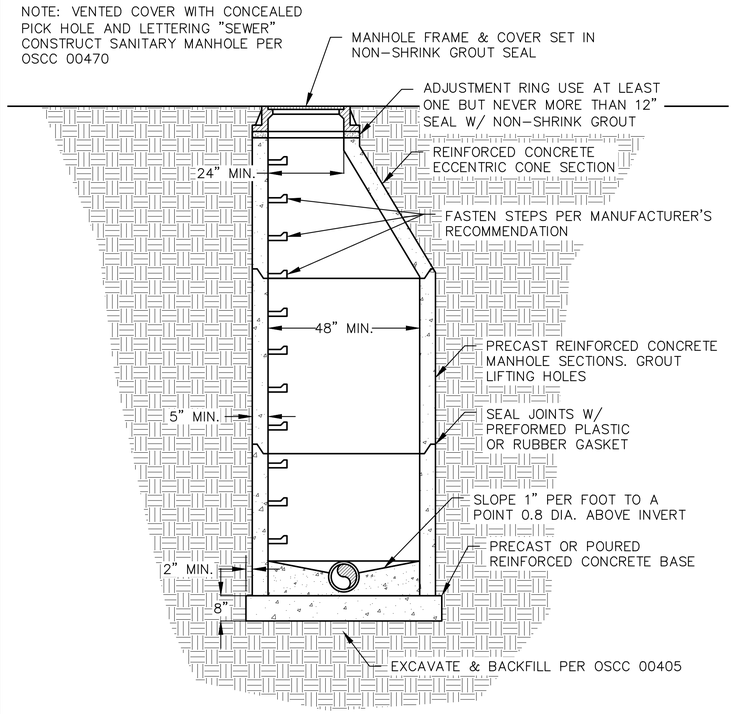
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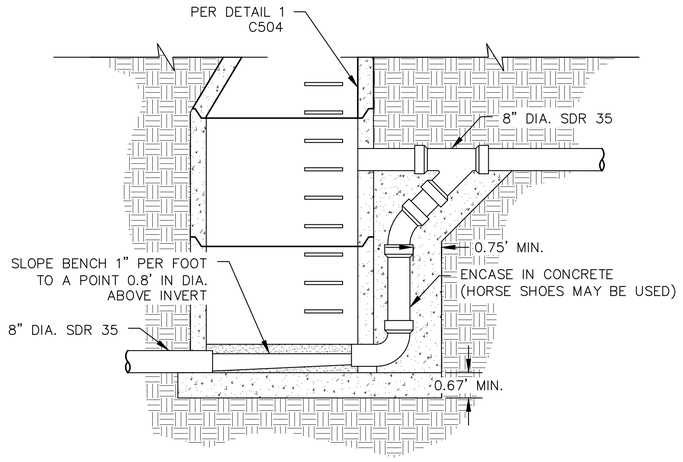
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CHECKED:	JT

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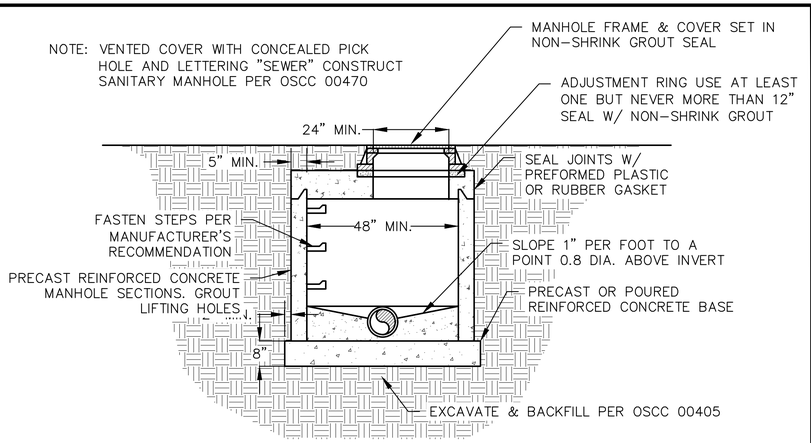
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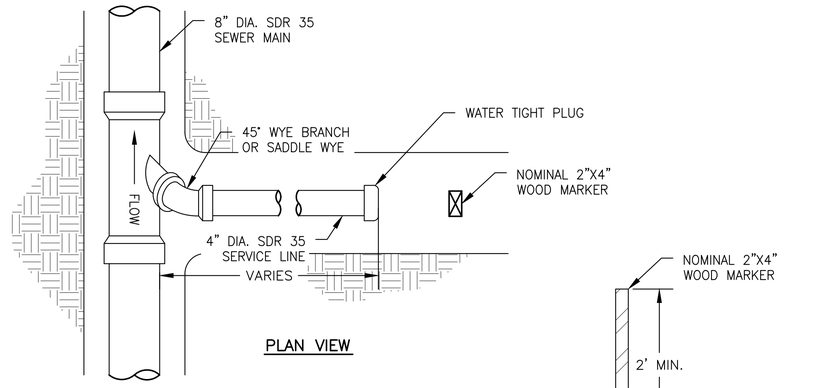
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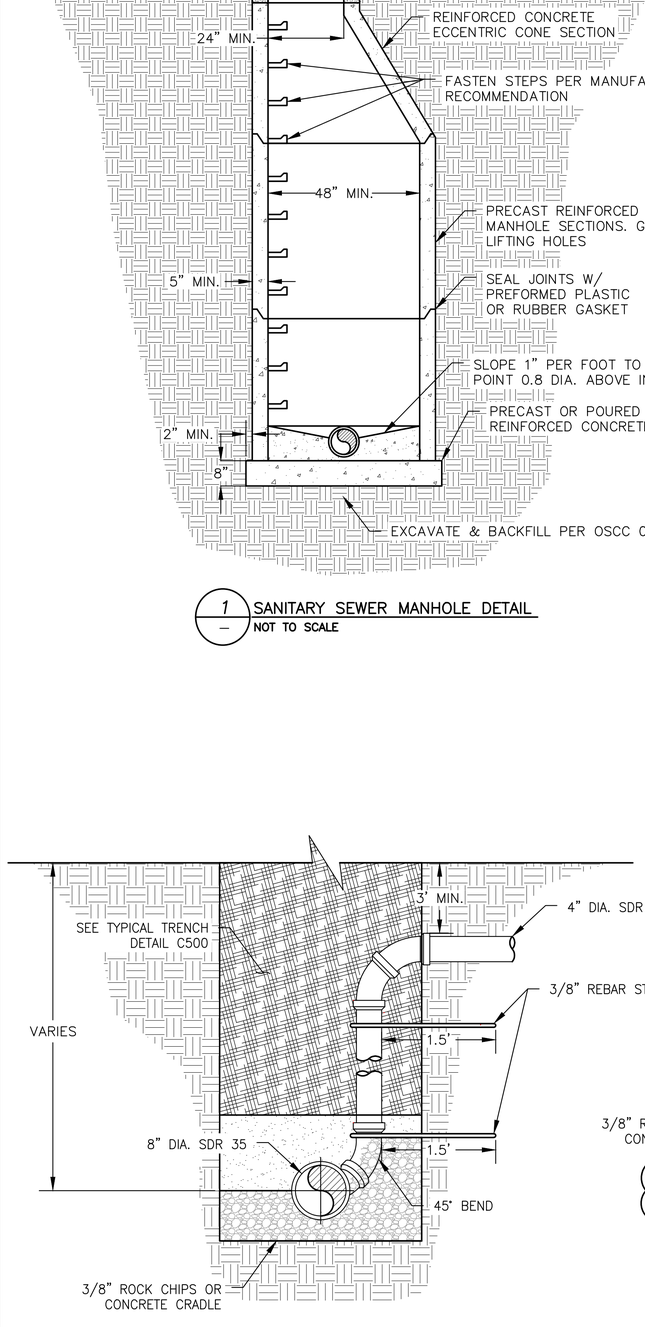
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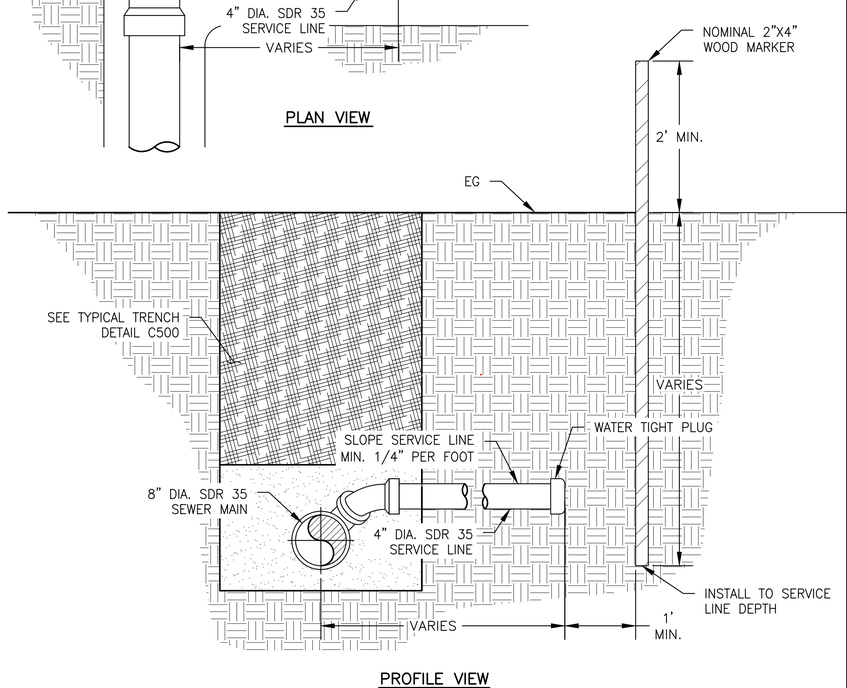
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PLAN VIEW



4 — SANITARY SEWER RISER DETAIL
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PROFILE VIEW

5 — SANITARY SEWER SERVICE DETAIL
NOT TO SCALE

SPF WATER ENGINEERING
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Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156

PARAMOUNT GOLD NEVADA CORP.
GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

SANITARY SEWER DETAILS

REGISTERED PROFESSIONAL ENGINEER
MATTHEW W. RASMUSSON
MAR. 13, 2019
OREGON
RENEWS: 12/31/2020

ITEM	DESCRIPTION	DATE
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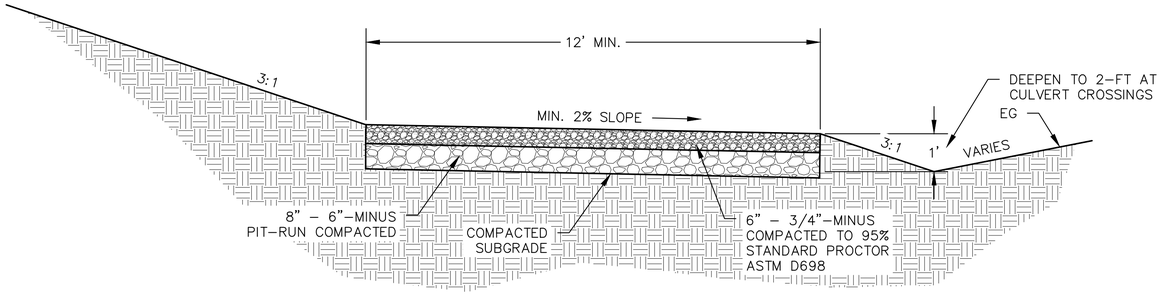
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DESIGNED:	EH/SM/JL
DRAWN:	JL/SM/KN
CHECKED:	JT

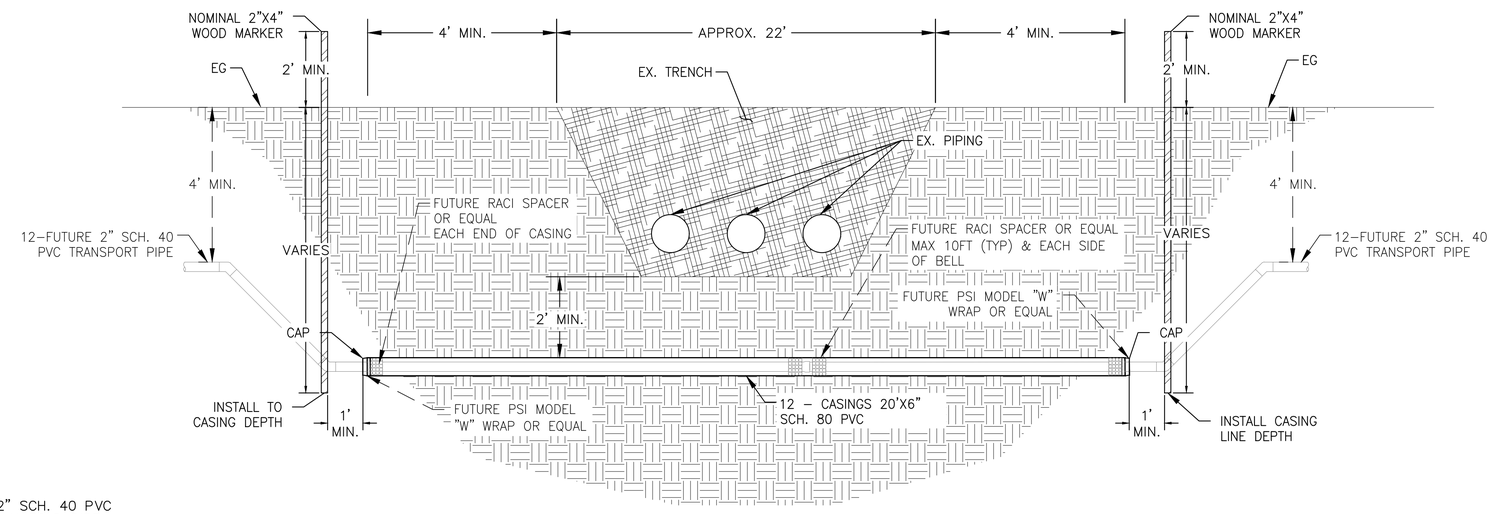
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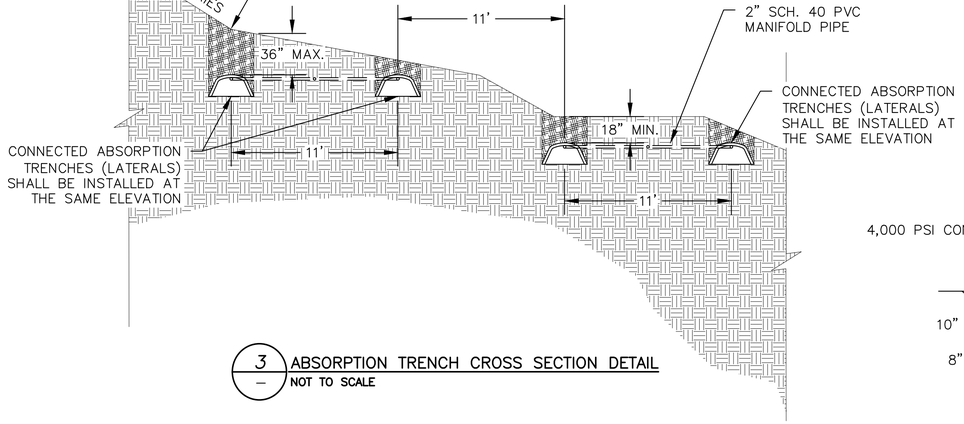


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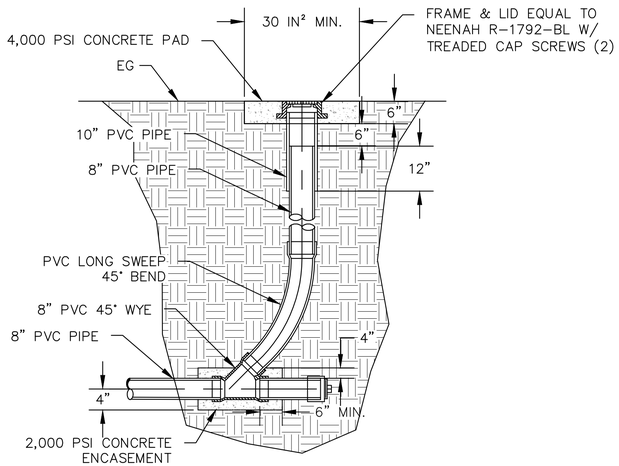
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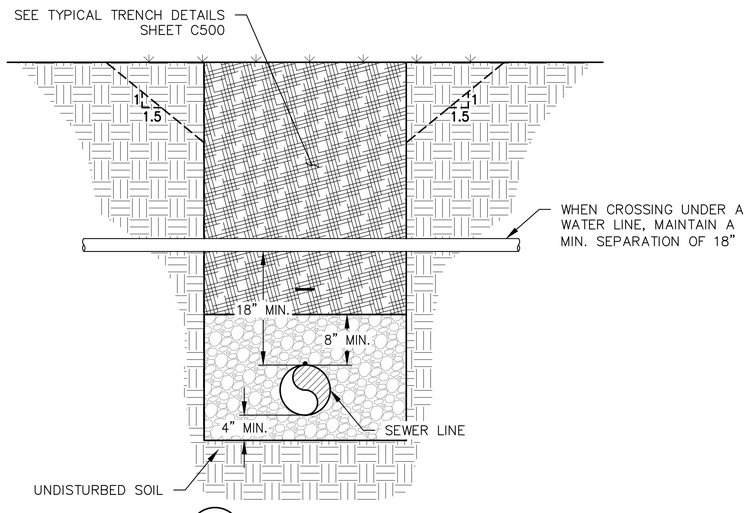
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NOT TO SCALE



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NOT TO SCALE



5 — SEWER/WATER LINE CROSSING TYP. DETAIL
NOT TO SCALE

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GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

TYP. ROAD AND SEWER DETAILS

REGISTERED PROFESSIONAL ENGINEER
OREGON
MAR. 13, 2015
MATTHEW W. RASMUSSON
8/22/2019
RENEWS: 12/31/2020

ITEM	DESCRIPTION	DATE
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REVISIONS

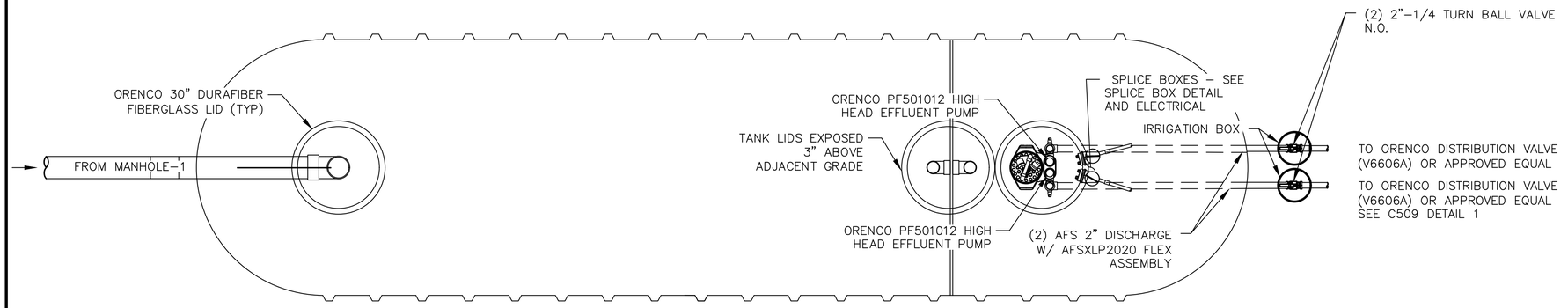
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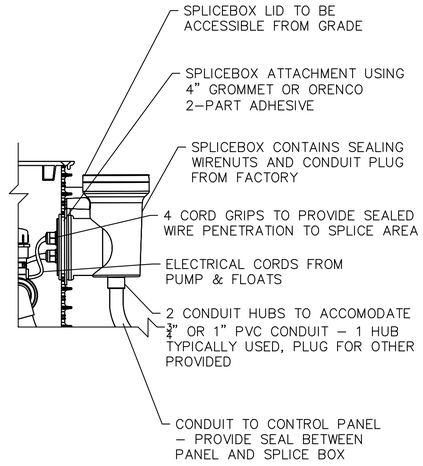
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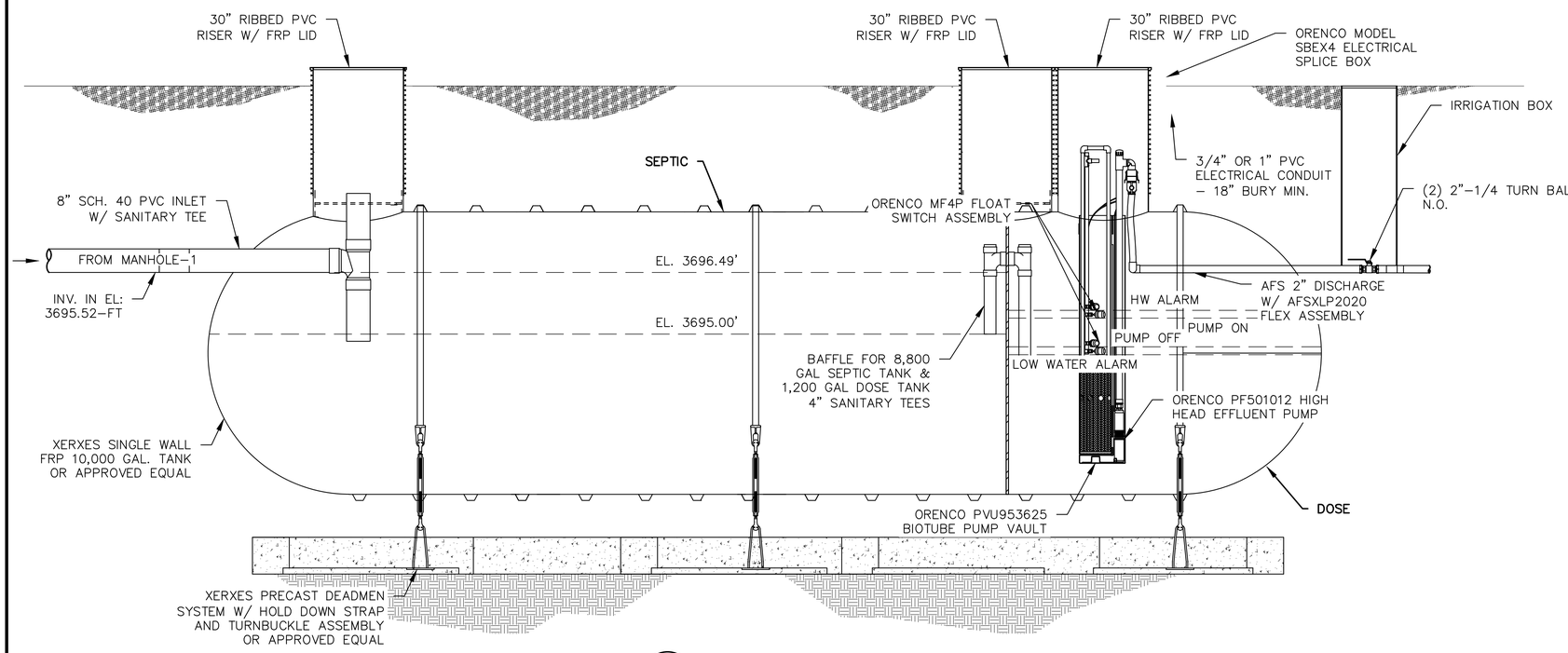
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ALL PRODUCT BRANDS THIS SHEET ARE "OR APPROVED EQUAL" ITEMS.
CONTRACTOR TO PROVIDE SUBMITTALS.



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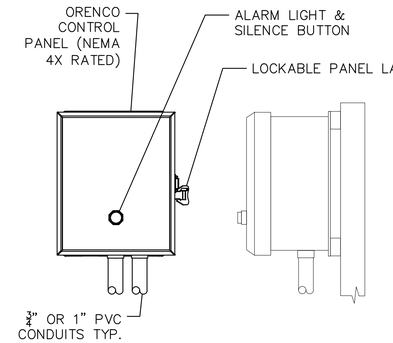
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PANEL MOUNTING REQUIREMENTS

- PANEL SHALL BE MOUNTED ON 4X4 WOODEN POST IN LOCATION SHOWN PER SHEET C2 AND ELECTRICAL
- PANEL DIMENSIONS: DAXMVP PANELS: 9.5" HIGH X 7.3" WIDE X 5.4" DEEP



4 — MVPDAX2 DM CONTROL PANEL
NOT TO SCALE

SPF WATER ENGINEERING
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Tel (208) 383-4140 Fax (208) 383-4156

GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

SEPTIC TANK DETAILS

REGISTERED PROFESSIONAL ENGINEER
MATTHEW W. RASMUSSON
OREGON
MAR 13, 2019
RENEWS: 12/31/2020

ITEM	DESCRIPTION	DATE
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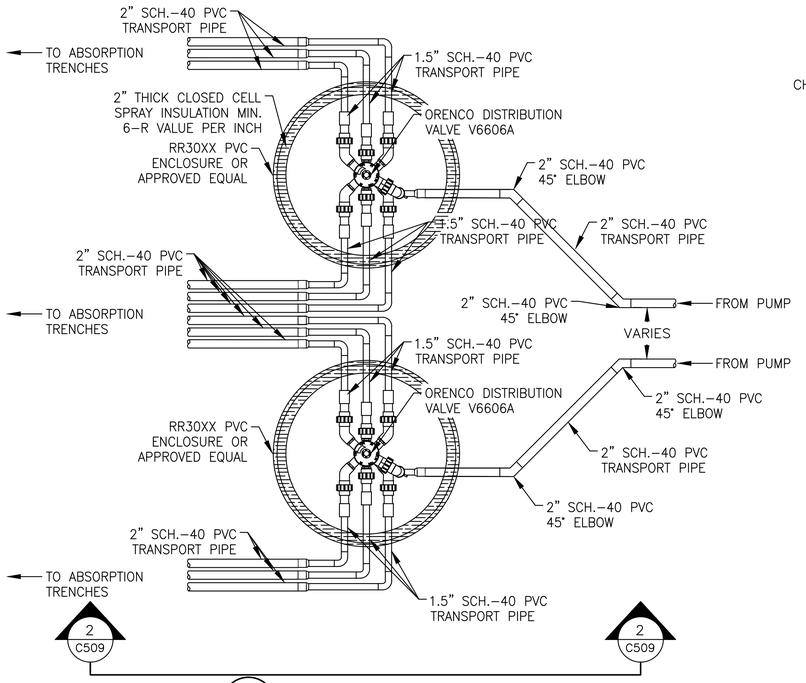
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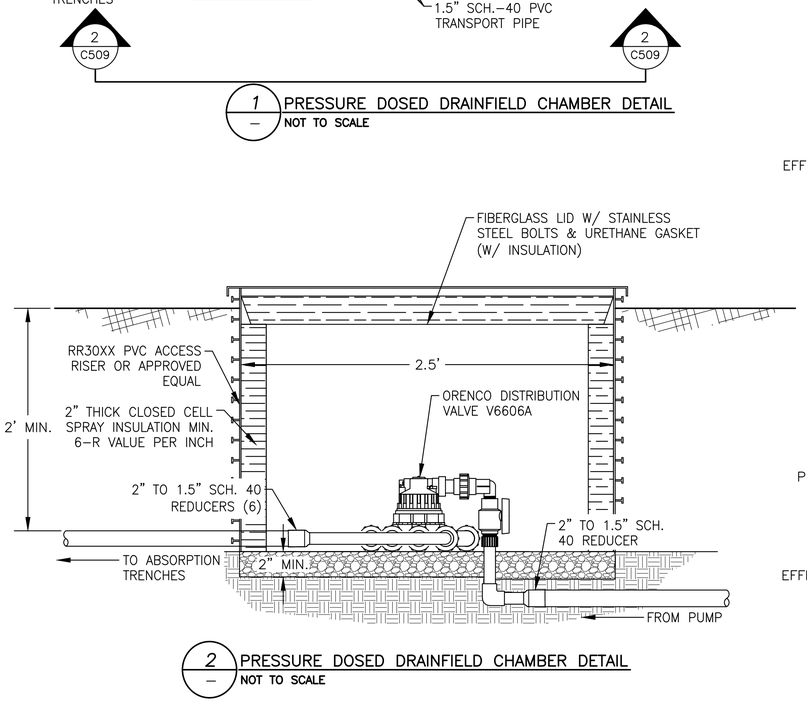
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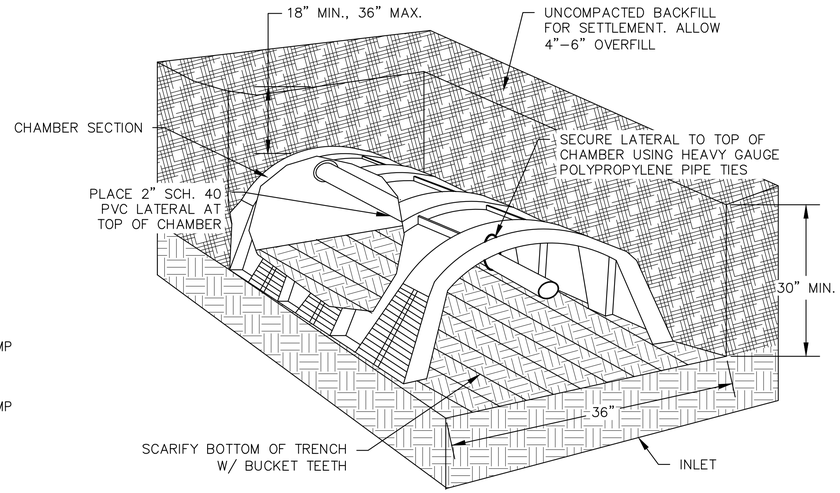
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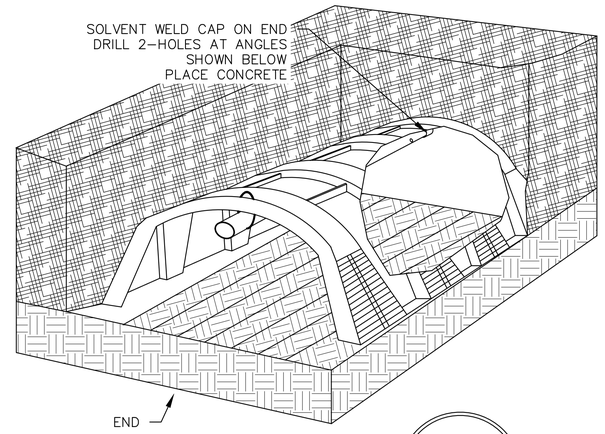
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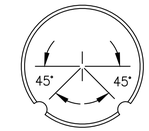


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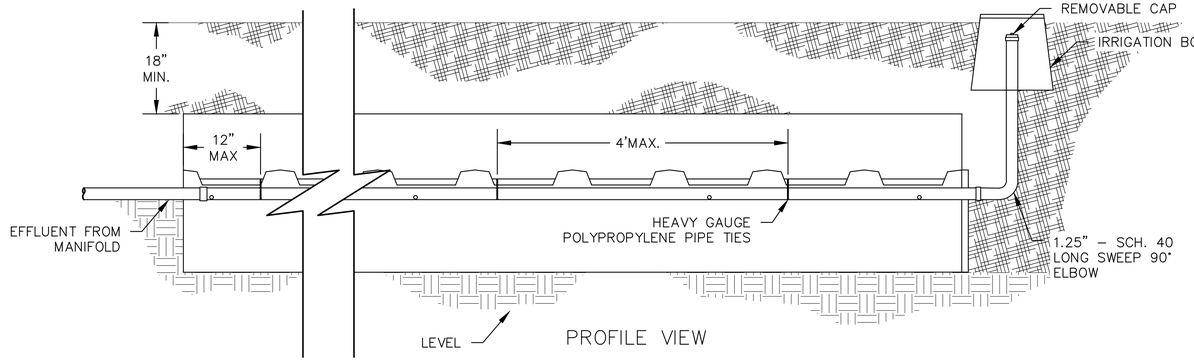


ISOMETRIC VIEW



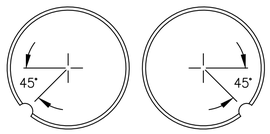


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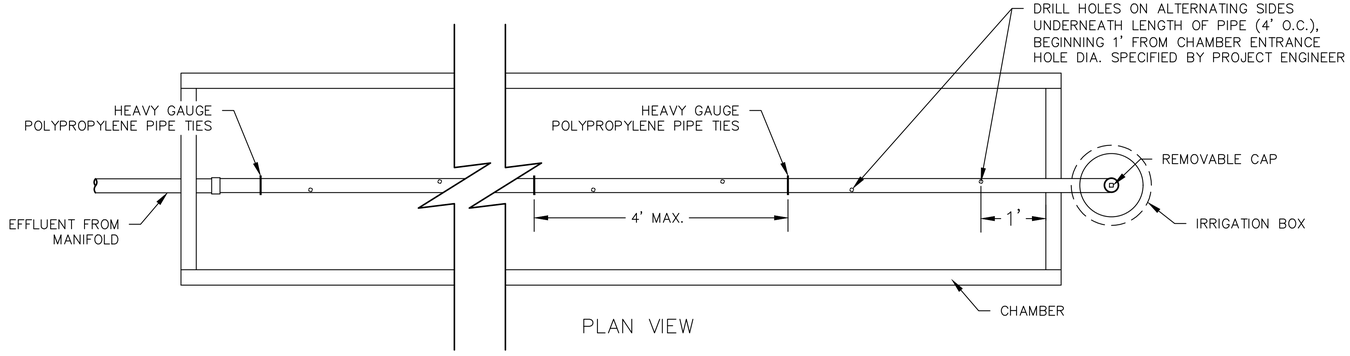


PROFILE VIEW

NOTE: ALTERNATE DIRECTION OF PERFORATION EVERY 4-FT



PERFORATIONS ALONG 2" SCH. 40 PVC PIPE



PLAN VIEW

3 — PRESSURE DOSED DRAINFIELD CHAMBER DETAIL
NOT TO SCALE

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GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

ABSORPTION TRENCH AND CHAMBER DETAILS

REGISTERED PROFESSIONAL ENGINEER
20170??
8/22/2019
OREGON
MAR 13, 2019
MATTHEW W. RASMUSSON
RENEWS: 12/31/2020

ITEM	DESCRIPTION	DATE
0	FINAL PERMIT SET	8/22/19

REVISIONS

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DESIGNED:	EH/SM/JL
DRAWN:	JL/SM/KN
CHECKED:	JT

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Appendix B
Site Evaluation Report

Matt Rasmusson

From: BROWN Larry <Larry.BROWN@state.or.us>
Sent: Thursday, May 16, 2019 9:19 AM
To: Matt Rasmusson
Cc: GEDDES Craig; Jason Thompson
Subject: Calico/Grassy Mountain Site Evaluation for Onsite sewage treatment and disposal

Follow Up Flag: Follow up
Flag Status: Flagged

Good Morning Matt:

The purpose of the site evaluation was to locate suitable soils in an area that is large enough for both the initial drainfield area and the replacement drainfield area. The criteria used for this site evaluation can be found in Oregon Administrative Rules (OAR) 340-071. Soil test pits and other site features were evaluated during the site visit. In the site inspection, the following features were evaluated:

- Soil types - how well they drain and other evidence of good soil structure for treatment
- Depth to groundwater or if groundwater is present.
- Slopes, escarpments, ground surface variations, topography
- Creeks or springs on the site or adjacent properties
- Whether the soils have been disturbed
- Setbacks from property lines, buildings, water lines, and other utilities
- Other site features that could affect the placement of the on-site septic system.

I have reviewed the site evaluation soil notes from Malheur County and discussed the findings with Craig Geddes. The majority of soils at this site include Class C soils which normally require a minimum of 125 linear feet of disposal trench per 150 gpd flow based on the soil depth observed. If pretreatment is utilized then 50 linear feet of disposal trench per 150 gpd flow would be required. With 10% slopes one would normally need to install a septic system as serial distribution. However, considering the flows and with large systems requiring pressurization, I am requiring equal distribution via a hydrosplitter; 18 to 24 inch trench depths. The 24 inch trench depth limitation is a conservative action due to the presence of a durapan observed at this site. Both areas A and B are approved. Do not extend drainlines past the large sage plant vegetation areas.

This system must be installed under dry soil conditions to reduce smearing. If smearing occurs, the sidewalls are to be raked. The site of disturbance must be reseeded. New vegetative growth (root development) will aid in any compaction/smearing created during the installation process. Both the initial and replacement disposal areas are to be protected from traffic, cover, development or other potential disturbance of natural soil conditions. Any road cuts downslope of the system will require 25 to 50 foot setback between the road cut to the lowest drainline. The area must not be subjected to excessive saturation due to; but not limited to: artificial drainage of ground surfaces, roads, driveways and building down spouts. Placement of a well within 100 feet of the approved areas invalidate this approval. Additionally, any alteration of natural soil conditions (i.e. cutting or filling) in the acceptable area may void this approval as well.

With predicted peak flows of 4,320 gpd, a standard system would require 3,600 linear feet of disposal trench for the initial system, 3,600 linear feet for the repair. In either situation pretreatment could be utilized thus reducing the linear footage requirement to 1,440 linear feet. Large system rules apply as stipulated in OAR 340-071-0520.

Now we need to wait until the written assessment concerning the impact of the proposed system on the quality of public waters and public health is conducted; and accepted and approved by DEQ before finalizing the sewage treatment and disposal septic system requirements.

If you have any questions, please contact me.

Sincerely,

Lawrence (Larry) Brown REHS
Environmental Health Specialist
DEQ Eastern Region - Water Quality Land Application
475 NE Bellevue Drive - Suite 110
Bend, OR 97701
Phone: (541) 633-2025
Fax: (541) 388-8283

Appendix C
Water Quality Impact Assessment

Grassy Mountain Gold Project
Wastewater Facilities

Water Quality Impact Assessment

Prepared for

Calico Resources USA Corp
665 Anderson Street
Winnemucca, Nevada 89445

Prepared by

SPF Water Engineering, LLC
300 East Mallard, Suite 350
Boise, Idaho 83706
(208) 383-4140

August 13, 2019



exp 5/1/20

SPF WATER ENGINEERING

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1. INTRODUCTION

SPF Water Engineering, LLC (SPF) has prepared a Level 1 nitrate balance evaluation to assess impacts to groundwater quality in support of a proposed wastewater treatment system at the Grassy Mountain Mine Project (Project). A large soil absorption system (LSAS) is proposed for treating 3,920 gallons per day (gpd) of domestic wastewater in Malheur County, Oregon. The Oregon Department of Environmental Quality (ODEQ) requested SPF use the Washington State Department of Health (WDOH) Level 1 nitrate balance spreadsheet for large on-site sewage system (LOSS).

This report presents background (Section 2), field investigation (Section 3), model parameters (Section 4), model results (Section 5), conclusions and recommendations (Section 6), and references (Section 7).

2. BACKGROUND

2.1. Permit Area

The Project is located in Malheur County, Oregon, approximately 22 miles south-southwest of Vale (Figure 1) and consists of two areas: The Mine and Process Area and the Access Road Area (Permit Area) (Figure 2).

The Mine and Process Area is located on three patented lode mining claims and unpatented lode mining claims that cover an estimated 886 acres. These patented and unpatented lode mining claims are part of a larger land position that includes 419 unpatented lode mining claims and nine mill site claims on lands administered by the Bureau of Land Management (BLM) (Figure 2). All proposed mining would occur on the patented claims, with some mine facilities on unpatented claims. The Mine and Process Area is in all or portions of Sections 5 through 8, Township 22 South, Range 44 East (T22S, R44E) (Willamette Meridian).

The Access Road Area is located on public land administered by the BLM, and private land controlled by others (Figure 2). A portion of the Access Road Area is a Malheur County road named Twin Springs Road. The Access Road Area extends north from the Mine and Process Area to Russell Road, a paved Malheur County road. The Access Road Area is in portions of Section 5, T22S, R44E, Sections 3, 10, 11, 14, 15, 21 through 23, 28, 29, and 32, T21S, R44E, Sections 1, 12 through 14, 23, 26, 27, and 34, T20S, R44E, Sections 6 and 7, T20S, R45E, and Sections 22, 23, 26, 35, and 36, T19S, R44E (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline) to accommodate possible minor widening or rerouting, and a potential powerline adjacent to the access road. There are several areas shown that are significantly wider than 300 feet on the Permit Area Map (Figure 2), which are areas where the final alignment has not yet been determined. The final engineering of the road will be consistent throughout, and within the Permit Area. The Access Road Area also includes a buffer on either side of the proposed road width for the collection of environmental baseline data. The road corridor will be approximately 30 feet wide, which includes a 20-foot wide road travel width (10 feet on either side of the road

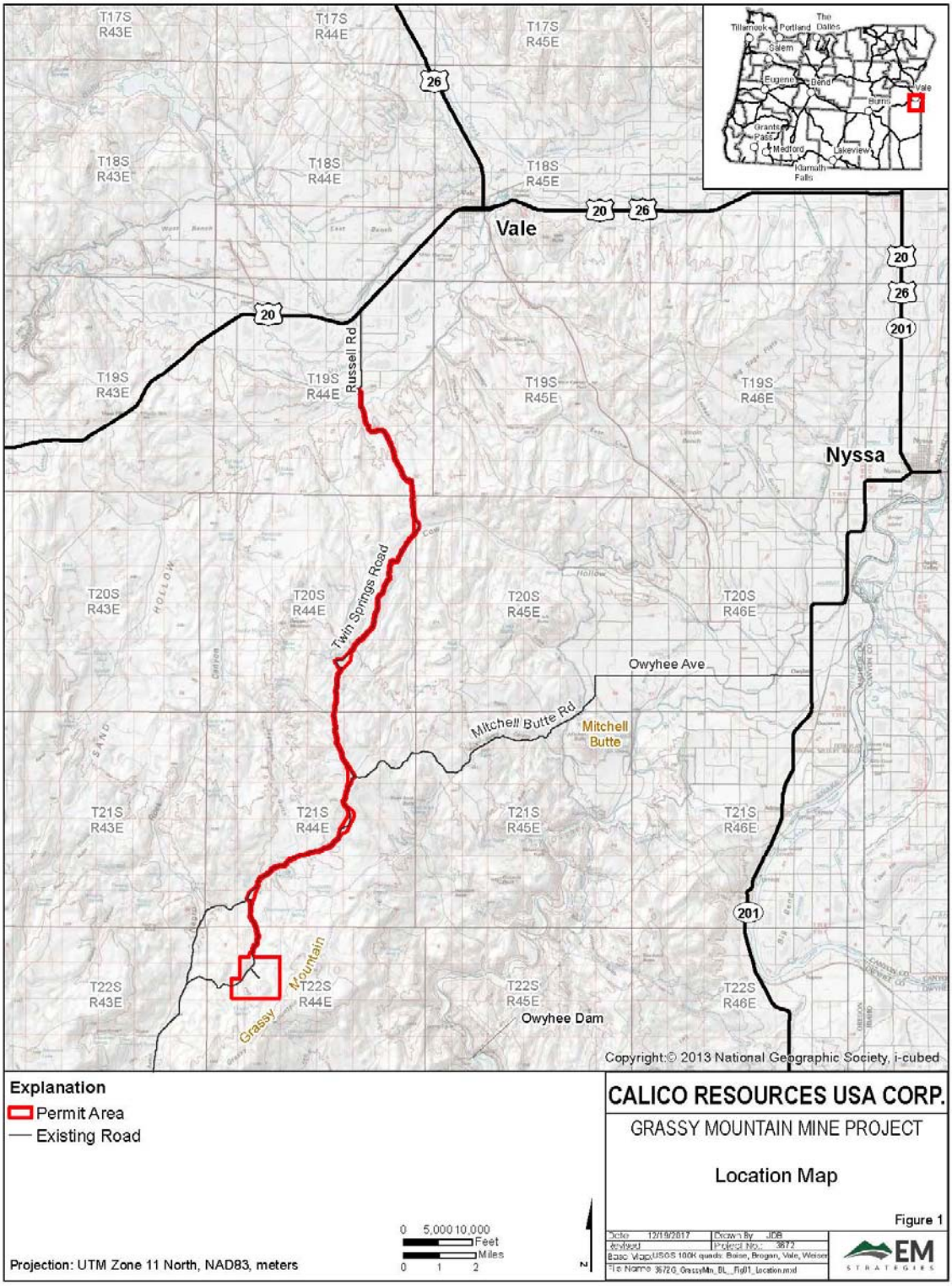


Figure 1. Project Location

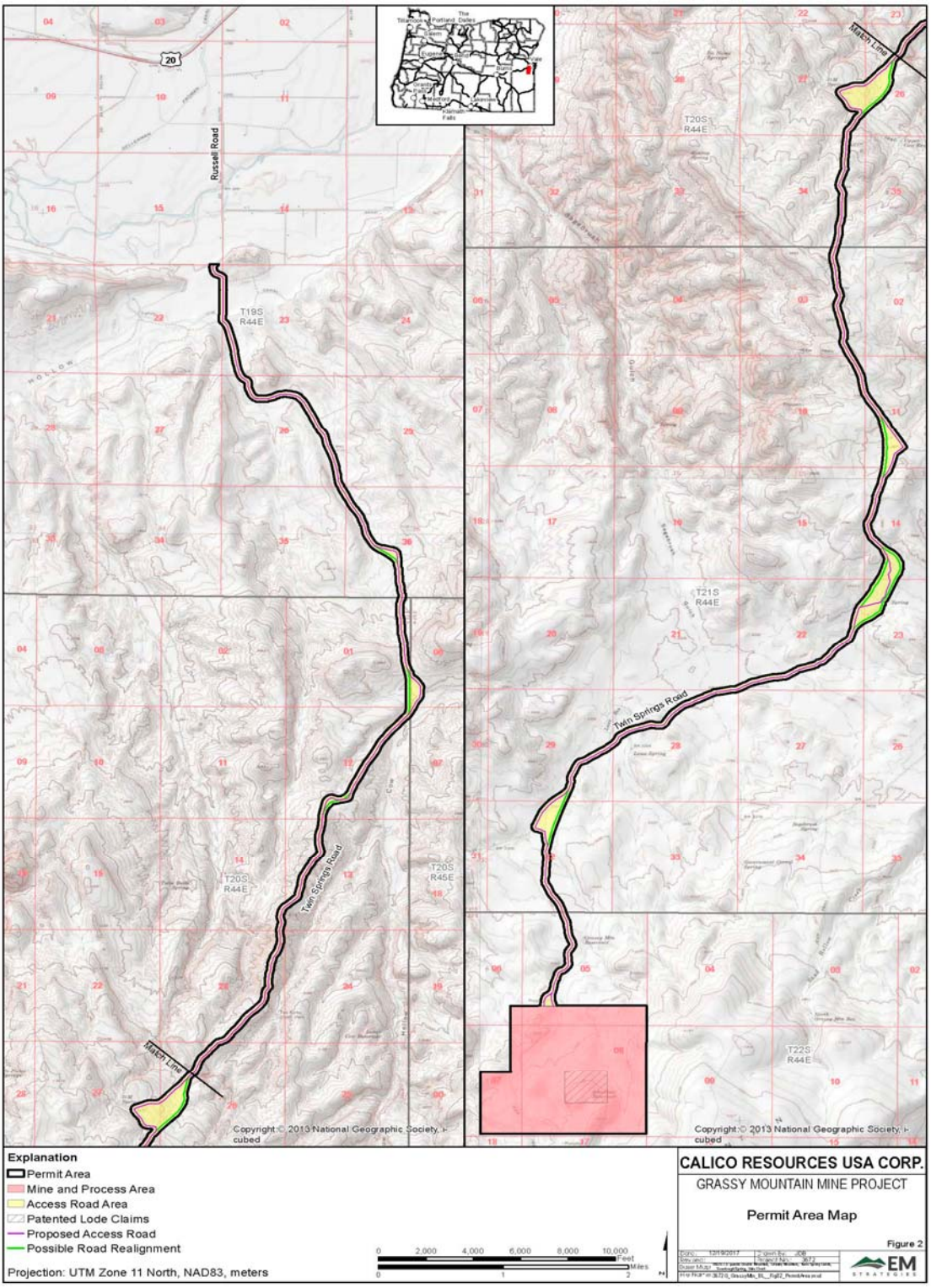


Figure 2. Permit Area

centerline), two-foot wide shoulders on each side of the road, minimum one-foot wide ditches on each side of the road, and appropriate cut and fill. The Access Road Area totals approximately 876 acres.

2.2. **Anticipated Wastewater Characteristics**

The daily average domestic wastewater design flow is estimated to be 3,920 gpd. This value assumes 112 workers at the mine per day and an average day potable water demand of 35 gpd (based on OAR 340-071-0220 for factories with shower facilities). The plant and mine offices and associated change houses are expected to include showers, wash basins, and toilets. There will not be on-site laundry facilities.

The effluent entering the LSAS will consist of typical residential strength sewage from workers at the mine site. The total nitrogen concentration of the septic tank effluent is assumed to be 60 mg/L, the default value used for the WDOH Level 1 nitrate balance spreadsheet.

The LSAS will also receive backwash water from the potable water treatment system backflush. The total daily design flow for the LSAS including water treatment backwash water is 4,320 gpd. For the nitrate balance study, the daily average domestic wastewater design flow of 3,920 gpd was used; the arsenic backwash water will not contain nitrate levels above the background groundwater concentration. Currently, one (1) drainfield is proposed, with a replacement area (Figure 3). The drainfield is sized based on a dosing rate of 0.4 gallons per square foot per day for type C soils.

2.3. **Vicinity Overview**

The LSAS will be located within the Permit Area on lands administered by BLM. For the purposes of the Level 1 nitrate balance evaluation, the point of compliance for evaluating water quality impacts from the LSAS is the Permit Area boundary, as shown on Figure 3. This point of compliance is considered conservative; there are currently no known downgradient receptors (non-Project) within at least ten miles of the proposed LSAS. The nearest Project water supply well is PW-4, located about 2 miles north of the proposed LSAS. A map of the site layout, as well as measurements done in ESRI ArcMap for the nitrate balance evaluation parameters, is also included in Figure 3.

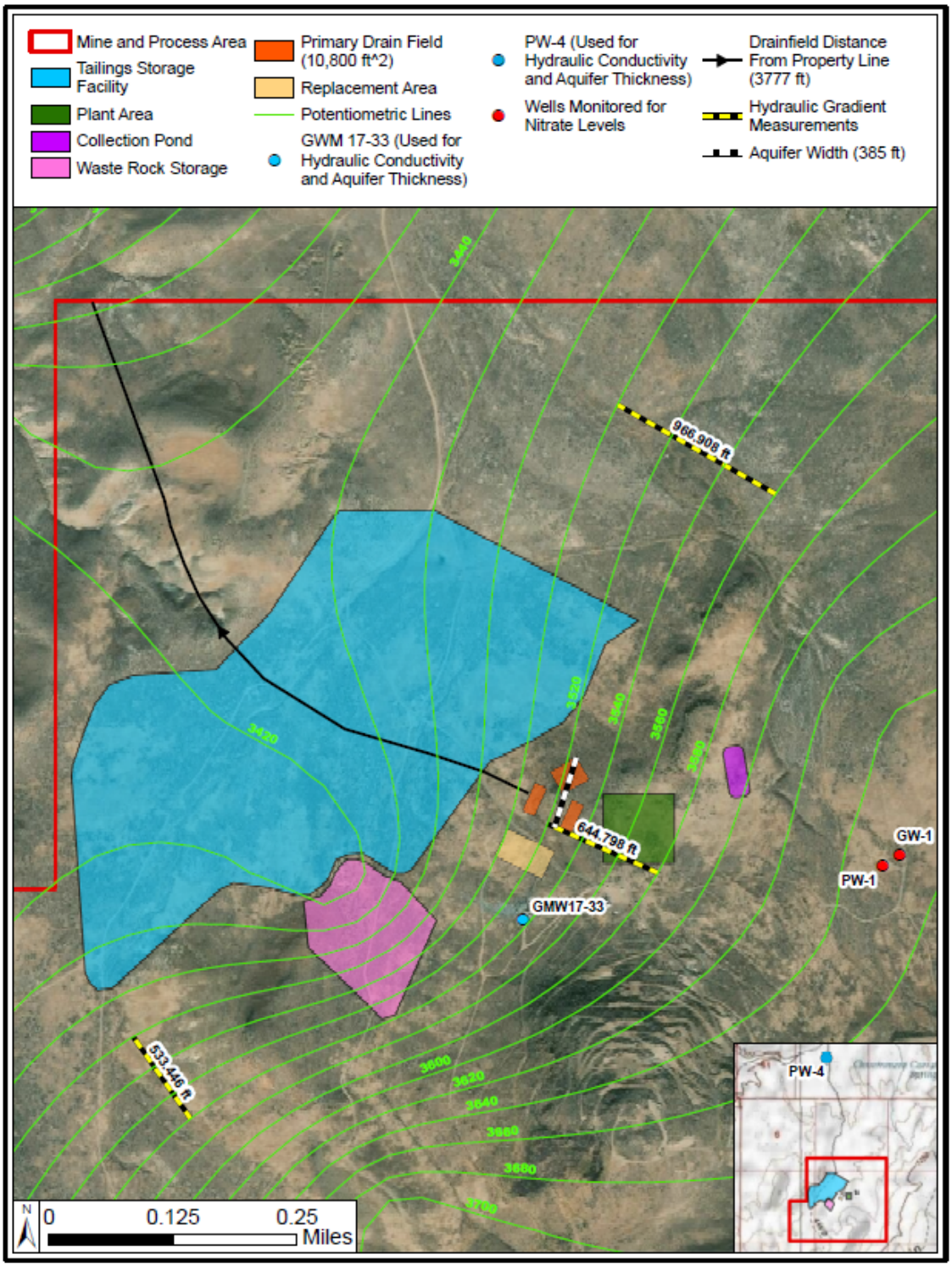


Figure 3. Grassy Mountain Site Plan and Nitrate Balance Study Parameters

2.3.1. Topography

The drainfield site is on a north-northwest facing slope. The percent slope is approximately 12%. Approximately 1,000 feet northwest of the northwestern boundary of the proposed drainfield there is a draw that slopes to the north. This draw will be filled in by a tailings storage facility. The bottom of the draw is approximately 160 feet lower in elevation than the proposed drainfield. The elevation of the proposed septic drainfield varies from 3,655 to 3,697 feet above mean sea level.

2.3.2. Climate

The total annual precipitation for the area is approximately 10 inches, mostly as snow during winter, with higher precipitation amounts between November and June at around one inch each month (refer to Table 1). Between July and October, precipitation is about half of the winter and spring months.

Table 1. Owyhee Dam Mean Precipitation (WRRC, 2017)

OWYHEE DAM, OREGON													
NCDC 1981-2010 Monthly Normals	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Precipitation (in.)	0.92	0.76	0.89	0.96	1.16	0.92	0.43	0.38	0.45	0.64	0.92	1.25	9.68

2.3.3. Surface Water Characterization

The closet surface water is an ephemeral stream approximately 1,300 feet to the northwest of the proposed drainfield. This ephemeral stream flows into Negro Rock Canyon Creek which eventually flows into the Malheur River approximately 16 miles north of the site. Due to distance to the nearby surface water and ephemeral characteristics, it is assumed that the drainfield will not have any negative effects on surface water.

2.4. Hydrogeologic Setting

Groundwater in the general vicinity of the proposed mine site is found primarily within unconsolidated and semi-consolidated sandstone and conglomerate units of the Grassy Mountain Formation. The Grassy Mountain Formation generally strikes from east to west and dips towards the north. Discontinuous lenses of higher permeability sandstone and conglomerate form localized and compartmentalized water-bearing units that are interbedded with thick layers of low-permeability clay and clayey siltstone that impede groundwater flow. These sedimentary rocks are locally capped by basalt, alluvium and colluvium. The Grassy Mountain Formation is underlain by a fine-grained lithic tuff, the Tuff of Kern Basin. The Grassy Mountain Formation is the host unit for the Grassy Mountain gold and silver deposit. A more detailed description of principal hydrogeological units can be found in the Grassy Mountain Gold Project Groundwater Characterization Report (SPF 2019b).

The aquifer system in the near vicinity of the proposed mine (except for the non-silicified area GMW17-33 is completed in) is typically found in silicified sediments or clay with very low

hydraulic conductivity and high hydraulic gradients. Production and monitoring wells near the deposit completed in unconsolidated sediments and fractured basalt typically have short-term yields of less than 50 gpm. Long-term aquifer sustainability appears to be restricted by negative hydraulic boundaries caused by faulting or silicification which limits the spatial extent of water-bearing zones. Wells near the deposit completed in clay or silicified sediments have very low yields, generally less than 5 gpm.

The aquifer system to the north/northwest downgradient of the proposed mine occurs in localized sandstone and conglomerate units of the Grassy Mountain Formation. These units are interbedded with thick layers of low-permeability clay and clayey siltstone, which appear to result in a confined aquifer. The Grassy Mountain Formation is underlain by fine-grained lithic tuff. The aquifer hydraulic conductivity increases downgradient of the proposed mine where the sediments are not silicified. However, aquifer sustainability appears to be still affected by faulting and lithologic variability, with limited data suggesting that the Grassy Mountain Formation thins out moving north from the deposit.

2.5. Local Hydrogeology

The location of the proposed drainfield is north of the mine and approximately 200 feet west and northwest of monitoring wells 59762 and GMW17-31 (driller's well reports and geologist lithology are provided in Appendix C). The geologist lithology log from GMW17-31 shows overburden for the top 8 feet, interbedded sandstone, siltstone, clay, and conglomerate from 8 to 60 feet, clay from 60 to 147 feet, then interbedded arkose, sandstone, siltstone, clay, and tuff from 147 to the bottom at 520 feet. The lithology noted traces of silicification 41 to 60 feet and 92 to 107 feet and indicated the majority of the bore was silicified from 147 feet to the bottom of the bore. Once completed with a screened interval of 458 to 498 feet, GMW17-31 had no measurable water in the well. Since construction, water has seeped into the well to an elevation of approximately 3,222 feet above mean sea level, roughly 500 feet below ground.

Near the proposed Grassy Mountain mine, due to the nature of the silicification and compartmentalization of the aquifer due to faulting, there tends to be deeper water levels. Downgradient of the proposed drainfield, the degree of silicification and faulting tends to decrease. It is expected the effluent from the drainfield will initially migrate downward until reaching less permeable siltstones, clays, or silicified sediments which will cause horizontal movement in the downgradient and down dip (northwest) direction. Once the effluent reaches the water table, estimated to be 3,450 feet above mean sea level, it will travel downgradient in the northwest direction flowing into the areas with less silicification. The water table is expected to be approximately 100 to 200 feet below ground surface in the vicinity of the drainfield.

A list of wells, locations, construction details, measurement protocols, water level data, and hydrographs are presented in the groundwater baseline report (SPF, 2019a). Well construction details are summarized in Table 2. The location of all the monitoring wells is shown on Figure 4.

Table 2. Well Construction Table

Calico Well ID	OWRD Well Tag Number	OWRD Name	Alternate Name	Drill Method	Depth of First Water (ft)	Well Const. Depth (ft)	Screened Interval (ft)	Well Casing Diameter (in)	TOC Elevation[4]	Elevation Screened Interval (ft)	Water Level Elevation (9/26/2018)	Production (gpm)[2]	Screened Lithology[1]
59760	107462	MALH 2974	Middle Sweizer, TW-1	air rotary	160	203	163-203	6	3762.1	3599-3559	3673.43	+10	fractured basalt
59761	109400	MALH 2993	Lower Sweizer, MW-2	air rotary	100	118	97-117	4	3762.2	3665-3645	3673.48	+50	fractured basalt
59762	109371	MALH 2976, 2985	MW-3	air rotary	626	700	550-660	4	3724.8	3175-3065	3103.4	<1	siltstone
59763	109356	MALH 2994	TW-4	air rotary	277	323	293-323	6	3519.4	3226-3196	3239.03	+5	fractured volcanics
59764	107466	MALH 2986	MW-5	air rotary	270	300	279-299	4	3511.9	3233-3213	3238.24	+10	fractured sandstone
59765		MALH 2979	MW-6	air rotary	29	36	28-36	4	3446.5	3418-3410	dry	dry	shallow sandstone
59766	107468	MALH 2980	MWS-8	air rotary	only damp when drilled	45	25-45	4	3459.7	3435-3415	3426.68	+10	shallow sandstone
59767		MALH 2995	MWS-9	air rotary	dry	40	20-40	4	3495.3	3475-3455	dry	dry	shallow sandstone
59768		MALH 54197	MWS-10	air rotary	21	25	10-25	4	3480.6	3471-3456	3463.46	0.5	shallow sandstone
59770		MALH 2983	MW-11	air rotary	dry when drilled	424	374-424	4	3389.0	3015-2965	3241.71	+0.5	volcanic tuff
59772	109352	MALH 2984	Upper Sweizer, MWS-13	air rotary	125	207	165-205	4	3768.2	3603-3563	3673.5	+50	fractured basalt
26-092-915	109354	MALH 54071		unknown	unknown	915	228-268	2	3710.0	3482-3442	3633.55	unk	unk
57-1		MALH 54195		unknown	unknown	765	108-138	1.25	3770.6	3663-3633	3699.1	unk	unk
57-10		MALH 54196		unknown	unknown	500	126-156	1	3681.1	3555-3525	3635.67	unk	unk
89-2	109360	MALH 54072		unknown	200	425	386-406	2	3293.5	2907-2887	3235.54	unk	unk
Bishop	None	MALH 54046	Rye Field	cable	unknown	482	135-145	12	3391.5	3257-3247	3281	50	coarse gravel
BLM	109398	MALH 2277	Owyhee Ridge	cable	unknown	175	159-166	6	3579.6	3421-3414	3423.95	+12	white sand
GMW17-31	125168	MALH 54404		air rotary	dry when drilled	498	458-498	5	3722.0	3262-3222	3222.6	0	siltstone, sinter, clay
GMW17-32	125169	MALH 54405		air rotary	244	718	678-718	5	3702.1	3026-2986	3082.1	<1	Arkose, siltstone, Clay
GMW17-33	125170	MALH 54406		air rotary	243	338	238-338	5	3702.7	3465-3365	3452.16	<30	sinter, siltstone, tuff
GMW18-34	130031	MALH 54437		air rotary	dry	950	830-890	5	3953.3	3127-3067	dry	dry	Arkose, siltstone, Clay
GW-1	107469	MALH 2281	47-1	air rotary	140	155.5	135.5-155.5	4	3709.1	3573.5-3553.5	3654.18	60	gravel
GW-2	109357	MALH 2279	47-2	air rotary	dry when drilled	325	290-320	4	3827.5	3537-3507	3662.91	0	blue and grey clay
GW-3	107467	MALH 2278	47-3	air rotary	dry when drilled	350	320-350	4	3633.6	3314-3284	3401.68	<1	blue and grey clay
GW-3A		MALH 2579		air rotary	dry	420	380-420	2	3655	3275-3235	dry	dry	silt and clay
GW-3B		MALH 2576		air rotary	dry	340	80-100	2	3626	3546-3526	dry	dry	clay
GW-4	107460	MALH 54073		unknown	50	370	280-350	4	3342.7	3063-2993	3260.85	100	sandstone, congl, clay
GW-5		MALH 54194		air rotary	unknown	265	204-224	2	3413.0	3209-3189	3221.45	<1	tuff, clay
GW-6	109368	MALH 2578		air rotary	145	340	300-340	2	3377.3	3077-3037	3236.16	3-4	sandstone, congl, clay
Prod 1	107457	MALH 2275, 2511		air rotary	145	425	145-255, 325-355, 380-420	6	3436.4	3291-3181, 3111-3081, 3056-3016	3436.41	30-100[3]	sandstone, blue clay, and hard sandstone
PW-1	109353	MALH 2276		air rotary	320	520	320-340, 400-420	6	3709.1	3389-3369, 3309-3289	3654.66	25-35[3]	brown clay and sand; coarse sandstone
PW-4	109351	MALH 2206		air rotary	280	375	280-300, 340-360	6	3341.4	3061-3041, 3001-2981	3261.39	175-250[3]	sandstone and conglomerate

1 - as reported on the drillers log
2 - based on short-term testing by driller during or following construction
3 - based on long-term test pumping
4 - surveyed with the exception of GW-3A, GW-3, GMW-17-31, GMW17-32, GMW17-33, and GMW18-34

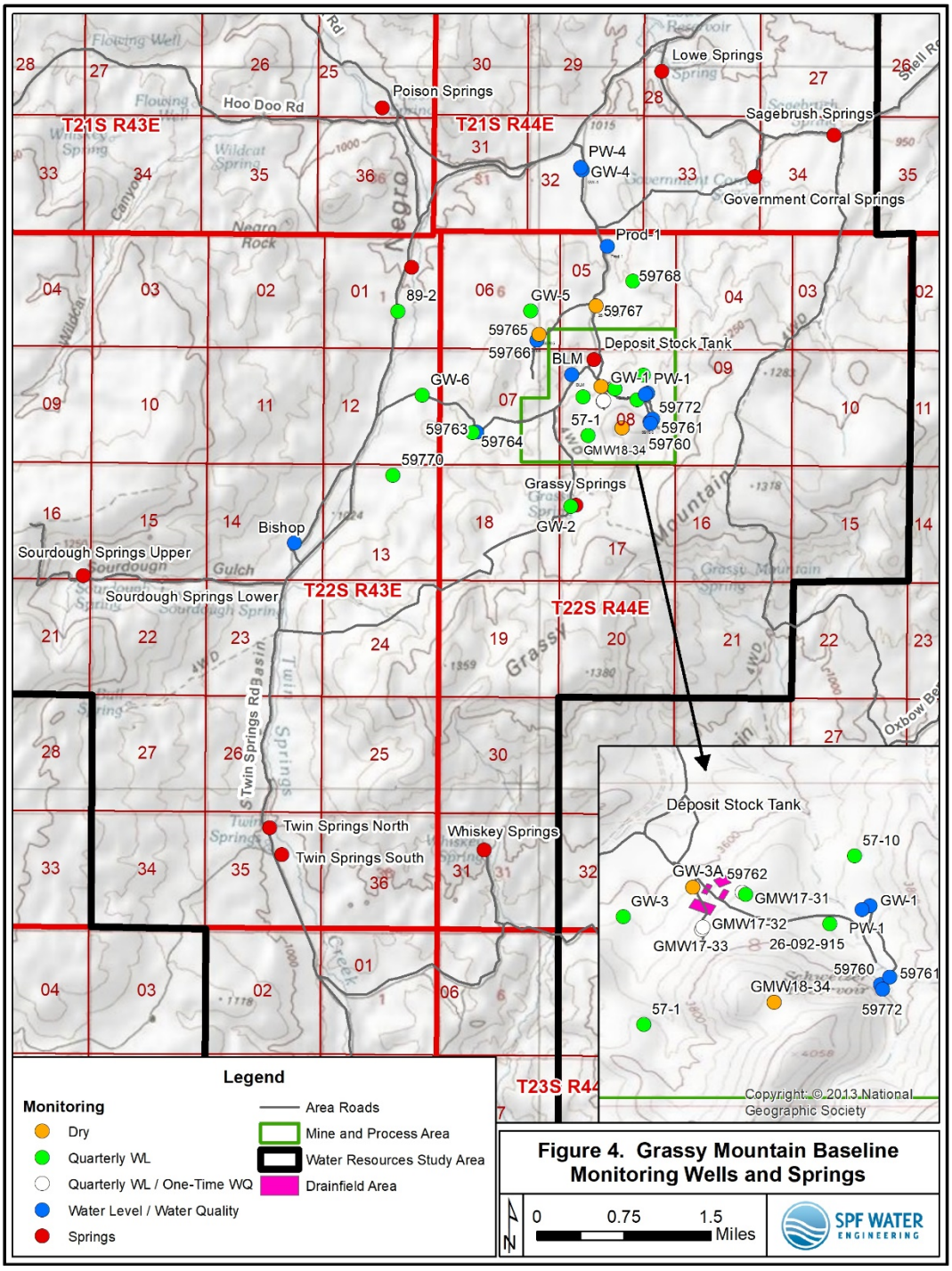


Figure 4. Grassy Mountain Baseline Monitoring Wells and Springs

Figure 4. Grassy Mountain Baseline Monitoring Wells and Springs

3. FIELD INVESTIGATION

Field investigations have consisted of recent shallow soil characterization efforts (test pits), pump testing of GMW17-33 and PW-4, and groundwater sampling in wells PW-1 and GW-1.

3.1. Test Pits

Strata advanced 20 soil test pits on April 22 and 23, 2019. Shallow soil characteristics, including soil type and infiltration capacity, were characterized from these test pits. The test pits were divided into three test areas: A, B, and C. Test Area B is where the primary drainfield is located. Test Area A is where the replacement drainfield is located. Test Area C, located approximately 800 feet to the east, was found to be unsuitable for a drainfield location due to impermeable soils. During test pit excavation, groundwater was not encountered. Three field infiltration rate tests were performed, two in Test Area A and one in Test Area B, with all three soils tested to have an infiltration rate of 9 inches per hour. A report prepared by Strata presenting the information gained from the test pits in provided in Appendix D. Larry Brown, with the Oregon Department of Environmental Quality, has also written a site evaluation email based on the test pits and other site features. This email is provided in Appendix E.

3.2. Aquifer Testing

Aquifer test pumping was completed by SPF on December 18, 2017 at GMW17-33 (SPF 2018a). The early-time transmissivity was found to be 900 square-feet per day (sqft/day).

PW-4 pump testing was completed by SRK on November 28, 1989 and documented in a hydrogeologic report by J.M. Montgomery Consulting Engineers (JMM 1991). The early time transmissivity was found to be approximately 508 square-feet per day (sqft/day).

3.3. Upgradient Nitrate Concentrations

Testing for dissolved nitrate levels was done in 2013 by ACZ Laboratories, Inc. for nearby wells GW-1 and PW-1. The laboratory results are provided in Appendix B. This data was used because they are directly upgradient from the drainfield. The average of the measurements was found to be 1.40 mg/L (Table 3).

Table 3. Dissolved nitrate concentrations for PW-1

Upgradient Nitrate in Ground Water	
Total Dissolved Nitrate (mg/L)	
PW-1	GW-1
0.6	2.25
0.62	2.17
0.62	2.15
Average= 1.40	

4. MODEL PARAMETERS

This section describes Level 1 nitrate balance model input parameters (Table 4 and). The WDOH Level 1 nitrate balance spreadsheet for LOSS was used to estimate the impact of the proposed drainfield on groundwater. The model is steady state and uses an Excel spreadsheet format.

Table 4. Nitrate Balance Model Input Parameter Summary

Input Values	Factor	Units	Values	Instructions	Information Source
Nitrate concentration in precipitation	N_R	mg/l as N	0.24	Default	
Total nitrogen concentration in wastewater	N_W	mg/l	60	Default - residential strength	
Soil denitrification	d	unitless	0.1	Default	
Aquifer thickness	b	ft	100	Default or aquifer thickness if known	Nearby Well Logs
Drainfield area	A_D	ft^2	10,800	Primary drainfield area	From Design Data
Distance from drainfield to property boundary	D_{pb}	ft	3,777	Measure in direction of GW flow	
Aquifer width	W_A	ft	385	Perpendicular to GW flow	
Aquifer hydraulic conductivity	K	ft/day	4.430	Measured or literature value	GMW17-33 and PW-4 Pump Test
Hydraulic gradient	i	ft/ft	0.089	If unknown, use 0.001	Potentiometric Map
Recharge	R	in/yr	0.50	Recharge will be a % of ppt	GW Characterization Report
Nitrate concentration of upgradient ground water	N_B	mg/l	1.4	Prefer sampling data	Upgradient Well Sampling
Wastewater volume	V_W	gpd	3,920	Design flows or measured volume	Wastewater Design

4.1. Hydraulic Characterization

Water budget parameters include hydraulic conductivity, hydraulic gradient, aquifer thickness, aquifer width, and natural recharge terms. These parameters are described in more detail below.

4.1.1. Hydraulic Conductivity

Hydraulic conductivity was estimated from GMW17-33 and PW-4 pumping test data. These wells represent the aquifer characteristics predicted to be encountered by effluent from the proposed drain field. GMW17-33 is located near the proposed mine, but in an area with less silicification (representative of the drain field location). PW-4 is located approximately 1.9 miles to the north, in an area with little silicification and the area where the proposed production wells are located. PW-4 is used because it represents the characteristics of the aquifer that the effluent would migrate through to reach any potable water production wells.

The GMW17-33 transmissivity was calculated to be 6,800 gpd per foot (gpd/ft) using the early-time recovery data and 340 gpd/ft using late-time recovery data (Figure 5). The average of the two values in square feet per day calculates out to 477 square feet per day. The aquifer thickness was estimated to be 100 feet based on the screened sections in the well (Appendix C). The hydraulic conductivity was calculated to be 4.77 ft/day by dividing the calculated transmissivity by the estimated aquifer thickness.

The transmissivity for PW-4 was calculated to be approximately 3,800 gpd/ft using the early-time recovery data and 1,700 gpd/ft using late-time recovery data (Figure 56). The average of the two values in square feet per day calculates out to 367 square feet per day. The aquifer thickness was estimated to be 90 feet based on the screened sections in the well (Appendix C). The hydraulic conductivity was calculated to be 4.08 ft/day by dividing the calculated transmissivity by the estimated aquifer thickness.

The two hydraulic conductivities calculated from the well pumping tests were averaged to get a hydraulic conductivity of 4.43 feet/day. This value is considered to be represent a typical hydraulic conductivity for the aquifer system in the vicinity of the drainfield.

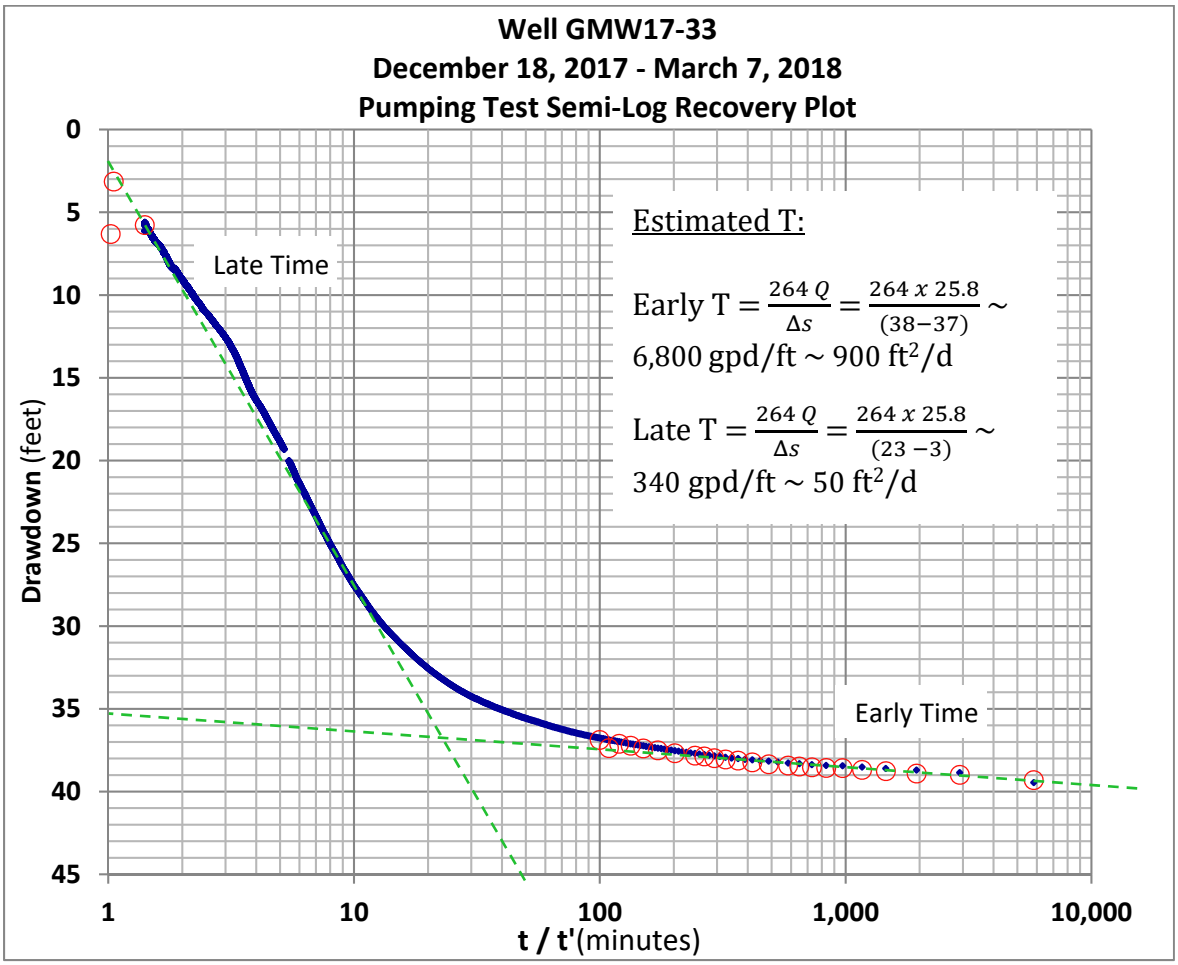


Figure 5. Pumping Test for GMW17-33

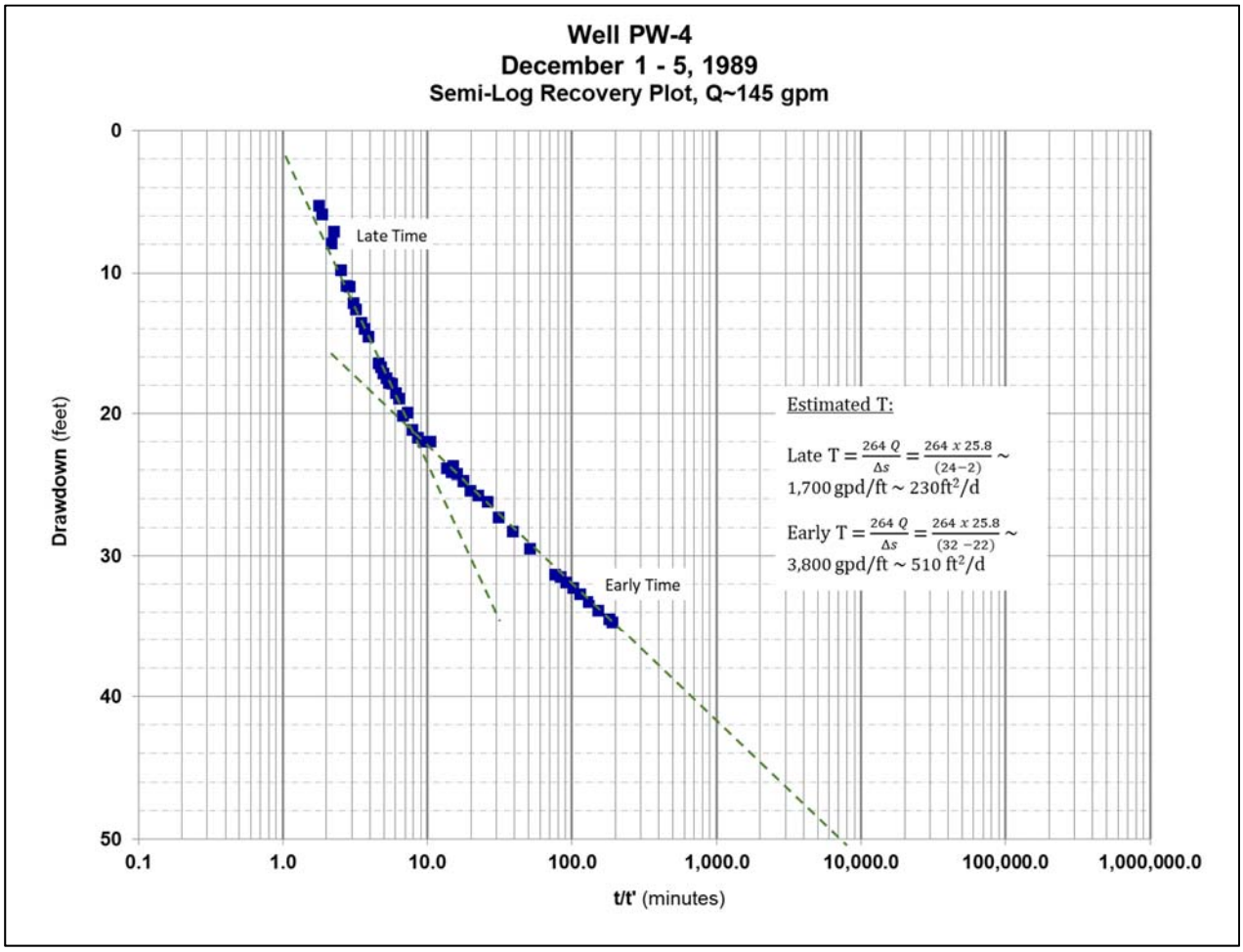


Figure 6. Pumping Test for PW-4

For comparison purposes, the Idaho Department of Environmental Quality's (IDEQ's) Nutrient Pathogen mass-balance spreadsheet provides guidelines for hydraulic conductivity (ft/d) as follows for various unconsolidated sediments:

- Silt and sandy silt (0.003 to 0.3)
- Silty sands and fine sands (0.03 to 3)
- Well-sorted sands and glacial outwash (3-300)
- Well-sorted gravel (30 to 3,000)

The hydraulic conductivities predicted from the two aquifer pumping tests are reflective of the range of literature values for well sorted sands noted above. These values also are consistent

with the literature values for clean sand as well and silty sand according to Freeze and Cherry, 1979 and Bear, 1972 (Table 5).

Table 5. Literature Values for Hydraulic Conductivity

Lithologic Deposit	Freeze and Cherry, 1979		Bear, 1972	
	cm/s	ft/d	cm/s	ft/d
Gravel	10^{-1} - 10^{2}	300 - 300,000	1 - 10^{2}	3,000 - 300,000
Clean sand	10^{-3} - 1	3 - 3,000	10^{-3} - 1	3 - 3,000
Silty sand	10^{-5} - 10^{-1}	0.03 - 300	10^{-7} - 10^{-3}	0.0003 - 3

4.1.2. Hydraulic Gradient

The hydraulic gradient and direction of groundwater flow was determined using the groundwater potentiometric surface map created from the Project monitoring well network (SPF 2019b). Three lines were created perpendicular to the potentiometric lines. The locations were chosen north of the drain field, near the drain field, and south of the drain field to find an average overall hydraulic gradient for the area (Figure 3). The average value is estimated to be 0.089 ft/ft.

4.1.3. Aquifer Thickness

The aquifer thickness was determined from the well logs for GMW17-33 and PW-4 (Appendix C). The screened water-bearing zones were used to estimate aquifer thickness. The shallow sinter, sandstone, and siltstone/clay zones are the portions of the aquifer that the wastewater effluent would be most likely to affect.

4.1.4. Aquifer Width

The aquifer width perpendicular to groundwater flow was estimated based on the direction of groundwater flow determined on the potentiometric map. The aquifer width was found to be 385 ft in ESRI ArcGIS (Figure 3).

4.1.5. Natural Recharge

Annual recharge to groundwater in the vicinity of Grassy Mountain has been estimated in the range of 0.25 to 1 inch based on climatic and topographic conditions (ABC, 1992). These values were supported by ABC's numerical groundwater flow model of Grassy Mountain, with an assigned recharge rate of 0.5 inches per year. For comparison purposes, the IDEQ Nutrient Pathogen mass-balance spreadsheet includes a natural recharge rate calculator using the total annual precipitation (TAP): $(TAP)^2 * 0.0046$). This formula also produces an an annual recharge rate of approximately 0.5 inches per year

4.2. Parcel and Septic System

The Grassy Mountain Mine Permit Area (Figure 2) encompasses approximately 866 acres. The proposed drainfield covers approximately 10,800 ft^2 near the plant area based on a preliminary design rate of 0.4 gpd per square foot of drainfield and a domestic loading rate of 3,920 gpd.

4.3. Nitrogen Budget

The upgradient nitrate concentration in groundwater of 1.40 mg/L was used in the nitrate balance model, as discussed in Section 2.2 above. Model simulated nitrate concentrations at the point of compliance (downgradient boundary) were compared to the background concentration.

Default model values were maintained for the septic tank effluent concentration (60.0 mg/L), soil denitrification (0.1), and nitrate concentration in precipitation (0.24 mg/L).

5. RESULTS

This section provides a summary of the nitrate balance model results and a discussion of the model's sensitivity to certain model inputs.

5.1. Model Results

The nitrate balance model results suggest that average downgradient nitrate concentration in groundwater is not expected to exceed 2 mg/L above the background concentration. For the values considered, the modeled increase above the background concentration was 1.76 mg/L. The Level 1 nitrate balance spreadsheet is provided in Appendix A.

5.2. Sensitivity Assessment

A limited sensitivity assessment was performed for key model parameters including hydraulic conductivity, hydraulic gradient, and aquifer width. The assessment involved increasing and decreasing each model parameter by a factor of 2 and running the model. The results of the sensitivity analysis are presented in Table 6.

Table 6. Sensitivity Assessment Summary for Nitrate Balance Study

Model Parameter	Base Model Value	Adjustment from Base Model	Sensitiviy Value	Increase Above Background Nitrate Concentration
Hydraulic Conductivity (ft/day)	4.43	1/2 decrease	2.22	3.39
		x 2 increase	8.86	0.89
Hydraulic Gradient (ft/ft)	0.089	1/2 decrease	0.045	3.36
		x 2 increase	0.178	0.89
Aquifer Thickness (feet)	100	1/2 decrease	50	3.4
		x 2 increase	200	0.89
Aquifer Width (feet)	385	1/2 decrease	192.5	3.4
		x 2 increase	770	0.89

6. CONCLUSIONS AND RECOMMENDATIONS

The Level 1 nitrate balance evaluation predicts an increase of 1.76 mg/L in the groundwater nitrate concentration downgradient of the Grassy Mountain Mine Permit Area boundary. The model is based on limited site-specific data and necessary simplifying assumptions. There currently are no drinking water wells in the area. The proposed wells to be used for potable use are or will be located more than 1.6 miles from the drainfield in deeper confined sand layers. A model sensitivity assessment has been performed to address model uncertainty.

Based on the results of the Level 1 nitrate balance evaluation, SPF recommends proceeding with the proposed drainfield design rate of 3,920 gpd of wastewater and a daily design flow of 4,320 to accommodate the estimated monthly arsenic treatment system backflush water. Should new or additional data be collected in support of the design and implementation, refinement of the nitrate balance study and conclusions presented in this report may be warranted.

7. REFERENCES

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Appendix A
Nitrate Balance Spreadsheet

Washington State Department of Health

Using Average of GMW17-33 and PW-4 Early and Later Time Data

Large On-Site Sewage System (LOSS) LEVEL 1 NITRATE BALANCE

Project name:	**Grassy Mountain Mine Project**
Address, city and county:	**SE1/4 of NW1/4 of S8, T22S, R44E**
Completed by (name and title):	**Kurt Newbry, Geologist**
Date:	**08/13/2019**

Input Values	Factor	Units	Values	Instructions	Information Source
Nitrate concentration in precipitation	N_R	mg/l as N	0.24	Default	
Total nitrogen concentration in wastewater	N_W	mg/l	60	Default - residential strength	
Soil denitrification	d	unitless	0.1	Default	
Aquifer thickness	b	ft	100	Default or aquifer thickness if known	Nearby Well Logs
Drainfield area	A_D	ft^2	10,800	Primary drainfield area	From Design Data
Distance from drainfield to property boundary	D_{pb}	ft	3,777	Measure in direction of GW flow	
Aquifer width	W_A	ft	385	Perpendicular to GW flow	
Aquifer hydraulic conductivity	K	ft/day	4.430	Measured or literature value	GMW17-33 and PW-4 Pump Test
Hydraulic gradient	i	ft/ft	0.089	If unknown, use 0.001	Potentiometric Map
Recharge	R	in/yr	0.50	Recharge will be a % of ppt	GW Characterization Report
Nitrate concentration of upgradient ground water	N_B	mg/l	1.4	Prefer sampling data	Upgradient Well Sampling
Wastewater volume	V_W	gpd	3,920	Design flows or measured volume	Wastewater Design
Output Values					
Groundwater nitrate value	N_{GW}	mg/l as N	3.16	Point of Compliance (POC)	
Groundwater nitrate value	$N_{GW\ ALT}$	mg/l as N	3.12	Alternative POC	
Increase above background nitrate concentration	$N_{GW\ BI}$	mg/l as N	1.76	Increase from Background	

Appendix B
ACZ Laboratory Results

SPF Water Engineering
Project ID: Calico Winter Sampling
Sample ID: GW-1

ACZ Sample ID: ***L11147-01***
Date Sampled: *03/14/13 18:00*
Date Received: *03/16/13*
Sample Matrix: *Ground Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation							03/26/13 17:25	mpb
Cyanide, WAD	SM4500-CN I- distillation							03/26/13 13:01	mpb

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration								
Bicarbonate as CaCO3		146			mg/L	2	20	03/20/13 0:00	abm
Carbonate as CaCO3		5	B		mg/L	2	20	03/20/13 0:00	abm
Hydroxide as CaCO3			U		mg/L	2	20	03/20/13 0:00	abm
Total Alkalinity		151			mg/L	2	20	03/20/13 0:00	abm
Chloride	M300.0 - Ion Chromatography	12.13			mg/L	0.5	2.5	03/22/13 2:01	tcd
Conductivity @25C	SM2510B	414			umhos/cm	1	10	03/20/13 22:49	abm
Cyanide, total	M335.4 - Colorimetric w/ distillation		U	*	mg/L	0.003	0.01	03/27/13 17:43	tcd
Cyanide, WAD	SM4500-CN I-Colorimetric w/ distillation		U	*	mg/L	0.003	0.01	03/26/13 15:32	tcd
Fluoride	M300.0 - Ion Chromatography	0.53		*	mg/L	0.1	0.5	03/22/13 2:01	tcd
Nitrate as N, dissolved	Calculation: NO3NO2 minus NO2	2.25	H		mg/L	0.04	0.2	03/29/13 14:02	calc
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	2.25	H	*	mg/L	0.04	0.2	03/19/13 20:25	mpb
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction		UH	*	mg/L	0.01	0.05	03/19/13 19:54	mpb
pH (lab)	SM4500H+ B								
pH		8.3	H		units	0.1	0.1	03/20/13 0:00	abm
pH measured at		20.0			C	0.1	0.1	03/20/13 0:00	abm
Residue, Filterable (TDS) @180C	SM2540C	300			mg/L	10	20	03/19/13 16:37	ljr
Residue, Non-Filterable (TSS) @105C	SM2540D		U	*	mg/L	5	20	03/20/13 15:01	khw
Sulfate	M300.0 - Ion Chromatography	35.82			mg/L	0.5	2.5	03/22/13 2:01	tcd

SPF Water Engineering
Project ID: Calico Winter Sampling
Sample ID: PW-1

ACZ Sample ID: ***L11314-04***
Date Sampled: *03/26/13 11:40*
Date Received: *03/28/13*
Sample Matrix: *Ground Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation							04/05/13 11:43	mpb
Cyanide, WAD	SM4500-CN I- distillation							04/03/13 10:30	mpb

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration								
Bicarbonate as CaCO3		126			mg/L	2	20	03/30/13 0:00	ljr
Carbonate as CaCO3		4	B		mg/L	2	20	03/30/13 0:00	ljr
Hydroxide as CaCO3			U		mg/L	2	20	03/30/13 0:00	ljr
Total Alkalinity		130			mg/L	2	20	03/30/13 0:00	ljr
Chloride	M300.0 - Ion Chromatography	8.48			mg/L	0.5	2.5	04/21/13 18:15	tcd
Conductivity @25C	SM2510B	347			umhos/cm	1	10	03/30/13 17:37	ljr
Cyanide, total	M335.4 - Colorimetric w/ distillation		U	*	mg/L	0.003	0.01	04/08/13 16:42	bsu
Cyanide, WAD	SM4500-CN I-Colorimetric w/ distillation		U	*	mg/L	0.003	0.01	04/03/13 23:38	pjb
Fluoride	M300.0 - Ion Chromatography	0.50		*	mg/L	0.1	0.5	04/21/13 18:15	tcd
Nitrate as N, dissolved	Calculation: NO3NO2 minus NO2	0.60	H		mg/L	0.02	0.1	04/22/13 16:22	calc
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	0.60	H	*	mg/L	0.02	0.1	03/28/13 18:18	pjb
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction		UH	*	mg/L	0.01	0.05	03/28/13 18:18	pjb
pH (lab)	SM4500H+ B								
pH		8.3	H		units	0.1	0.1	03/30/13 0:00	ljr
pH measured at		20.0			C	0.1	0.1	03/30/13 0:00	ljr
Residue, Filterable (TDS) @180C	SM2540C	240			mg/L	10	20	03/29/13 16:43	khw
Residue, Non-Filterable (TSS) @105C	SM2540D	7	B	*	mg/L	5	20	03/30/13 17:04	khw
Sulfate	M300.0 - Ion Chromatography	30.60			mg/L	0.5	2.5	04/21/13 18:15	tcd

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

SPF Water Engineering
Project ID: Calico 2nd Qtr
Sample ID: GW-1

ACZ Sample ID: ***L12799-04***
Date Sampled: *06/17/13 15:40*
Date Received: *06/19/13*
Sample Matrix: *Ground Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Chloride	M300.0 - Ion Chromatography	1	12.5		*	mg/L	0.5	2.5	06/27/13 23:34	tcd
Fluoride	M300.0 - Ion Chromatography	1	0.49	B	*	mg/L	0.1	0.5	06/27/13 23:34	tcd
Nitrate as N, dissolved	Calculation: NO3NO2 minus NO2		2.17	H		mg/L	0.02	0.1	07/01/13 16:17	calc
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	1	2.17	H	*	mg/L	0.02	0.1	06/19/13 22:10	pjb
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	1		UH	*	mg/L	0.01	0.05	06/19/13 22:10	pjb
Residue, Filterable (TDS) @180C	SM2540C	1	290		*	mg/L	10	20	06/22/13 10:11	dcw
Sulfate	M300.0 - Ion Chromatography	1	35.1		*	mg/L	0.5	2.5	06/27/13 23:34	tcd

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

SPF Water Engineering
Project ID: Calico 2nd Qtr
Sample ID: PW-1

ACZ Sample ID: ***L12799-06***
Date Sampled: *06/17/13 18:15*
Date Received: *06/19/13*
Sample Matrix: *Ground Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Chloride	M300.0 - Ion Chromatography	1	8.83		*	mg/L	0.5	2.5	06/28/13 0:27	tcd
Fluoride	M300.0 - Ion Chromatography	1	0.47	B	*	mg/L	0.1	0.5	06/28/13 0:27	tcd
Nitrate as N, dissolved	Calculation: NO3NO2 minus NO2		0.62	H		mg/L	0.02	0.1	07/01/13 16:18	calc
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	1	0.62	H	*	mg/L	0.02	0.1	06/19/13 22:12	pjb
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	1		UH	*	mg/L	0.01	0.05	06/19/13 22:12	pjb
Residue, Filterable (TDS) @180C	SM2540C	1	270		*	mg/L	10	20	06/22/13 10:14	dcw
Sulfate	M300.0 - Ion Chromatography	1	32.2		*	mg/L	0.5	2.5	06/28/13 0:27	tcd

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

SPF Water Engineering
Project ID: Calico 3rd Q sampling
Sample ID: PW-1

ACZ Sample ID: ***L13751-03***
Date Sampled: *08/06/13 14:50*
Date Received: *08/08/13*
Sample Matrix: *Ground Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Chloride	M300.0 - Ion Chromatography	1	8.96		*	mg/L	0.5	2.5	08/15/13 23:48	tcd
Fluoride	M300.0 - Ion Chromatography	1	0.44	B	*	mg/L	0.1	0.5	08/15/13 23:48	tcd
Nitrate as N, dissolved	Calculation: NO3NO2 minus NO2		0.62	H		mg/L	0.02	0.1	08/20/13 13:09	calc
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	1	0.62	H	*	mg/L	0.02	0.1	08/08/13 19:26	pjb
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	1		UH	*	mg/L	0.01	0.05	08/08/13 19:26	pjb
Residue, Filterable (TDS) @180C	SM2540C	1	264		*	mg/L	10	20	08/12/13 16:03	mss3
Sulfate	M300.0 - Ion Chromatography	1	33.7		*	mg/L	0.5	2.5	08/15/13 23:48	tcd

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

SPF Water Engineering
Project ID: Calico 3rd Q sampling
Sample ID: GW-1

ACZ Sample ID: ***L13751-04***
Date Sampled: *08/06/13 15:35*
Date Received: *08/08/13*
Sample Matrix: *Ground Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Chloride	M300.0 - Ion Chromatography	1	12.0		*	mg/L	0.5	2.5	08/16/13 16:10	tcd
Fluoride	M300.0 - Ion Chromatography	1	0.45	B	*	mg/L	0.1	0.5	08/16/13 16:10	tcd
Nitrate as N, dissolved	Calculation: NO3NO2 minus NO2		2.150	H		mg/L	0.06	0.3	08/20/13 13:09	calc
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	3	2.15	H	*	mg/L	0.06	0.3	08/08/13 21:16	pjb
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	1		UH	*	mg/L	0.01	0.05	08/08/13 19:28	pjb
Residue, Filterable (TDS) @180C	SM2540C	1	308		*	mg/L	10	20	08/12/13 16:04	mss3
Sulfate	M300.0 - Ion Chromatography	1	36.7		*	mg/L	0.5	2.5	08/16/13 16:10	tcd

** Please refer to Qualifier Reports for details.*

Appendix C
Well Driller Reports

MALH 54406

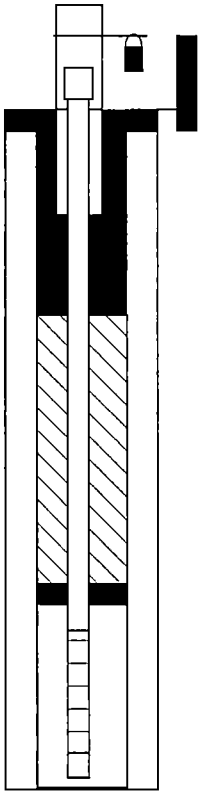
STATE OF OREGON
MONITORING WELL REPORT **GMW17-33 / MALH 54406** WELL I.D. LABEL# L 125170
(as required by ORS 537.765 & OAR 690-240-0395)
START CARD # 1036990

(1) LAND OWNER
Owner Well I.D. GMW-17-33
First Name _____ Last Name _____
Company CALICO RESOURCES USA CORP
Address P O BO Q
City VALE State OR Zip 97918

(2) TYPE OF WORK
☒ New ☐ Deepening ☐ Conversion ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD
☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Hollow Stem Auger ☐ Cable Mud ☐ Reverse Rotary ☐ Other

(4) CONSTRUCTION
Piezometer Well ☐
Depth of Completed Well 340.00 ft. Special Standard ☐



MONUMENT/VAULT Above Ground
From _____ To _____

BORE HOLE
Diameter 16 From 0 To 118

CASING
Dia. 12 From ☒ 3 To 118
Gauge .250 Wld Thrd
Material ◉ Steel ○ Plastic ☒ ☐

LINER
Dia. _____ From ☐ _____ To _____
Gauge _____ Wld Thrd
Material ○ Steel ○ Plastic ☐ ☐

SEAL
From 0 To 118
Material Cement
Amount 69 Sacks Grout weight 15.6

SCREEN
Casing/Liner Casing Material PVC
Diameter 5 From 238 To 338
Slot Size 0.020

FILTER
From 233 To 235 Material SAND SEAL Size of pack 20/40

(5) WELL TESTS
◉ Pump ○ Bailer ○ Air ○ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
20		340	1
40	28	335	2

Temperature 60 °F Lab analysis ☐ Yes
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SALEM, OR
Supervising Geologist/Engineer SPF Engineering
Water quality concerns? ☐ Yes (describe below)

From	To	Description	Amount	Units

(6) LOCATION OF WELL (legal description)
County MALHEUR Twp 22.00 S N/S Range 44.00 E E/W WM
Sec 8 SE 1/4 of the NW 1/4 Tax Lot 101
Tax Map Number _____ Lot _____
Lat ° ' " or 43.67235700 DMS or DD
Long ° ' " or -117.36162400 DMS or DD
◉ Street address of well ○ Nearest address
REFER TO GPS

(7) STATIC WATER LEVEL

	Date	SWL(psi)	+ SWL(ft)
Existing Well / Predeepening			
Completed Well	11/28/2017		243

Flowing Artesian? ☐ Dry Hole? ☐
WATER BEARING ZONES Depth water was first found 251.00

SWL Date	From	To	Est Flow	SWL(psi)	+ SWL(ft)
11/28/2017	243	338	20		243

(8) WELL LOG
Ground Elevation _____

Material	From	To
brown clay boulders	0	16
brown clay & rock fragments	16	23
redish sandstone, clay strips	23	30
green claystone	30	35
green & red sandstone	35	46
tan & red claystone	46	73
white,yellow & red clay	73	92
tan claystone	92	98
tan clay layers with rock	98	110
bown & red sandstone	110	120
red, white & brown very hard clay	120	172
red clay with brown strips soft	172	185
red clay, bounces on rock	185	200
brown sandstone	200	212
brown clay strips, sandstone	212	220
brown clay	220	225
brown & grey clay	225	230
brown sandstone	230	245
brown clay	245	251

Date Started 11/2/2017 Completed 11/30/2017

(unbonded) Monitor Well Constructor Certification
I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon monitoring well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 1896 Date 12/14/2017
Password : (if filing electronically)
Signed TONY HACKETT (E-filed)

(bonded) Monitor Well Constructor Certification
I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon monitoring well construction standards. This report is true to the best of my knowledge and belief.

License Number 1899 Date 12/14/2017
Password : (if filing electronically)
Signed SAM P KINGREY (E-filed)
Contact Info (optional)

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK
Form Version:

MONITORING WELL REPORT -
continuation page

WELL I.D. LABEL# L125170

GMW17-33 / MALH 54406 START CARD # 1036990

(4) CONSTRUCTION

BORE HOLE

Dia	From	To
12	118	365

FILTER PACK

From	To	Material	Size
235	339	SILICA SAND	8/12

SEAL

Material	From	To	Amt	sacks/ lbs	grout weight
C5	0	233	132	S	14.1

CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
◉	○	5	☒	2	238	sch80	○	◉		☒

SCREENS

Perf/ Screen	Casing/ Liner	Screen Dia	From	To	Scrn size/ slot width	Slot length	# of slots	Tele/ pipe size

(5) WELL TESTS

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(7) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(8) WELL LOG

Material	From	To
fractured black rock	251	290
grey clay	290	295
black, brown fractured rock	295	314
grey clay strips with black rock	314	320
grey clay	320	327
black, grey rock fractured	327	338
brown clay	338	365

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DEC 21 2017

SALEM, OR

Comments/Remarks

Jake Kingrey

David Dutcher

PW-4 / MALH 2206

JAN 02 1990

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

WATER RESOURCES DEPT.
SALEM, OREGON

Malh 2206

21S/44E/32bd
W-14815

(START CARD) # W-14811

(1) OWNER:
Well Number: PW-4
Name: ATLAS PRECIOUS METALS
Address: 313 A STREET WEST
City: VALE State: OR Zip: 97918

(2) TYPE OF WORK:
☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD
☒ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Other

(4) PROPOSED USE:
☐ Domestic ☐ Community ☒ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval: Yes ☒ No ☐ Depth of Completed Well 375 ft.
Explosives used: Yes ☐ No ☒ Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
14 3/4	0	40	PORTLAND CEMENT	0	40	19
9 7/8	40	375	VOLCLAY	5	275	40
			CEMENT	0	5	

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☐ Other
Backfill placed from 375 ft. to 370 ft. Material 10-20 MESH
Gravel placed from 370 ft. to 275 ft. Size of gravel 10-20 MESH

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	10"	0	40	.250	☒	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	6 5/8"	0	280	.250	☐	☐	☐	☐
	6 5/8"	300	340	.250	☒	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☐ Perforations Method
☒ Screens Type WIRE WOUND Material Low Carbon Steel

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
280	300	.030		6"		☐	☒
340	360	.030		6"		☐	☒
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
100		350	1 hr.

Temperature of water 62°F Depth Artesian Flow Found —
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☒ Odor ☐ Colored ☐ Other
Depth of strata: 280 STILL USABLE

(9) LOCATION OF WELL by legal description:
County MALHEUR Latitude Longitude
Township 21S N or S, Range 44E E or W, WM.
Section 32 SE ¼ NW ¼
Tax Lot Lot Block Subdivision
Street Address of Well (or nearest address)

(10) STATIC WATER LEVEL:
81 ft. below land surface. Date 11/17/89
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 280'

From	To	Estimated Flow Rate	SWL
280	360	100 gpm	81

(12) WELL LOG:
Ground elevation ≅ 3350

Material	From	To	SWL
Alluvium	0	25'	
Clay	25	150'	
Sandy clay	150	175	
Sandstone	175	215	
Clay	215	275	
Sandstone	275	305	
Clay	305	325	
Sandstone and Conglomerate	325	365	
Clay.	365	375	

Date started 11/16/89 Completed 11/20/89

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.
WWC Number
Signed Date 11/20/89

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 544
Signed Date 11-20-89

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 3/85

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.765 & OAR 690-240-095)

JAN 26 1994

WATER RESOURCES DEPT.
SALEM, OREGON

MALH 2985 Start Card # 59762

22S/44E/8bd

9

(1) OWNER/PROJECT:

WELL NO. MW-3

Name: Newmont Gold
Address: 318 A Street
City: West Vale State: OR Zip: 97918

(2) TYPE OF WORK:

[X] New construction [ ] Repair [ ] Recondition
[ ] Conversion [ ] Deepening [ ] Abandonment

(3) DRILLING METHOD

[X] Rotary Air [ ] Rotary Mud [ ] Cable
[ ] Hollow Stem Auger [ ] Other

(6) LOCATION OF WELL By legal description

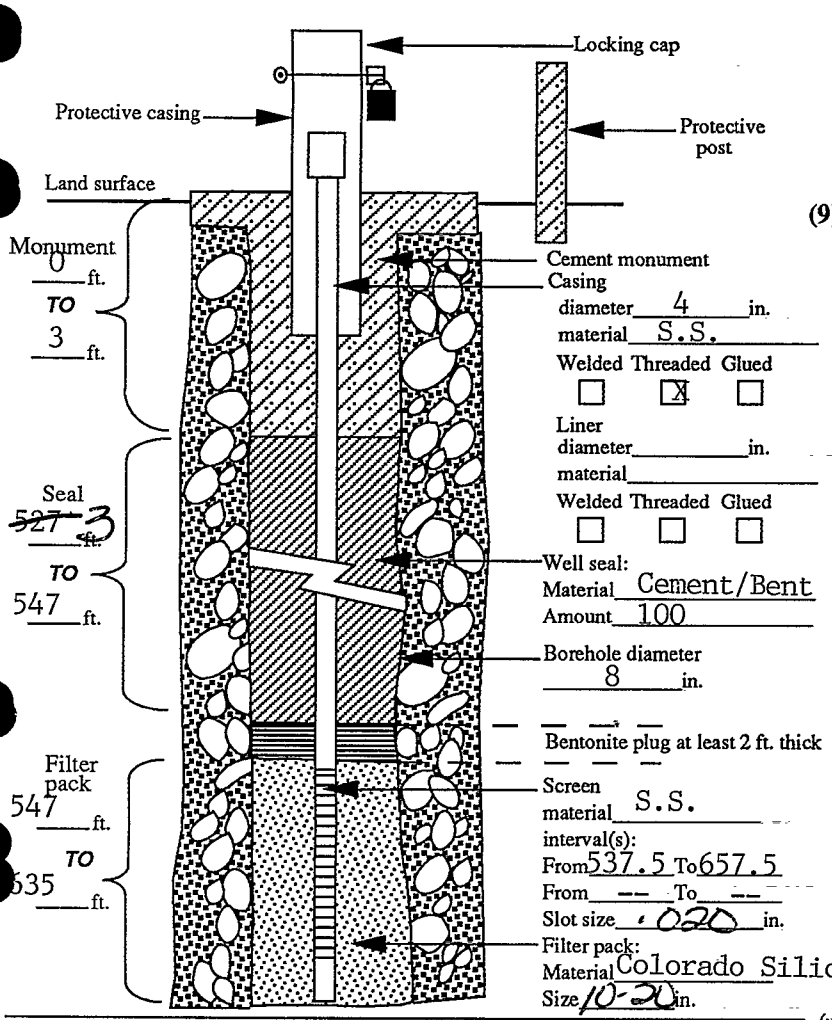
Well Location: County Malheur
Township 22S (N or S) Range 44E (E or W) Section 8
1. SE 1/4 of NW 1/4 of above section.
2. Street address of well location Grassy Mountain, Vale OR
3. Tax lot number of well location Unknown
4. ATTACH MAP WITH LOCATION IDENTIFIED.

(7) STATIC WATER LEVEL:

626 Ft. below land surface. Date 10/29/93
Artesian Pressure _____ lb/sq. in. Date _____

(4) BORE HOLE CONSTRUCTION 59762 / MALH 2976, 2985

Special Standards: Yes [ ] No [X] Depth of completed well 657.5 ft.



(8) WATER BEARING ZONES:

Depth at which water was first found ------

From	To	Est. Flow Rate	SWL

(9) WELL LOG:

Ground elevation _____

Material	From	To	SWL
****See Attached Sheet*******			

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WATER RESOURCES DEPT.
SALEM, OREGON

Date started 10/16/93 Completed 10/29/93

(5) WELL TEST:

[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian
Permeability ---- Yield ------ GPM
Conductivity ---- PH ------
Temperature of water 56 °F/C Depth artesian flow found ---- ft.
Was water analysis done? [ ] Yes [X] No
By whom? -------
Depth of strata to be analyzed. From ----- ft. to ----- ft.
Remarks: See attached sheet for sand pack

Name of supervising Geologist/Engineer Mike Pappalardo

(unbonded) Monitor Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to the best knowledge and belief.

Signed [signature] MWC Number 1098 Date 1/13/94

(bonded) Monitor Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

Signed [signature] MWC Number 10096 Date 1-13-94

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

59762 / MALH 2976, 2985

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SALEM, OREGON

RECEIVED
MAR 14 1994
WATER RESOURCES DEPT.
SALEM, OREGON

Newmont Gold
318 A Street
West Vale, OR 97918

Start Card # 59762

(9) Well Log

Material	From	To	SWL
Alluvium sand and cobbles	0	1	
Arkose sandstone buff medium grained course	1	19	
Sandstone orange to buff gray green course to medium grained	19	25	
Sandstone olive green medium grained	25	36	
Sandstone orange to red medium grained to fine	36	42	
Sandy clayey siltstone pink purple/yellow streaks	42	57	
Clayey siltstone light olive green and tan	57	78	
Claystone orange light purple yellow	78	94	
Silicified tan buff and brown	94	109	
Silty claystone purple gray and yellow	109	115	
Clayey siltstone gray/pink/yellow	115	160	
Clayey siltstone orange/yellow/gray	160	178	
Clayey siltstone gray	178	180	
Clayey siltstone tan and gray partial silicification	180	187	
Clayey siltstone tan grading into gray decrease in silicificaiton	187	215	
Clayey siltstone gray grading into tan increaded silicification	215	220	
Clayey siltstone highly silicified tan to brown	220	256	
Clayey siltstone tan grading into gray decreasing silicification from high to moderate	256	305	
Clayey siltstone gray grading into tan increasing silicification	305	312	
Silicified siltstone tan to light brown	312	332	
Clayey siltstone tan to gray	332	345	
Clayey siltstone gray grading into tan with increasing silicification	345	355	
Clayey siltstone tan	355	360	
Clayey siltstone green and brown	360	385	
Clayey siltstone gray and brown	385	401	
Clayey siltstone grey with brown and charcoal mottling	401	435	
" gray	435	501	
Clayey siltstone gray	501	515	
Clayey siltstone charcoal	515	525	
Clayey siltstone gray	525	570	
Clayey siltstone gray charcoal	570	625	
Clayey siltstone gray	625	650	
Silicified siltstone gray	650	700	

Hole was bridging partial sand pack and native materials from 611-635
Native material around screen at 635 - 657

MALH 54404

GMW17-31 / MALH 54404

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.765 & OAR 690-240-0395)

WELL I.D. LABEL# L 125168

START CARD # 1035606

(1) LAND OWNER

Owner Well I.D. GMW-17-31

First Name _____ Last Name _____

Company CALICO RESOURCES USA CORP.

Address P O BOX Q

City VALE State OR Zip 97918

(2) TYPE OF WORK

☒ New ☐ Deepening ☐ Conversion ☐ Alteration (repair/recondition) ☐ Abandonment

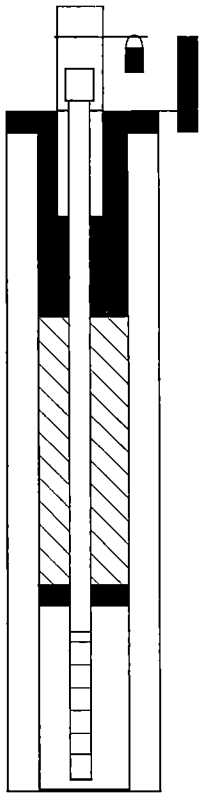
(3) DRILL METHOD

☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Hollow Stem Auger ☐ Cable Mud ☐ Reverse Rotary ☐ Other _____

(4) CONSTRUCTION

Piezometer Well ☐

Depth of Completed Well 498.00 ft. Special Standard ☐



MONUMENT/VAULT Above Ground

From _____ To _____

BORE HOLE

Diameter 16 From 0 To 98

CASING

Dia. 12 From ☒ 3 To 98

Gauge .250 Wld Thrd

Material ◉ Steel ○ Plastic ☒ ☐

LINER

Dia. _____ From ☐ _____ To _____

Gauge _____ Wld Thrd

Material ○ Steel ○ Plastic ☐ ☐

SEAL

From 0 To 38

Material Bentonite Chips

Amount 36 Sacks Grout weight _____

SCREEN

Casing/Liner Casing Material PVC

Diameter 5 From 458 To 498

Slot Size 0.020

FILTER

From 453 To 455 Material SAND SEAL Size of pack 20/40

(5) WELL TESTS

○ Pump ○ Bailer ○ Air ○ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

RECEIVED BY OWRD

Temperature _____ °F Lab analysis ☐ Yes By _____

DEC 21 2017

Supervising Geologist/Engineer SPF Water Engineering

SALEM, OR

Water quality concerns? ☐ Yes (describe below)

From	To	Description	Amount	Units

(6) LOCATION OF WELL (legal description)

County MALHEUR Twp 22.00 S N/S Range 44.00 E E/W WM

Sec 8 SE 1/4 of the NW 1/4 Tax Lot 100

Tax Map Number _____ Lot _____

Lat ° ' " or 43.67387000 DMS or DD

Long ° ' " or -117.35963000 DMS or DD

○ Street address of well ◉ Nearest address

REFER TO GPS

(7) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening				
Completed Well				

Flowing Artesian? ☐ Dry Hole? ☒

WATER BEARING ZONES Depth water was first found _____

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(8) WELL LOG

Ground Elevation 3711.00

Material	From	To
soft brown clay-top soil	0	3
brown decomposed sand & gravel	3	8
soft light brown sandstone	8	17
hard green sandstone	17	22
med. hard green sandstone	22	28
hard green sandstone	28	41
soft orange sandstone	41	47
soft red sandstone	47	55
sticky red clay	55	60
soft red clay some white clay strips	60	82
hard dark red strips of claystone	82	107
soft red & white clay	107	122
soft tan & red clay	122	142
med. hard red claystone	142	147
hard grey sandstone	147	157
med. hard orange, tan & red claystone	157	177
hard red yellow claystone	177	197
soft red clay	197	202
broken black basalt	202	212

Date Started 8/1/2017 Completed 11/30/2017

(unbonded) Monitor Well Constructor Certification

I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon monitoring well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 1896 Date 12/14/2017

Password : (if filing electronically) _____

Signed TONY HACKETT (E-filed) Tony Hackett

(bonded) Monitor Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon monitoring well construction standards. This report is true to the best of my knowledge and belief.

License Number 1899 Date 12/14/2017

Password : (if filing electronically) _____

Signed SAM P KINGREY (E-filed) Sam P Kingrey

Contact Info (optional) _____

ORIGINAL - WATER RESOURCES DEPARTMENT

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version:

MALH 54404

GMW17-31 / MALH 54404

MONITORING WELL REPORT - continuation page

WELL I.D. LABEL# L 125168

START CARD # 1035606

(4) CONSTRUCTION

BORE HOLE

Dia	From	To
10	98	520

FILTER PACK

From	To	Material	Size
455	499	SILICA SAND	8/12

SEAL

Material	From	To	Amt	sacks/ lbs	grout weight
C5	0	453	200	S	14.1
Cement	38	98	41	S	15.6
Cement	499	520	9	S	15.6

CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
	●	5	X	2	458	sch80		●		X

SCREENS

Perf/ Screen	Casing/ Liner	Screen Dia	From	To	Scrn size/ slot width	Slot length	# of slots	Tele/ pipe size

(5) WELL TESTS

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(7) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+ SWL(ft)

(8) WELL LOG

Material	From	To
med. hard multicolored sandstone	212	217
soft yellow orange grey clay	217	242
hard layers sandstone grey	242	258
soft tan clay	258	269
strips of grey clay & grey sandstone	269	309
hard brown glassy rock	309	319
soft tan & grey clay	319	336
hard brown glassy rock	336	337
soft tan clay	337	342
hard fractured brown rock	342	351
hard layers brown sandstone w/clay strip	351	385
hard brown rock	385	397
hard int. lyrs sndstne/clay in 1' strips	397	446
brown clay	446	454
hard brown sandstone	454	456
soft brown clay	456	459
hard layers brown sandstone	459	465
brown clay	465	481
hard sandstone brown	481	498
sticky brown clay	498	520

RECEIVED BY OWRD

DEC 21 2017

SALEM, OR

Comments/Remarks

additional drillers 1)Jake Kingrey

2)David Dutcher

CALICO RESOURCES

GRASSY MOUNTAIN PROJECT

Page 1 of 5 Hole No. GMW17-31 Depth 520

UTM East _____, North _____ Elev _____ Azimuth / Incline -90

Logged by: M.F. MCGINNIS Drill Type _____ Contractor DOWN RIGHT DRILLING

DATE Start _____ Finish _____ 0=none 1 or tr=trace 2 or W=weak 3 or M=moderate 4 or S=strong 5 or Int=intense

Depth	Lithology Graphic	Lithology	CLAY/ ARG.	Silica	SULF/ pyrite	Qtz Veins	FeOx	CALCITE		Sample Number	Au ppm	Description/Remarks	COLOR
0-3		Ovb	20%	0	0	0	WK	S				OVERBURDEN - MIXED LITHO - CALCAREOUS	BROWN
3-8		Ovb	50%				0	S					OLIVE GRAY GREEN
8-17		Tgls	30%				0	S				SANDSTONE, SLTST & CLAY - CALCAREOUS	
17-22			30%				0	S					
22-28			10%				0	T					
28-41			—				TR	0				90% SANDST 10% SLTST & CLAY BLUE-GREEN - PISTACHIO GREEN	PISTACHI GREEN
41-47		Tgls CONGLOM	—	Tr			WK					SANDST & SLTST SOME ROUNDED CONGLOM PEBBLES TRACE SILIC'D SLTST	BROWN GREEN
47-55		CONGLOM Tgs CLAY	20%	Tr			INT					SANDST, SLTST, CLAY, CONGLOM	BRICK RED
55-60		Tgs CLAY CONGLOM		Tr			INT						"
60-65		CLAY	80%	0			MOD					RED-BROWN CLAY	RED-BROWN & GRA
65-72		CLAY	100				WK						REDDISH GRAY
72-77							WK						
77-82							S					RED CLAY	RED
82-87							INT						
87-92		CLAY	90										
92-97		CLAY	80	Tr								RED CLAY & SILIC'D SLTST/TUFF	RED TAN
97-102		CLAY/ SLTST	70	WK			INT						
102-107			70	WK			M						
107-110		CLAY	100	0			T					LT. GRAY CLAY	GRAY
110-117			100	0			0						

CALICO RESOURCES **GRASSY MOUNTAIN PROJECT** Page 2 of 5 Hole No. GMW17-31 Depth 520

UTM East _____, North _____ Elev _____ Azimuth / Incline -90

Logged by: M.F. McGINNIS Drill Type _____ Contractor _____

DATE Start _____ Finish _____ 0=none 1 or tr=trace 2 or W=weak 3 or M=moderate 4 or S=strong 5 or Int=intense

Depth	Lithology Graphic	Lithology	CLAY/ ARG	Silica	pyrite	Qtz Veins	FeOx			Sample Number	Au ppm	Description/Remarks	COLOR
117 - 122		CLAY	100	0	0	0	W					YELLOW BROWN CLAY	YELLOW BROWN
122 - 127			100				M					RED CLAY	RED BROWN
127 - 132			100				S						RED
132 - 137			100				S						RED
137 - 142			100				S						RED
142 - 147			100				S					90% CLAY 10% SS & SLTST	RED BROWN
147 - 152		SS, ARK SLTST, TUFF	W	TR			W					ARKOSE, SANDSTONE, SILTST, TUFF TUFFACEOUS SLTST RED GREEN, BROWN, TAN WHITE	MULTI
152 - 157			W	TR			W						
157 - 162			W	WK			W					10% SILC'D SLTST & TUFF	
162 - 167			W	WK			T						
167 - 172			W	WK			T						
172 - 177			W	WK			T						
177 - 182			W	WK			T						
182 - 187		AS ABOVE + CLAY	20%	W			T					AS ABOVE PLUS GRAY CLAY	OLIVE GRN & BROWN
187 - 192			20%	W			T						"
192 - 197		SS, ARK SLTST, TUFF TR. SINTER	20%	W			T					SS, SILC'D SLTST & TUFF 20% SINTER W/ SOME MICRO BX	"
197 - 202		SS, ARK SLTST, TUFF 30% SINTER	W	M			T					DITTO 30% SINTER	"
202 - 207		"	W	M			T					DITTO	"
207 - 212		"	W	M			T					DITTO	"
212 - 217		" + CLAY	20%	W			T					DITTO + GRAY CLAY	"

CALICO RESOURCES

GRASSY MOUNTAIN PROJECT Page 3 of 5 Hole No. GMW17-31 Depth 520

UTM East _____, North _____ Elev _____ Azimuth — Incline -90°

Logged by: M.F. MCGINNIS Drill Type _____ Contractor _____

DATE Start _____ Finish _____ 0=none 1 or tr=trace 2 or W=weak 3 or M=moderate 4 or S=strong 5 or Int=intense

Depth	Lithology Graphic	Lithology	CLAY / ARG	Silica	pyrite	Qtz Veins	FeOx	CALCITE		Sample Number	Au ppm	Description/Remarks	COLOR
217-222		SS, SLTST ARK, TUFF		M	0	0	T	0				SS. SILIC'D SLTST & TUFF — OLIVE GRN, BROWN MAROON, GRN, TAN	MULTI
222-227		↓		M	0	0	W						
227-232		AS ABOVE + CLAY	20% / W	M	TR		W					+ CLAY	
232-237			40% / M	T	0		M					SLTST, TUFF, CLAY — YELLOW-BROWN, TAN, GRAY	YELLOW BRN TAN
237-242			10% / M	0	0		M						
242-247			10% / M	0	TR	↓	M						
247-252		SINTER SLTST	W	S	0	T	T					60% SINTER - CHALCEDONIC 40% SLTST & SILIC'D SLTST — TRACE HAIRLINE QTZ VLTS	TAN WHITE RUSTY
252-257		↓	W	S		0	T						
257-262			W	S		T	W					TRACE HAIRLINE QTZ VLTS	
262-267		↓	W	S		T	W						
267-272		CLAY, SLTST TUFF, SINTER	70%	M	↓	0	W					30% SINTER - CHALCEDONIC 70% CLAY, SLTST, TUFF	
272-277		80% CLAY SLTST 20% TUFF	80%	W	TR		T					80% DK GRAY CLAY W/ F.G. DISS PY 20% SLTST & TUFF FeO_x TR-WK	DK. GRAY RUSTY BROWN
277-282		↓	80%	T	3%		T					↓	↓
282-287			80%	T	5%		T						
287-292			80%	W	↓		T						
292-297			80%	W	↓		0						
297-302			80%	W	10%		T						
302-307			80%	0	↓		0						
307-312			80%	0	↓		T						
312-317		↓	80%	W	5%	↓	T	↓				↓	↓

CALICO RESOURCES

GRASSY MOUNTAIN PROJECT

Page 4 of 5 Hole No. GMW17-31 Depth 520

UTM ____ East ____, North ____ Elev ____ Azimuth — Incline -90°

Logged by: M.F. MCGINNIS Drill Type ____ Contractor DOWN RIGHT DRILLING

DATE Start ____ Finish ____ 0=none 1 or tr=trace 2 or W=weak 3 or M=moderate 4 or S=strong 5 or Int=intense

Depth	Lithology Graphic	Lithology	CLAY/ARG	Silica	SULF/pyrite	Qtz Veins	FeOx	CALCITE		Sample Number	Au ppm	Description/Remarks	COLOR
317-322		CLAY 10% SINTER	90%/W	0	TR	0	T	0				90% CLAY 10% SINTER	BROWN TAN GRAY
322-327		SINTER	0	S	0		T					SINTER & SILIC'D SLTST WHITE SINTER? FeOx T	WHITE TAN LT.GRA
327-332			0	S			T						
332-337			0	S			T						
337-342			0	S			T						
342-347		SINTER SILIC'D SLTST CLAY	10%/T	T			T					+ CLAY	WHITE TAN RUSTY
347-352		ARK 10% CLAY	10%/W	0	TR		T					ARKOSE - WHITE & TAN + CLAY FeOx T	
352-357		ARK 10% CLAY	M	0	0		T						
357-362		ARK TUFF	M	W			T					90% ARKOSE + SILIC'D SLTST 10% TUFF & TUFFACEOUS SLTST FeOx T	
362-367		ARK TUFF	10%/W	W			T						
367-372		ARK TUFF	10%/WR	W	TR		T						WHITE RUSTY TAN
372-377		ARK TUFF	W	W	0		T						
377-382		ARK TUFF CLAY	10%/W	W			W					ARKOSE, TUFF, SILIC'D SLTST, CLAY FeOx W	
382-387		ARK TUFF CLAY	20%/W	W			W						
387-392			5%/M	M			W						
392-397		SINTER	0	S			W					SINTER - TAN, BROWN, DK. BROWN + SILIC'D SLTST FeOx W	TAN BROWN BLACK
397-402		SINTER	0	S			W						
402-407		SINTER	0	S			W						
407-412		SINTER	0	S			T					FeOx T	
412-417		SINTER 10% ARK	T	S			T					+ WHITE ARKOSE	

CALICO RESOURCES

GRASSY MOUNTAIN PROJECT

Page 5 of 5 Hole No. GMW17 31 Depth 520 FT

UTM East _____, North _____ Elev _____ Azimuth / Incline -90°

Logged by: M.F. MCGINNIS Drill Type _____ Contractor DOWN RIGHT DRILLING

DATE Start _____ Finish _____ 0=none 1 or tr=trace 2 or W=weak 3 or M=moderate 4 or S=strong 5 or Int=intense

Depth	Lithology Graphic	Lithology	CLAY / ARG	Silica	pyrite	Qtz Veins	FeOx	CALCITE	Sample Number	Au ppm	Description/Remarks	COLOR
417 - 422		ARK, TUFF SINTER	0 / W	M	0	0	T	0			ARKOSE, TUFF, TUFFACEOUS SLTST, SINTER GRAY, TAN, WHITE, BRN, GREEN	MULTI
422 - 427		↓	5% / W	M	↓	↓	T	T			↓	↓
427 - 432		↓	30% / M	W			T	T			+ 30% CLAY	
432 - 437		SLTST TUFF	30% / M	W			T	0			SLTST, TUFF, SILIC'D SLTST	TAN GRAY
437 - 442		↓	30% / M	W	↓		T	0				↓
442 - 447		↓	10% / M	W	2%		T	W			(BROWN BIO → CLAY)	BRN
447 - 452		SLTST CLAY	10% / M	W	0		M	0			SLTST, CLAYSTONE, CLAY FeOx M - BRICK RED CALCITE W THROUGHOUT	TAN GRAY BRICK RED
452 - 457		↓	10% / M	W	↓		T	W			AS ABOVE & 5% SINTER CALC W	TAN GRAY
457 - 462		SLTST CLAY SINTER	10% / M	W	↓		T	W			AS ABOVE & 20% SINTER	
462 - 467		SLTST CLAY	20% / S	0	↓		0	W			SLTST, CLAYSTONE, CLAY	
467 - 472		↓	20% / S	0	T		0	W			↓	GRAY
472 - 477		↓	20% / S	0	0		0	W			↓	↓
477 - 482		↓	20% / S	0	0		0	0			↓	↓
482 - 487		SLTST TUFF CLAY	10% / S	0	T		0	0			TUFF, TUFFACEOUS, SLTST, CLAY (BROWN BIOTITE → CLAY)	GRAY DK BRN
487 - 492		↓	20% / S	0	0		T	W			↓	↓
492 - 497		SLTST, TUFF CLAY, SINTER	5% / S	W	↓		T	W			SILIC'D SLTST, TUFF, CLAY 10% SINTER	↓
497 - 502		↓	20% / S	W	↓		0	0			↓	↓
502 - 507		↓	5% / S	W	↓		0	0			SLTST, TUFF, CLAY, SCATTERED SINTER	↓
507 - 512		↓	5% / S	T	↓		T	0			↓	↓
512 - 520		↓	5% / S	T	↓	↓	T	W			↓	↓

T.D.

Appendix D
Strata Test Pit Reports

STRATA

May 23, 2019
File: BO19059A

Ms. Nancy Wolverson
Calico Resources USA Corp
665 Anderson Street
Winnemucca, Nevada 89445

RE: **Geotechnical Engineering Evaluation**
Wastewater Drain Field Characterization
Grassy Mountain Mine
Malheur County, Oregon

Hello, Ms. Wolverson:

STRATA is pleased to present our authorized Geotechnical Engineering Evaluation for the proposed septic drain fields for the Grassy Mountain Mine located approximately 22.5 miles southwest of Nyssa, Oregon in Malheur County, Oregon. This report has been developed in accordance with our proposal, dated September 26, 2018. The purpose of our evaluation was to explore the subsurface conditions in areas designated by SPF Water Engineers in order to assist project planning and design of the proposed septic system drain fields.

The following report provides a summary of our investigation of subsurface conditions for sanitary disposal for the proposed development. It is our opinion that geotechnical continuity with the project team throughout construction will help identify suitable soils during excavation for the proposed septic drain field.

The project design, owner, and construction team must read, understand, and implement this report in its entirety. Portions of the report cannot be relied upon individually without the supporting text of remaining sections, appendices and plates. Our opinion is the success of the proposed construction will depend on following the report recommendations, good construction practices, and providing the necessary construction monitoring, testing, and consultation to verify that work has been constructed as recommended.

We appreciate the opportunity to work with Calico Resources USA and SPF Water Engineers and look forward to our continued involvement on this project throughout construction.

Sincerely,
STRATA

Daniel P. Zimmerman

REGISTERED PROFESSIONAL ENGINEER
5-23-19
84139PE

Daniel P. Zimmerman, P.E.
Project Engineer

OREGON
MARCH 9, 2010
DANIEL PETER GADO
EXPIRES: 6-30-2019

Daniel P. Gado

Daniel P. Gado, P.E.
Senior Engineer

DPZ/DPG/tb

Engineering Soil Report

Wastewater Drain Field Characterization
Grassy Mountain Mine
Malheur County, Oregon

Prepared For:

Ms. Nancy Wolverson
Calico Resources USA Corp
665 Anderson Street
Winnemucca, Nevada 89445

Prepared By:

STRATA
8653 West Hackamore Drive
Boise, Idaho 83709
P. 208.376.8200
F. 208.376.8201

May 23, 2019

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Plate 1: Exploration Location Plan
Appendix A: Exploratory Test Pit Logs and Unified Soil Classification System (USCS)
Appendix B: Laboratory Test Results

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Geotechnical Engineering Evaluation
Wastewater Drain Field Characterization
Grassy Mountain Mine
Malheur County, Oregon

INTRODUCTION

STRATA has performed our Geotechnical Engineering Evaluation for the proposed Wastewater Disposal Drain Field for the Grassy Mountain Mine Facility located approximately 21 miles south of the intersection of US 20 and Russell Road, in Malheur County, Oregon. The purpose of our evaluation was to explore the subsurface soil conditions at the project site and prepare geotechnical recommendations to assist project planning, design, and construction. Our geotechnical report could be used for planning the location of a septic drain field on the site. We accomplished our services referencing our authorized geotechnical proposal dated February 21, 2019, and authorized February 21, 2019. To accomplish our evaluation, STRATA performed the following services:

1. Provided geotechnical engineering observation during the excavation and sampling of the test pits. Samples of the various soils encountered were taken for classification and laboratory testing.
2. We performed three infiltration tests in the underlying permeable sand and gravel subsoil in the area of the proposed septic drain fields.
3. Laboratory testing was accomplished on select samples obtained from the test pits. The laboratory testing included grain-size analyses, fines content determinations (percent passing the No. 200 sieve), Atterberg limits, and moisture contents. Laboratory testing was accomplished referencing ASTM standards. Soil samples will be retained for a period of 90 days after completion of our field explorations and then discarded, unless we are notified otherwise.
4. The logs of the test pits and a location plan were prepared.
5. Performed geotechnical engineering analyses and developed recommendations for the feasibility of using on-site soils for infiltration of wastewater for septic drain field design.
6. Prepared a geotechnical engineering evaluation report summarizing our field and laboratory evaluations and engineering analyses for the project. Our report includes conclusions, opinions, and recommendations for the suitability of on-site soils for use as septic drain fields, subsurface infiltration rates, and anticipated ground water level for sanitary disposal areas.

PROJECT UNDERSTANDING

Existing Site Conditions

The project mine site is located approximately 2 miles south of Twin Springs Road and Rock Canyon Road in Malheur County, Oregon. The hilly terrain is covered with grasses and sage brush. The mine site will be located at a conical hill located at the south end of the site. On the hill, multiple primitive, single-lane roads have been constructed. We understand that the site has been considered for mining operation off and on for more than 30 years. Evidence of previous subsurface investigations are visible all over the hill. The hillside is covered with multiple boulders of sandstone, conglomerate, and basalt. Grades lessen to the east, north, and west of the hill. Drainage areas trend south to north to the west and east of the mine site. A spine consisting of surface rock extends to the north of the hill. Additional primitive, single-lane roads cross the site. The road to the mine crosses the spine at the base of the hill and extends to the east and south.

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Planned Septic Drain Field Locations

SPF Water Engineers (SPF) located twenty test pits in three areas to the northwest and northeast of the mine location to identify potential drain field sites. These three drain field site areas were designated areas A, B, and C by SPF. Area A was located north and south of the site entry road on the hillside west of the spine. Area B was located north of the entry road and north of Area A. These two areas were located on a west facing slope. The surface conditions in the vicinity of Area A consisted of grasses and sage brush. Area B surface vegetation was similar to that of Area A, but the surface also contained surficial boulders and cobbles. Area C was on the east side of the spine, north of the entry road on a northeast facing slope. The twenty test pits were located with GPS and staked.

SUBSURFACE EVALUATION PROCEDURES

STRATA accomplished a recent subsurface exploration on April 22, and 23, 2019 via twenty (20) exploratory test pits excavated between 3 and 10 feet below the existing ground surface (BGS). The approximate exploration locations are illustrated on Plate 1, *Exploration Location Plan.* Soil test pit locations were pre-staked by SPF, or established in the field, and located using GPS.

A geotechnical engineer visually evaluated the soil encountered in each test pit and logged the soil profile referencing the Unified Soil Classification System (USCS). We provide a brief USCS explanation in Appendix A to help interpret the terms on the test pit logs. We also provide individual test pit logs in Appendix A. The test pits remained open following the completion of the excavations to make the subsurface conditions available for inspection by Malheur County Health Department inspectors.

We accomplished in-situ infiltration testing in Test Pits TP-A1, TP-A4, and TP-B2 to assist in evaluating the infiltration rates for the granular soils encountered in these test pits. The tests were accomplished by excavating a roughly 6-inch diameter hole to a depth of approximately 6 inches. The bottom of the hole was cleaned and the soil was pre-saturated prior to performing infiltration test. Water depths were recorded at 5-minute intervals for a period of one-half hour. The results of the field infiltration tests are presented in Table 1.

Table 1. Field Infiltration Test Results

Test Pit	USCS Soil Classification	Depth (feet BGS)	Field Infiltration Rate (in/hr)
TP-A1	SP-SM	3.5	9
TP-A4	SP-SM	4	9
TP-B2	SM	2.5	9

SUBSURFACE CONDITIONS

All three drain field site areas generally had a topsoil layer consisting of clay or clayey sand that varied in thickness between 3 and 9 inches. Area A soils generally exhibited near-surface clays and clayey sands overlaying an alluvial permeable granular layer, overlaying soft sedimentary claystones and sandstone. Area A soils exposed near the entry road included fill that was not exposed throughout the test pit. Area B soils exhibited occasional coarse-grained layers underlying the surficial clayey soils, with thicker granular layers present higher on the hillside, in Test Pits TP-B2 and TP-B5. The rock layer underlaying the Area B soils consisted of claystone and sandstone, and were encountered closer to the ground surface,

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in general, than Area A. Area C soils were more clayey, with clayey soils extending from the ground surface down to basalt and claystone. It should be noted that the depths and thicknesses of the various soils encountered on the logs usually vary within the test pits, due to sloping ground surfaces and uneven deposition. We provide more specific discussion of each soil unit encountered below:

Area A Soils

Generally, thin layers of native granular soil above relatively shallow sedimentary rock were encountered in the Area A test pits located southwest of the road. These granular soils appear to be suitable for infiltration.

- **Uncontrolled Fill and Possible Fill – Silty Sand (SM), Poorly-graded Sand with Silt and Gravel (SP-SM), and Poorly-graded Gravel with Sand and Silt (GP-GM)** – Test Pits TP-A1 and TP-A3 were located adjacent to the entry road. We observed poorly-graded sand with silt and gravel (SP-SM) in Test Pit TP-A1 between depths of 2 and 5 feet BGS. The sand observed in Test Pit TP-A1 was not easily identifiable as fill, but we did not observe it in any other test pit. This possible fill was light brown, brown, white and rust, dense, and moist. We encountered sub-rounded and rounded, poorly-graded gravel with sand and silt (GP-GM) soils in TP-A3 that appeared to be imported fill, used to construct the entry road. The gravel encountered in TP-A3 was obviously placed, as it was an approximately 8-inch-thick layer exposed in the north end of the test pit, adjacent to the road at a depth of approximately 3 feet BGS. The gravel fill was medium dense to dense, light brown, and moist. Silty sand (SM) was observed above the layer of gravel in TP-A3. This soil was likely placed during road grading. The silty sand was brown, loose, and moist.
- **Native – Lean/Fat Clay (CL/CH) and Clayey Sand (SC) –** Native lean and fat clay (CL/CH, respectively) and clayey sand (SC) was encountered at the ground surface to depths of between 1 and 4 feet BGS in all but TP-A3. The surficial layers include 3 to 9 inches of topsoil with roots. The clay and sandy clay were brown, dark brown, and reddish-brown, soft to medium stiff near the surface to very stiff with depth, and slightly moist to moist. Clayey Sand (SC) was encountered in Test Pit TP-A4 between depths of approximately 2.5 to 3.5 feet BGS. The clayey sand was light brown, medium dense, and slightly moist.
- **Native – Silty Sand with Gravel (SM), Poorly-graded Gravel with Silt and Sand (GP-GM), Poorly-graded Sand with Silt and Gravel (SP-SM), and Well-Graded Sand with Silt, Gravel and Cobbles (SW-SM) –** We observed poorly-graded gravel with silt and sand (GP-GM) in Test Pit TP-A3 away from the road between depths of approximately 1 to 3.5 feet BGS. This soil was brown, medium dense to dense and moist. We encountered poorly-graded sand with gravel and silt (SP-SM) in Test Pit TP-A4 below the clay and clayey sand from 4 feet BGS to the depth excavated of 5 feet BGS. The depth to this soil varied across the test pit. We encountered silty sand (SM) in Test Pit TP-A5 below the surficial clay layer between depths of 1 and 4 feet BGS and between 1.5 and 3.5 feet in TP-A6. This soil was tan and brown to dark brown, medium dense, and slightly moist to moist. Well-graded sand with silt, gravel, and cobbles (SW-SM) was encountered in Test Pit TP-A6 from 3.5 to 5 feet BGS. The sand was brown, medium dense to dense, and slightly moist.

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- **Sedimentary Claystone and Sandstone –** Weathered sedimentary rock in the form of claystone and sandstone was encountered in every test pit except TP-A4 in the Area A test pits. This sedimentary rock was encountered between 3 feet and 5 feet BGS to the termination depths excavated in these test pits, which ranged from 5 to 9 feet BGS. The weathered sedimentary rock was very stiff to hard, dark brown, white, olive, rust, green and red and slightly moist to moist.
- **Groundwater –** We did not encounter groundwater at the time of exploration. According to Oregon Water Resources Department on-line well log data, groundwater is greater than 200 feet below the ground surface in this area. Groundwater is not expected to influence the proposed drain field in this area.

Area B Soils

Generally, soils encountered in the lower Area B test pits (Test Pits TP-B1, TP-B4A, and TP-B6) were generally not suitable for infiltration. These test pits were in areas where the ground surface contained rock outcroppings or surficial boulders, and suitable infiltration layers were thin or not present. The remaining Area B test pits (TP-B2, TP-B3 and TP-B5) exhibited surficial silty sand and poorly-graded sand with silt soil layers that may be suitable for infiltration.

- **Native – Lean/Fat Clay (CL/CH) and Clayey Sand (SC) –** Native lean and fat clay (CL/CH, respectively) and clayey sand (SC) was encountered at the ground surface to depths of between 2 and 2.5 feet BGS in Test Pits TP-B1, TP-B4A, and TP-B6. The surficial layers include 3 to 12 inches of topsoil with roots. The clay was brown, dark brown, and orangish-brown, medium stiff to very stiff, and moist. Clayey Sand (SC) was encountered in Test Pit TP-B4A from the ground surface to a depth of approximately 1-foot BGS. The clayey sand was dark brown, loose to medium dense, and very moist.
- **Native – Silty Sand with Gravel (SM), Poorly-graded Gravel with Clay and Sand (GP-GC), and Poorly-graded Sand with Silt and Gravel (SP-SM) –** We encountered silty sand (SM) in Test Pits TP-B2, TP-B3, and TP-B5 from the ground surface to depths of between 1.5 and 4 feet BGS. This soil was tan to brown, loose to medium dense, and moist. We observed poorly-graded gravel with clay and sand (GP-GC) in Test Pit TP-B4A between depths of approximately 2.5 to 3 feet BGS underlaying the surficial clayey sand and lean clay. This soil was orangish-brown, medium dense, and moist. Poorly-graded sand with silt (SP-SM) was encountered in Test Pit TP-B5 between 1.5 to 3.5 feet BGS. The sand was olive, medium dense to dense, and moist.
- **Sedimentary Claystone and Sandstone –** Weathered sedimentary rock in the form of claystone and sandstone was encountered in every test pit in the Area B test pits. Claystone and weathered claystone were encountered at 2 feet and 2.5 feet BGS to the depths excavated in Test Pits TP-B1 and TP-B6, respectively. Weathered sandstone and sandstone were observed below the surficial soils in the remaining Area B test pits from depths of 1.5 to 4 feet BGS to the depths to test pit termination depths of 3 to 9.5 feet BGS. The weathered sedimentary rock was very stiff to hard, tan, brown, white, olive, rust, pink and red and slightly moist to moist.
- **Groundwater –** We did not encounter groundwater at the time of exploration. According to Oregon Water Resources Department on-line well log data, groundwater is greater than 200 feet below the ground surface in this area. Groundwater is not expected to influence the proposed drain field in this area.

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Area C Soils

The subsurface conditions observed in Area C were generally not suitable for infiltration. We observed clayey soils overlying basalt and siltstone/claystone in this area. The depth that basalt and siltstone/claystone was encountered was generally between 1 foot and 6 feet BGS. Cobbles and boulders were observed in the near-surface clays is several test pits.

- **Native – Lean/Fat Clay (CL/CH) and Clayey Sand (SC) –** Native lean and fat clay (CL/CH, respectively) was encountered at the ground surface to depths of between 9 inches and 5 feet BGS in every Area C test pit. The surficial layers include 6 to 9 inches of topsoil with roots. The clay was brown, dark brown, and white, medium stiff to very stiff, and slightly moist to very moist. Clayey Sand (SC) was encountered in Test Pit TP-C2 through TP-C4 below the surficial clay layers. The clayey sand was encountered between 2 and 4.5 feet BGS in Test Pit TP-C2, between 2.5 and 4.5 feet in TP-C3, and between 4 and 6 feet BGS in TP-C4. An Atterberg limits test performed on the clayey sand indicated the clay portion consisted of fat clay. The clayey sand was tan, medium dense, and slightly moist to moist.

- **Sedimentary Siltstone/Claystone and Weathered Basalt –** Weathered sedimentary rock in the form of siltstone and claystone was encountered in the higher elevation test pits (Test Pits TP-C1 through TP-C4). Siltstone or claystone was encountered between 3 feet and 6 feet BGS in TP-C1; between 4.5 feet and 10 feet BGS in TP-C2; between 4.5 feet and 6 feet BGS in TP-C3; and between 6 and 10 feet BGS. The weathered sedimentary rock was very stiff, tan, brown, white, and olive, and slightly moist to moist. Weathered basalt was encountered below the surficial clay and clayey sand in Test Pits TP-C5 through TP-C8. The basalt was encountered between depths of 9 inches and 5 feet BGS to the total depths excavated. In Test Pit TP-C7, the basalt was in a soil matrix, meaning it could be weathered in place or indicative of colluvial soils.

- **Groundwater –** We did not encounter groundwater at the time of exploration According to Oregon Water Resources Department on-line well log data, groundwater is greater than 75 feet below the ground surface in this area. Groundwater is not expected to influence the proposed drain field in this area.

We provide a USCS classification summary and specific soil contacts and descriptions on individual test pit logs provided as Appendix A to this report. Subsurface variations may exist between exploration locations and may not be apparent until construction. Test pits only allow us to observe a portion of the site subsurface conditions. Where such variations exist, they may impact our opinions and recommendations presented, as well as construction timing and costs.

LABORATORY TESTING

We returned soil samples collected in the field to our laboratory for further classification and testing. Laboratory testing was accomplished referencing *ASTM* International (ASTM) procedures. We developed our laboratory testing program for this project primarily to evaluate subsurface characteristics and engineering properties. Specifically, we accomplished moisture content, Atterberg Limits, and gradation testing. We present laboratory test results on individual test pit logs located in Appendix A and individual laboratory test results in Appendix B. We will retain soil samples for 90 days and discard after this time period unless we are notified to store the samples for an extended period.

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GEOTECHNICAL OPINIONS AND RECOMMENDATIONS

We present the following geotechnical recommendations to assist infrastructure planning, design, and construction for the proposed septic drain fields at the Grassy Mountain Mine site located south approximately 20 miles south of Vale, Oregon in Malheur County, Oregon, as illustrated on Plate 1. This report provides a summary of our observations and recommendations for design criteria for the septic drain field, which the civil design and construction teams must review to verify the applicability for the planned construction. We base our recommendations on the results of our recent field evaluation, laboratory testing, our experience with similar soil conditions, and our understanding of the proposed construction. Once the location of the drain fields are finalized and a site grading and drainage plan is developed, STRATA must be notified to review these plans to verify our report recommendations have been incorporated into these plans.

Excavation Characteristics

Based on exploration results, it appears the near surface soil and soft sedimentary rock encountered in excavated test pits may be excavated with conventional equipment. Excavations can cave and slough and must be sloped back in accordance with *Occupational Health and Safety Act* (OSHA) guidelines. Fine to coarse-grained soil is expected to be exposed in excavations throughout the development area and should be temporarily sloped at 1.5H:1V (horizontal to vertical) for excavations deeper than 4 feet. Due to the potential for varying soil conditions at the time of construction, we recommend earthwork contractors evaluate each excavation configuration specific to OSHA guidelines and to seek appropriate professional guidance to ensure excavation safety and stability.

Septic Drain Field Sites

We explored three primary areas under consideration for septic drain field design. These areas and the locations of the test pits were identified and located by SPF Water Engineers as shown on Plate 1. Most of test pits in each area had surficial clayey soils that are not suitable for septic system design. Additionally, relatively impermeable sedimentary rock and weathered igneous rock was encountered at relatively shallow depths of 3 to 5 feet BGS within the majority of our test pits. The presence of shallow rock may create design challenges to maintain minimum separation depths from the base of the drain field to relatively impermeable rock below.

In Area A thin layers of potentially suitable infiltration soil were encountered in test pits TP-A1, TP-A3, TP-A4, TP-A5 and TP-A6. Soils considered suitable for infiltration include silty sand (SM), silty gravel, (GM), poorly-graded and well-graded sand and sand with silt (SP, SW, SP-SM, and SW-SM), and poorly-graded and well-graded gravel and gravel with silt (GP, GW, GP-GM, and GW-GM).

In Area B, we observed thin layers of granular soil that are potentially suitable for infiltration in the test pits located along the east side, or upslope (Test Pits TP-B2, TP-B3, and TP- B5). The remaining Area B test pits, and Test Pit TP-A2, were deemed not suitable for infiltration.

In Area C, test pits we did not observe any soil layers suitable for drain field design.

We performed three field infiltration tests—two tests in Area A soils, and one in Area B soils, as shown in Table 1, in the *Subsurface Evaluation Procedure* section of this report. The field infiltration rate for all three soils was approximately 9 inches per hour. We recommend using a maximum design infiltration rate of 4 inches per hour for the suitable infiltration soils identified in Areas A and B as described above.

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STRATA's scope of services does not include detailed design of septic drain fields. The presence of shallow bedrock throughout the study may require importing permeable filter sand above the acceptable native infiltration soils (identified above) to maintain minimum separation depths from the base of the infiltration field to the bedrock below.

Groundwater

Groundwater was not encountered within test pits excavated on site and is anticipated to be at depths greater than 75 feet BGS. Groundwater is not expected to influence the proposed drain field design based on the locations identified in this study.

GEOTECHNICAL DESIGN CONTINUITY

Geotechnical design continuity will be an important aspect of this project's successful completion. In our opinion, geotechnical continuity can occur in the planning, design and construction project aspects. Specifically, we recommend STRATA should be retained to provide geotechnical engineering oversight during excavation to identify suitable soil layers in the area of the drain field.

EVALUATION LIMITATIONS

This report has been prepared to assist project planning, design and construction of the proposed septic drain fields to be located at the Grassy Mountain Mine in Malheur County, Oregon. Our geotechnical findings and opinions have been developed based on the authorized subsurface exploration and laboratory testing, as well as our understanding of the project at this time. Our report findings and recommendations should not be extrapolated to other future site developments without allowing adequate geotechnical consultation by STRATA.

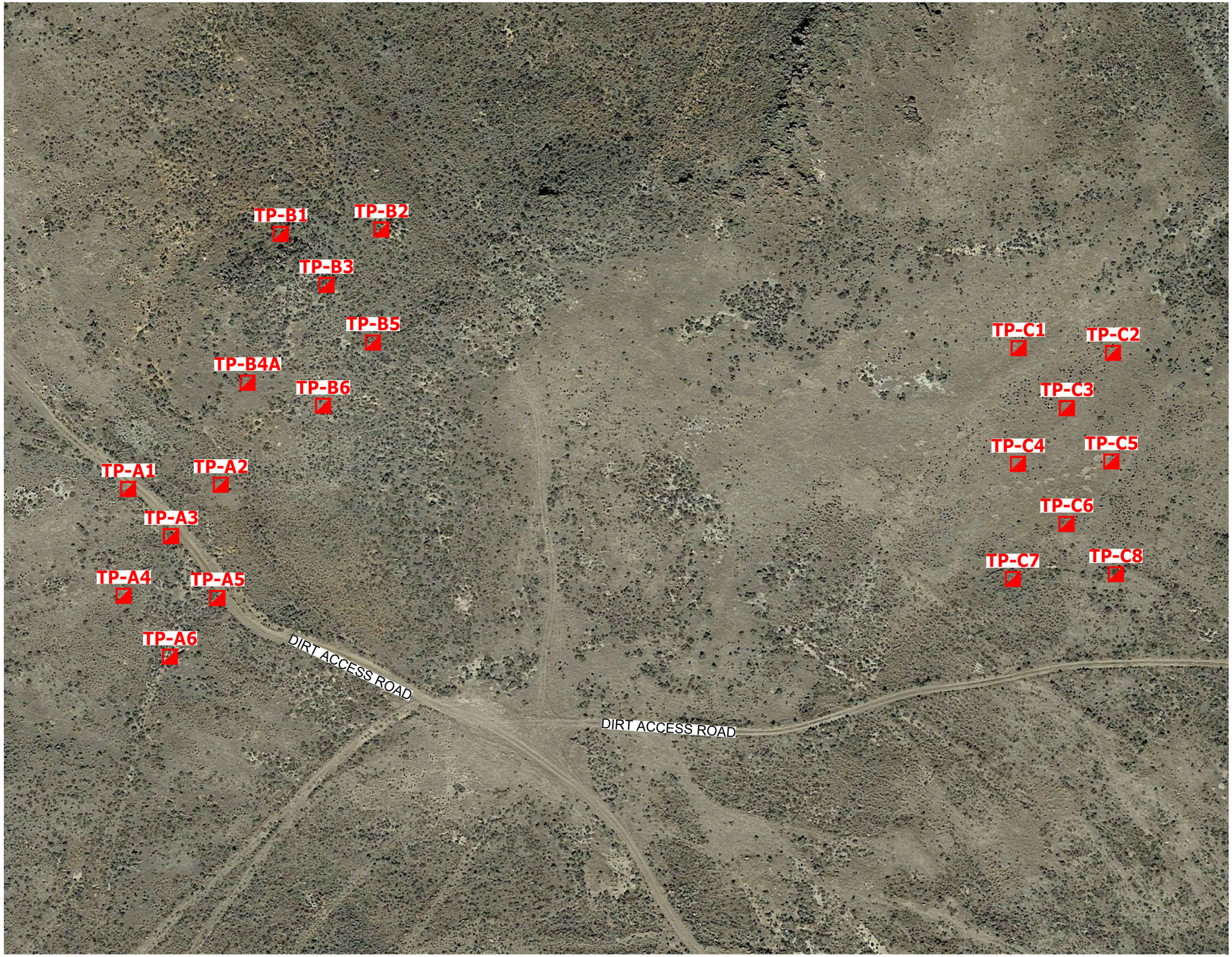
Subsurface variations may exist between exploration locations and may not be apparent until construction. Test pits only allow us to observe a portion of the site subsurface conditions. Where such variations exist, they may impact opinions and recommendations presented in this report, as well as construction timing and costs. Our services consist of professional opinions and findings made in accordance with generally accepted geotechnical engineering principles and practices in southeast Oregon at the time of this report. The geotechnical recommendations provided herein are based on the premise that appropriate geotechnical consultation during subsequent design phases is implemented and an adequate program of tests and observations will be conducted by STRATA during construction to verify compliance with our recommendations and to confirm conditions between exploration locations. This acknowledgment is in lieu of all warranties either express or implied.

The following plates and appendices accompany and complete this report:

Plate 1: Exploration Location Plan
Appendix A: Exploratory Test Pit Logs
Unified Soil Classification System (USCS)
Appendix B: Summary of Laboratory Test Results

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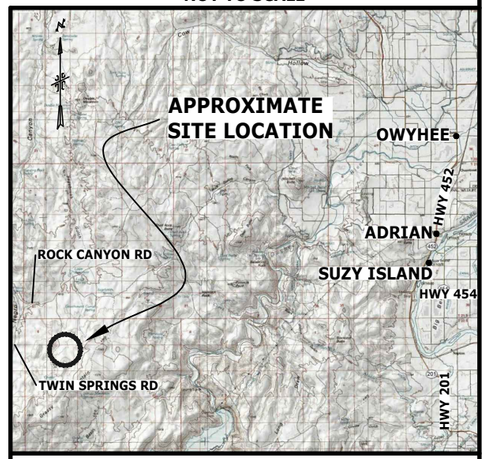


LEGEND

TP-1A — Approximate test pit location observed by STRATA on April 22 and 23, 2019

VICINITY MAP

NOT TO SCALE



EXPLORATION LOCATION PLAN

Wastewater Drain Field Characterization
Grassy Mountain Mine
Mahleur County, Idaho

0 60 120 240

SCALE: 1 inch = 120 ft

STRATA

DRAWING DATE: May 8, 2019

DRAWING BY: M. Taylor | CHECKED BY: D. Zimmerman

Client SPF Water Engineering | Project No. BO19059A | PLATE: 1

THIS PLAN COMPRISES A PORTION OF STRATA'S REPORT AND THE TEXT OF THE REPORT CONTAINS ESSENTIAL INFORMATION: BEFORE UTILIZING THIS PLAN FOR ANY PURPOSE WHATSOEVER, THE REPORT SHOULD BE READ COMPLETELY. THIS PLAN IS INTENDED TO HELP VISUALIZE THE INFORMATION PROVIDED IN THE REPORT. THESE LOCATIONS AND INFORMATION WERE ADDED TO EXISTING PLANS OF THE SITE PREVIOUSLY PREPARED BY OTHERS AND NO CHECK OF ACCURACY, CURRENCY, APPROPRIATENESS, ETC., OF INFORMATION PROVIDED BY OTHERS WAS PERFORMED, SINCE SUCH CHECKS WERE NOT PART OF STRATA'S SCOPE OF SERVICES.

REFERENCE: Image created from Google Earth Pro & Earth Point Topo Map, USGS Quadrangles, Dated 9-28-2015.

APPENDIX A

Exploratory Test Pit Log and Unified Soil Classification System (USCS)

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, FAT CLAY, (CH) dark brown, stiff, moist	0.0	CH						2.5		43.673480° N -117.361543° W
FAT CLAY, (CH) dark brown, stiff, moist		CH								
(POSSIBLE FILL) POORLY-GRADED SAND WITH SILT AND GRAVEL, (SP-SM) light brown, rust, white, rounded to subrounded, dense, moist	2.5	SP-SM		BG	7.7		6.3			Infiltration test performed at a depth of 3.5 feet BGS Field Infiltration Rate=9 in/hr
CLAYSTONE, dark brown, very stiff, moist, weathered, slickenside	5.0			BG						

Test Pit Terminated at 6.5 Feet.

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-A1
Project: BO19059A	**Date Excavated:** 04-22-2019
Backhoe: TB500RB	**Bucket Width:** 36
Depth to Groundwater: N.E.	**Logged By:** DPZ

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EXPLORATORY TEST PIT LOG

Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, FAT CLAY, (CH) dark reddish-brown, stiff, moist	0.0	CH								43.673465° N -117.361112° W
FAT CLAY, (CH) reddish-brown, stiff, moist		CH								
SILTY LEAN CLAY, (CL) reddish-brown, stiff to very stiff, moist	2.5	CL		BG						
CLAYSTONE, dark brown, rust, olive, white, hard, moist, weathered	5.0									
	7.5									

Test Pit Terminated at 9.0 Feet.

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-A2
Project: BO19059A	**Date Excavated:** 04-22-2019
Backhoe: TB500RB	**Bucket Width:** 36
Depth to Groundwater: N.E.	**Logged By:** DPZ

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EXPLORATORY TEST PIT LOG

Sheet 1 of 1

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USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, SILTY SAND, (SM) brown, loose, moist	0.0	SM								43.673305° N -117.361362° W Fill north side to approximately 3.5 feet
(NATIVE) - POORLY-GRADED GRAVEL WITH SILT AND SAND, (GP-GM) brown, medium dense to dense, moist		GP-GM		BG	8.8		11.1			With rounded gravel and occasional angler cobbles between 2 and 3.5 feet 8 inch layer imported subbase at 3 feet on north side
CLAYSTONE, rust, dark brown, red, green, white, stiff to hard, moist	2.5									
Test Pit Terminated at 5.0 Feet.	5.0									

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-A3	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-22-2019		
Backhoe: TB500RB	**Bucket Width:** 36		
Depth to Groundwater: N.E.	**Logged By:** DPZ		Sheet 1 of 1

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USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL	Atterberg Limits PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, CLAYEY SAND, (SC) dark brown, medium dense, moist	0.0	SC		BG	48.5		27.7	0.75	43	24	43.673109° N -117.361576° W Surficial cobbles and boulders
SANDY LEAN CLAY, (CL) light brown, stiff, slightly moist		CL		BG							
Contact depth varies	2.5										
CLAYEY SAND, (SC) light brown, medium dense, slightly moist		SC		BG	13.1		22.4		50	21	
POORLY-GRADED SAND WITH SILT AND GRAVEL, (SP-SM) tan, medium dense to dense, slightly moist		SP-SM		BG							
				BG	8.1		9.6				Infiltration test performed at a depth of 4 feet BGS Field Infiltration Rate=9 in/hr
Test Pit Terminated at 5.0 Feet.	5.0										

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-A4
Project: BO19059A	**Date Excavated:** 04-22-2019
Backhoe: TB500RB	**Bucket Width:** 36
Depth to Groundwater: N.E.	**Logged By:** DPZ

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EXPLORATORY TEST PIT LOG

Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, SANDY LEAN CLAY, (CL) dark brown, soft to medium stiff, moist	0.0	CL								43.673107° N -117.361146° W
COLLUVIUM, SILTY SAND WITH GRAVEL, (SM) brown to dark brown, medium dense, moist	2.5	SM		BG	13.7		10.9			Clay and sandstone pockets
CLAYSTONE AND CLAYEY SANDSTONE, dark brown, hard, moist	5.0									
Test Pit Terminated at 7.5 Feet.	7.5									

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-A5	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-22-2019		
Backhoe: TB500RB	**Bucket Width:** 36		Sheet 1 of 1
Depth to Groundwater: N.E.	**Logged By:** DPZ		

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USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, LEAN CLAY, (CL) dark brown, soft to medium stiff, moist	0.0	CL								43.672901° N -117.361369° W
LEAN CLAY, (CL) dark brown, soft to medium stiff, moist		CL								
SILTY SAND WITH GRAVEL, (SM) tan, medium dense, slightly moist	2.5	SM								
WELL-GRADED SAND WITH SILT AND GRAVEL, (SW-SM) brown, medium dense to dense, slightly moist		SW-SM		BG	8.4		13.2			
CLAYSTONE, white, brown, very stiff, slightly moist, weathered	5.0			BG				>4.5		

Test Pit Terminated at 5.5 Feet.

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-A6
Project: BO19059A	**Date Excavated:** 04-22-2019
Backhoe: TB500RB	**Bucket Width:** 36
Depth to Groundwater: N.E.	**Logged By:** DPZ

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EXPLORATORY TEST PIT LOG

Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, LEAN CLAY, (CL) brown, very stiff, moist	0.0	CL								43.674312° N -117.360853° W
LEAN CLAY WITH OCCASIONAL COBBLES, (CL) brown, very stiff, moist		CL								
Contact varies										
CLAYSTONE, orange to white, hard, slightly moist, weathered	2.5									
	5.0									
Test Pit Terminated at 6.0 Feet.										

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-B1	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-22-2019		
Backhoe: TB500RB	**Bucket Width:** 36		
Depth to Groundwater: N.E.	**Logged By:** DPZ		Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL	Atterberg Limits PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, SILTY SAND, (SM) light brown to brown, loose to medium dense, moist	0.0	SM									43.674320° N -117.360400° W
SILTY SAND, (SM) light brown, medium dense, moist	2.5	SM		BG	28.9		28.8		NV	NP	Infiltration test performed at a depth of 2.5 feet BGS Field Infiltration Rate=9 in/hr
SANDSTONE, brown and white, hard, slightly moist, weathered	5.0										
	7.5										
Test Pit Terminated at 9.5 Feet.											

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-B2
Project: BO19059A	**Date Excavated:** 04-22-2019
Backhoe: TB500RB	**Bucket Width:** 36
Depth to Groundwater: N.E.	**Logged By:** DPZ

STRATA

EXPLORATORY TEST PIT LOG

Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, SILTY SAND, (SM) brown, loose, moist	0.0	SM								43.674137° N -117.360650° W
SILTY SAND, (SM) brown, loose, moist		SM								
SANDSTONE TO WEATHERED SANDSTONE, tan, white, very dense, slightly moist	2.5									
Test Pit Terminated at 3.0 Feet.										

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-B3	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-22-2019		
Backhoe: TB500RB	**Bucket Width:** 36		
Depth to Groundwater: N.E.	**Logged By:** DPZ		Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, CLAYEY SAND, (SC) dark brown, loose to medium dense, very moist	0.0	SC								43.67381° N -117.36101° W
LEAN CLAY, (CL) orangish brown, very stiff, moist		CL								
POORLY-GRADED GRAVEL WITH CLAY AND SAND, (GP-GC) orange-brown, medium dense, moist	2.5	GP-GC		BG						
ROCK, SANDSTONE, red, pink, hard, slightly moist										Highly fractured

Test Pit Terminated at 4.0 Feet.

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-B4A	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-22-2019		
Backhoe: TB500RB	**Bucket Width:** 36		
Depth to Groundwater: N.E.	**Logged By:** DPZ		Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL	Atterberg Limits PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, SILTY SAND, (SM) brown, medium dense, moist	0.0	SM									43.673949° N -117.360438° W
SILTY SAND, (SM) brown, medium dense, moist		SM		BG	31.1		20.3		46	13	
POORLY-GRADED SAND WITH SILT AND GRAVEL, (SP-SM) olive, medium dense to dense, moist	2.5	SP-SM		BG	6.2		15.8				
SANDSTONE AND CLAYEY SANDSTONE, olive, white, very dense to hard, moist	5.0										

Test Pit Terminated at 5.5 Feet.

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-B5
Project: BO19059A	**Date Excavated:** 04-22-2019
Backhoe: TB500RB	**Bucket Width:** 36
Depth to Groundwater: N.E.	**Logged By:** DPZ

STRATA

EXPLORATORY TEST PIT LOG

Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, FAT CLAY, (CH) dark brown, medium stiff, moist	0.0	CH								43.673733° N -117.360661° W
FAT CLAY, (CH) dark brown, medium stiff, moist		CH								
LEAN CLAY, (CL) tan, stiff, slightly moist		CL								Possible colluvium
CLAYSTONE, rust, brown, white, very stiff, slightly moist, weathered	2.5									
CLAYSTONE, brown, hard, slightly moist										
Test Pit Terminated at 5.0 Feet.	5.0									

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-B6	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-22-2019		
Backhoe: TB500RB	**Bucket Width:** 36		
Depth to Groundwater: N.E.	**Logged By:** DPZ		Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, LEAN CLAY, (CL) brown, medium stiff to very stiff	0.0	CL								43.673932° N -117.357471° W
LEAN CLAY, (CL) brown, medium stiff to very stiff		CL								Occasional basalt cobbles between 2 and 3 feet
CLAYSTONE/SILTSTONE, brown, olive, white, very stiff, moist, weathered	2.5									
	5.0									

Test Pit Terminated at 6.0 Feet.

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-C1	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-23-2019		
Backhoe: TB500RB	**Bucket Width:** 36		
Depth to Groundwater: N.E.	**Logged By:** DPZ		Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL	Atterberg Limits PI	Remarks
TOPSOIL, LEAN CLAY, (CL) dark brown, medium stiff to stiff, moist	0.0	CL									43.673917° N -117.357036° W
LEAN CLAY, (CL) dark brown, medium stiff to stiff, moist		CL									
CLAYEY SAND, (SC) tan, medium dense, slightly moist	2.5	SC		BG	21.6		30.6	2.25	58	29	Note: BGS = Below Ground Surface
SILTSTONE/CLAYSTONE, brown, white, very stiff, moist, weathered	5.0										
	7.5										
Test Pit Terminated at 10.0 Feet.	10.0										

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-C2	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-23-2019		
Backhoe: TB500RB	**Bucket Width:** 36		
Depth to Groundwater: N.E.	**Logged By:** DPZ		Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, LEAN CLAY, (CL) dark brown to brown, medium stiff to stiff, moist to very moist	0.0	CL								43.673728° N -117.357246° W
LEAN CLAY, (CL) dark brown to brown, medium stiff to stiff, moist to very moist		CL								
CLAYEY SAND, (SC) tan, medium dense, moist	2.5	SC								
SILTSTONE/CLAYSTONE, brown, tan, very stiff, moist, weathered	5.0									

Test Pit Terminated at 6.0 Feet.

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-C3	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-23-2019		
Backhoe: TB500RB	**Bucket Width:** 36		
Depth to Groundwater: N.E.	**Logged By:** DPZ		Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, LEAN CLAY, (CL) dark brown, medium stiff, moist	0.0	CL								43.673545° N -117.357473° W
LEAN CLAY WITH OCCASIONAL SAND, (CL) dark brown, medium stiff to very stiff, moist	2.5	CL						3.25		
CLAYEY SAND, (SC) tan, medium dense, slightly moist	5.0	SC								
SILTSTONE, tan, white, very stiff, slightly moist, weathered	7.5									
Test Pit Terminated at 10.0 Feet.	10.0									

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-C4
Project: BO19059A	**Date Excavated:** 04-23-2019
Backhoe: TB500RB	**Bucket Width:** 36
Depth to Groundwater: N.E.	**Logged By:** DPZ

STRATA

EXPLORATORY TEST PIT LOG

Sheet 1 of 1

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USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, LEAN CLAY, (CL) dark brown, medium stiff to very stiff, moist	0.0	CL								43.673549° N -117.357043° W
LEAN CLAY, (CL) dark brown, medium stiff to very stiff, moist	2.5	CL								
BASALT, weathered	5.0									
Test Pit Terminated at 6.5 Feet.										

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-C5	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-23-2019		
Backhoe: TB500RB	**Bucket Width:** 36		
Depth to Groundwater: N.E.	**Logged By:** DPZ		Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:38 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, LEAN CLAY, (CL) brown, stiff, moist	0.0	CL								43.673344° N -117.357248° W
LEAN CLAY WITH SILT, SAND AND COBBLES, (CL) brown, stiff, moist		CL						2.5		
FAT CLAY WITH GRAVEL, (CH) dark brown with white, stiff to very stiff, moist	2.5	CH						2.0		Possible colluvium
Contact varies										
BASALT, weathered	5.0									

Test Pit Terminated at 6.0 Feet.

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-C6	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-22-2019		
Backhoe: TB500RB	**Bucket Width:** 36		
Depth to Groundwater: N.E.	**Logged By:** DPZ		Sheet 1 of 1

STRATA TEST PIT - STRATA.GDT - 5/21/19 14:39 - V:\STRATA - IDAHO PROJECTS\STRATA - BOISE PROJECTS\2019 PROJECTS\BO19059A - GRASSY MT MINE-CALICO RESOURCES USA\ELECTRONIC LOGS\BO19059A TP LOGS.GPJ

USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, LEAN CLAY, (CL) dark brown, medium stiff, moist	0.0	CL								43.673164° N -117.357498° W
COLLUVIUM, BASALT, IN A SILT, SAND, AND CLAY MATRIX, cobbles and boulders > 18 inch, or possible weathered in place	2.5									
Test Pit Terminated at 4.5 Feet.										

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-C7	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-22-2019		
Backhoe: TB500RB	**Bucket Width:** 36		
Depth to Groundwater: N.E.	**Logged By:** DPZ		Sheet 1 of 1

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USCS Description	Depth (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
TOPSOIL, LEAN CLAY, (CL) dark brown, stiff, very moist	0.0	CL								43.673178° N -117.357023° W
LEAN CLAY WITH SURFICIAL COBBLES, (CL) dark brown, stiff, very moist at surface to slightly moist below 2 feet	2.5	CL								
BASALT, weathered	5.0									
	7.5									
Test Pit Terminated at 8.0 Feet.										

Client: Calico Resources USA Corp.	**Test Pit Number:** TP-C8	STRATA	**EXPLORATORY TEST PIT LOG**
Project: BO19059A	**Date Excavated:** 04-22-2019		
Backhoe: TB500RB	**Bucket Width:** 36		
Depth to Groundwater: N.E.	**Logged By:** DPZ		Sheet 1 of 1

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UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL NAMES
COARSE GRAINED SOIL	GRAVEL	CLEAN GRAVEL		GW	Well-Graded Gravel, Gravel-Sand Mixtures.
				GP	Poorly-Graded Gravel, Gravel-Sand Mixtures.
		GRAVEL WITH FINES		GM	Silty Gravel, Gravel-Sand-Silt Mixtures.
				GC	Clayey Gravel, Gravel-Sand-Clay Mixtures.
	SAND	CLEAN SAND		SW	Well-Graded Sand, Gravelly Sand.
				SP	Poorly-Graded Sand, Gravelly Sand.
		SAND WITH FINES		SM	Silty Sand, Sand-Silt Mixtures.
				SC	Clayey Sand, Sand-Clay Mixtures.
FINE GRAINED SOIL	SILT AND CLAY LIQUID LIMIT LESS THAN 50%			ML	Inorganic Silt, Sandy or Clayey Silt.
				CL	Inorganic Clay of Low to Medium Plasticity, Sandy or Silty Clay.
				OL	Organic Silt and Clay of Low Plasticity.
	SILT AND CLAY LIQUID LIMIT GREATER THAN 50%			MH	Inorganic Silt, Micaceous Silt, Plastic Silt.
				CH	Inorganic Clay of High Plasticity, Fat Clay.
				OH	Organic Clay of Medium to High Plasticity.
				PT	Peat, Muck and Other Highly Organic Soil.

BORING LOG SYMBOLS

- Standard 2-Inch OD Split-Spoon Sample
- California Modified 3-Inch OD Split-Spoon Sample
- Rock Core
- Shelby Tube 3-Inch OD Undisturbed Sample

GROUNDWATER SYMBOLS

- Groundwater After 24 Hours
- (7-3-07) Indicates Date of Reading
- Groundwater at Time of Drilling

TEST PIT LOG SYMBOLS

- BG — Baggie Sample
- BK — Bulk Sample
- RG — Ring Sample

Shorthand Notation:
BGS = Below Existing Ground Surface
N.E. = None Encountered

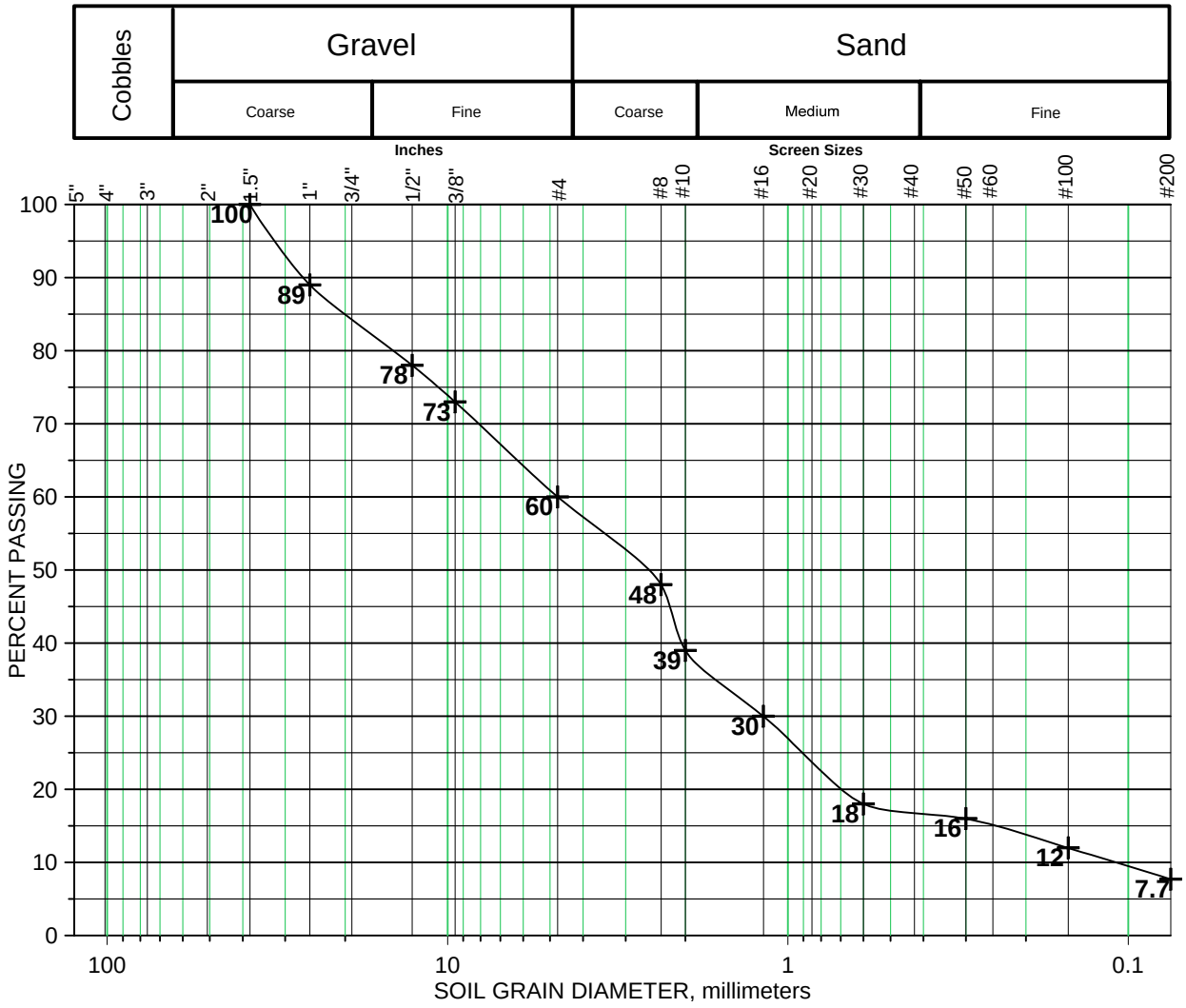
STRATA

APPENDIX B

Summary of Laboratory Test Results

GRADATION ANALYSIS
ASTM D 6913

Project: Grassy Mountain Mine
Client: Calico Resources USA Corp
Project Number: BO19059A
Sample Number: BL190304
Sample Location: TP-A1 @ 2'-3'
Sample Classification: Poorly-graded Sand with Silt and Gravel (SP-SM)
Moisture Content: 6.3%
Date tested: 4/25/19 By: K. Irwin

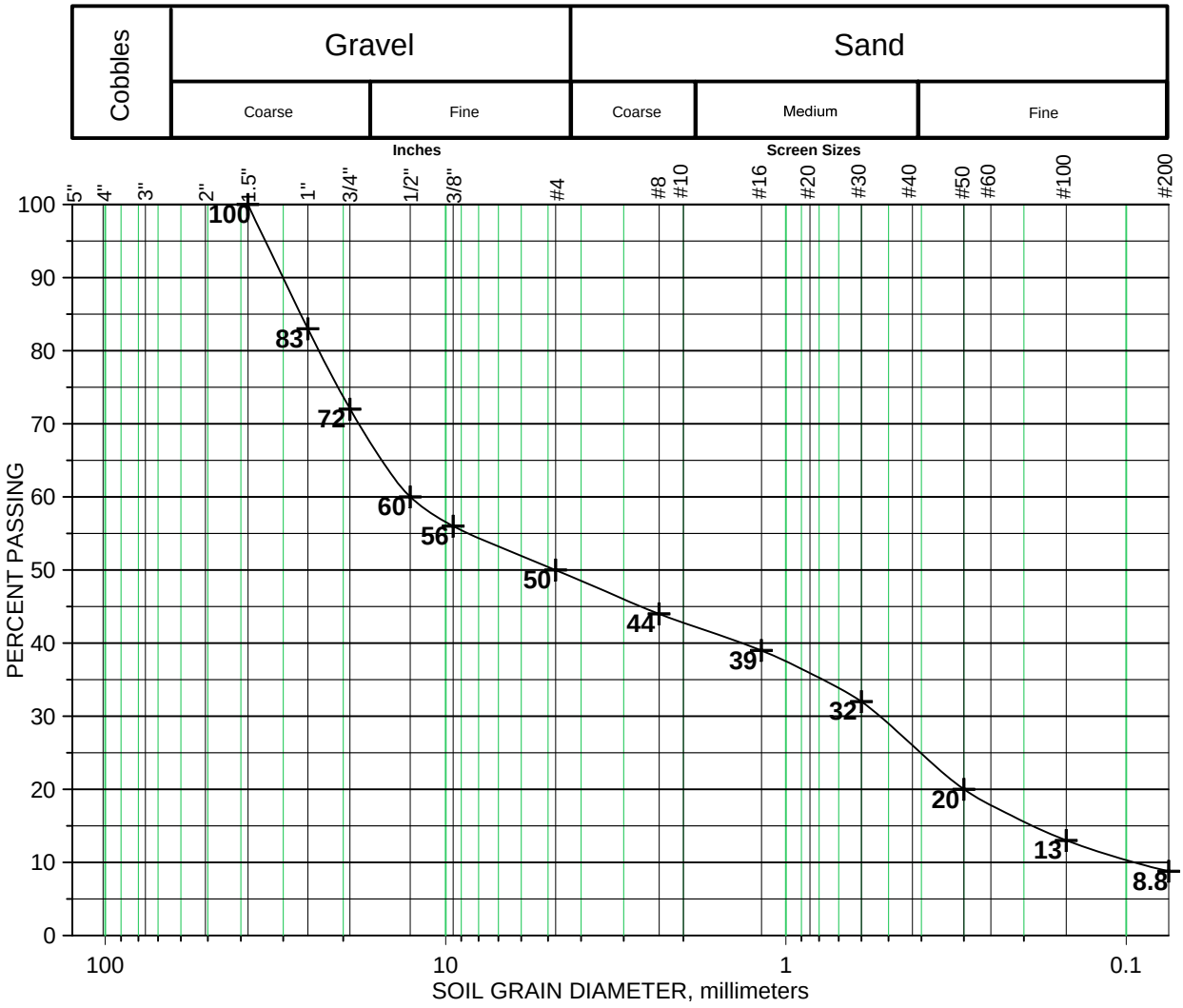


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GRADATION ANALYSIS
ASTM D 6913

Project: Grassy Mountain Mine
Client: Calico Resources USA Corp
Project Number: BO19059A
Sample Number: BL190305
Sample Location: TP-A3 @ 1.5'-2.5'
Sample Classification: Poorly-graded Gravel with Silt and Sand (GP-GM)
Moisture Content: 11.1%
Date tested: 4/25/19 By: K. Irwin

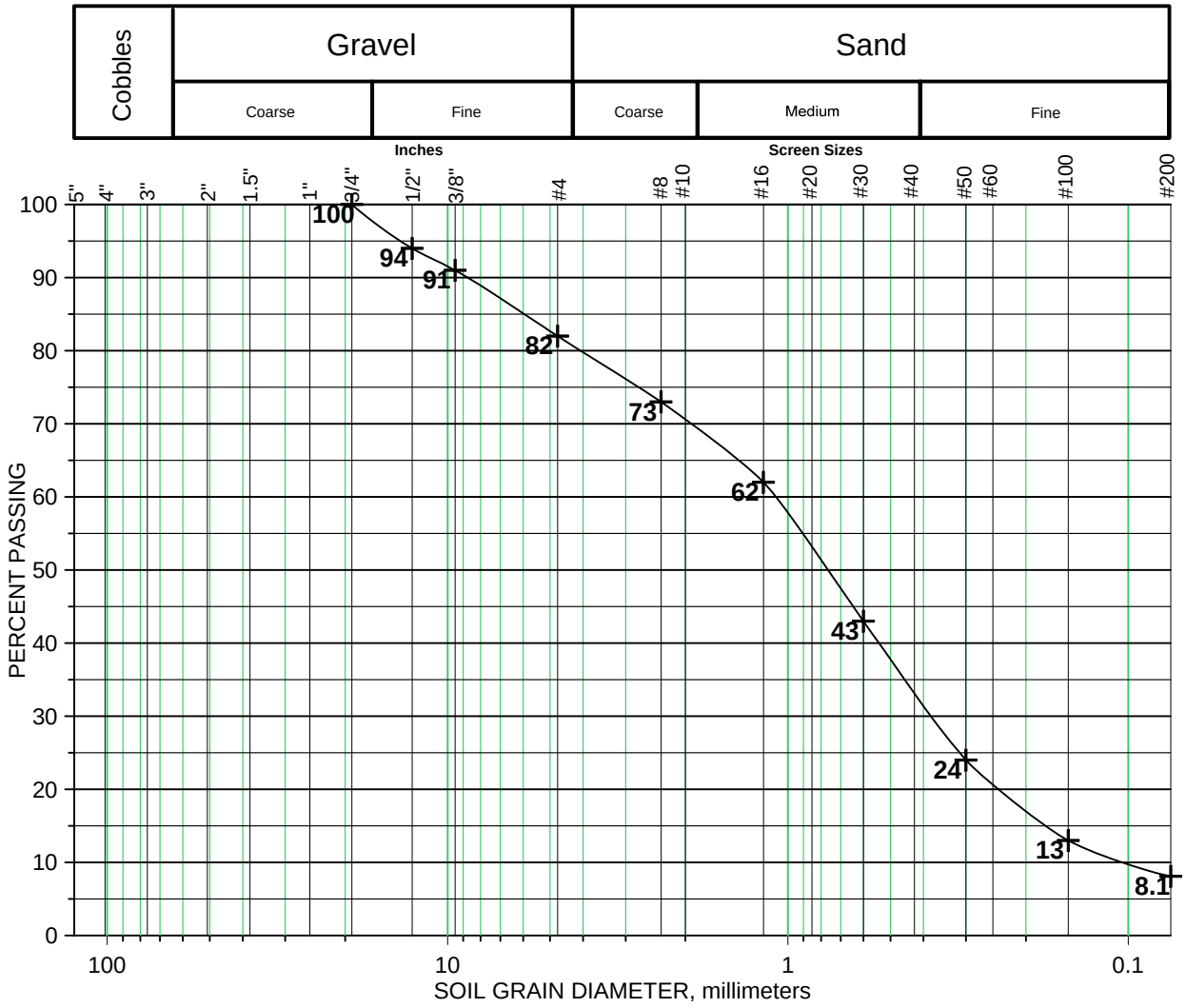


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GRADATION ANALYSIS
ASTM D 6913

Project: Grassy Mountain Mine
Client: Calico Resources USA Corp
Project Number: BO19059A
Sample Number: BL190309
Sample Location: TP-A4 @ 4'-5'
Sample Classification: Poorly-graded Sand with Silt and Gravel (SP-SM)
Moisture Content: 9.6%
Date tested: 4/25/19 By: K. Irwin

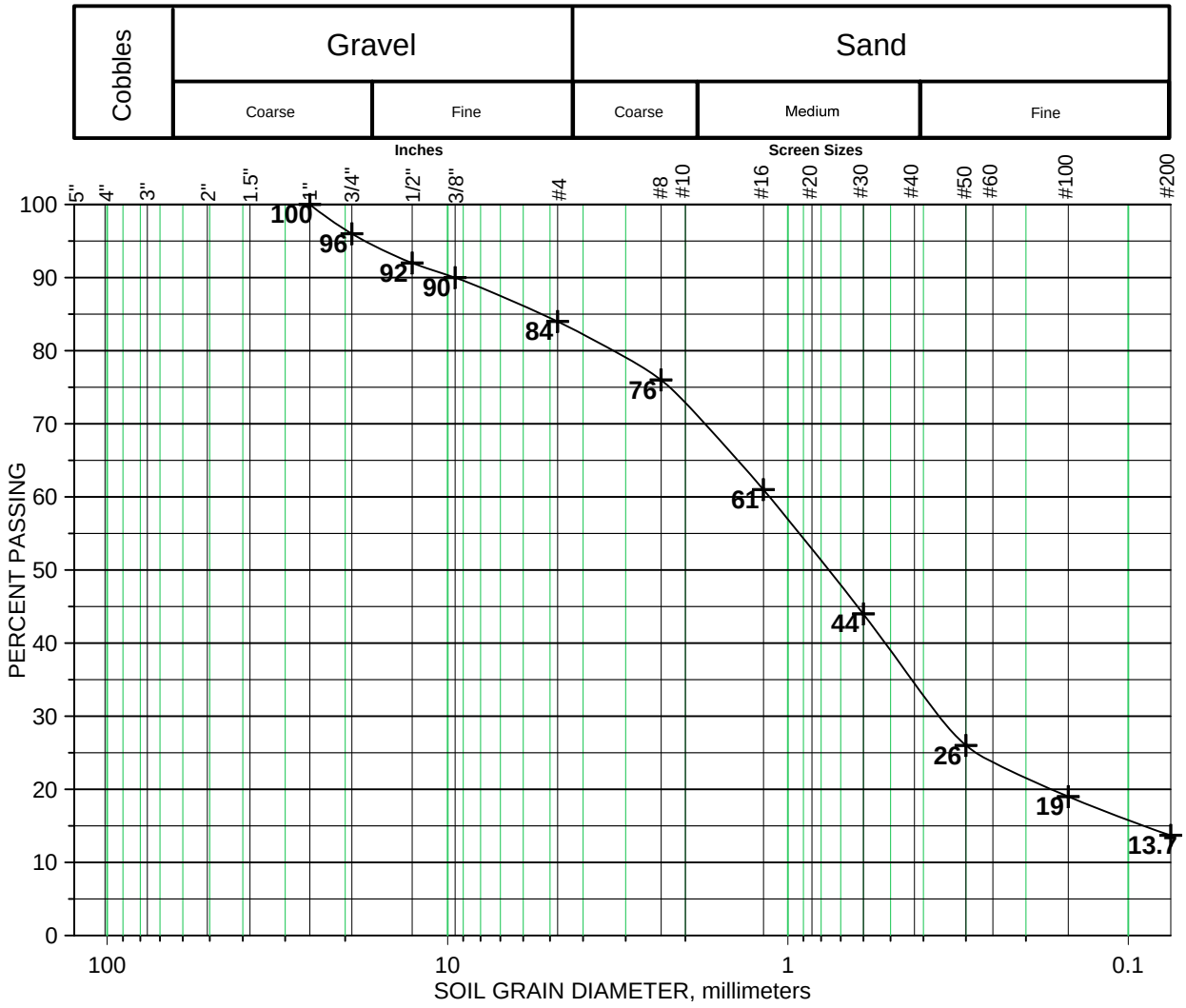


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GRADATION ANALYSIS
ASTM D 6913

Project: Grassy Mountain Mine
Client: Calico Resources USA Corp
Project Number: BO19059A
Sample Number: BL190310
Sample Location: TP-A5 @ 3'-4'
Sample Classification: Silty Sand with Gravel (SM)
Moisture Content: 10.9%
Date tested: 4/25/19 By: K. Irwin

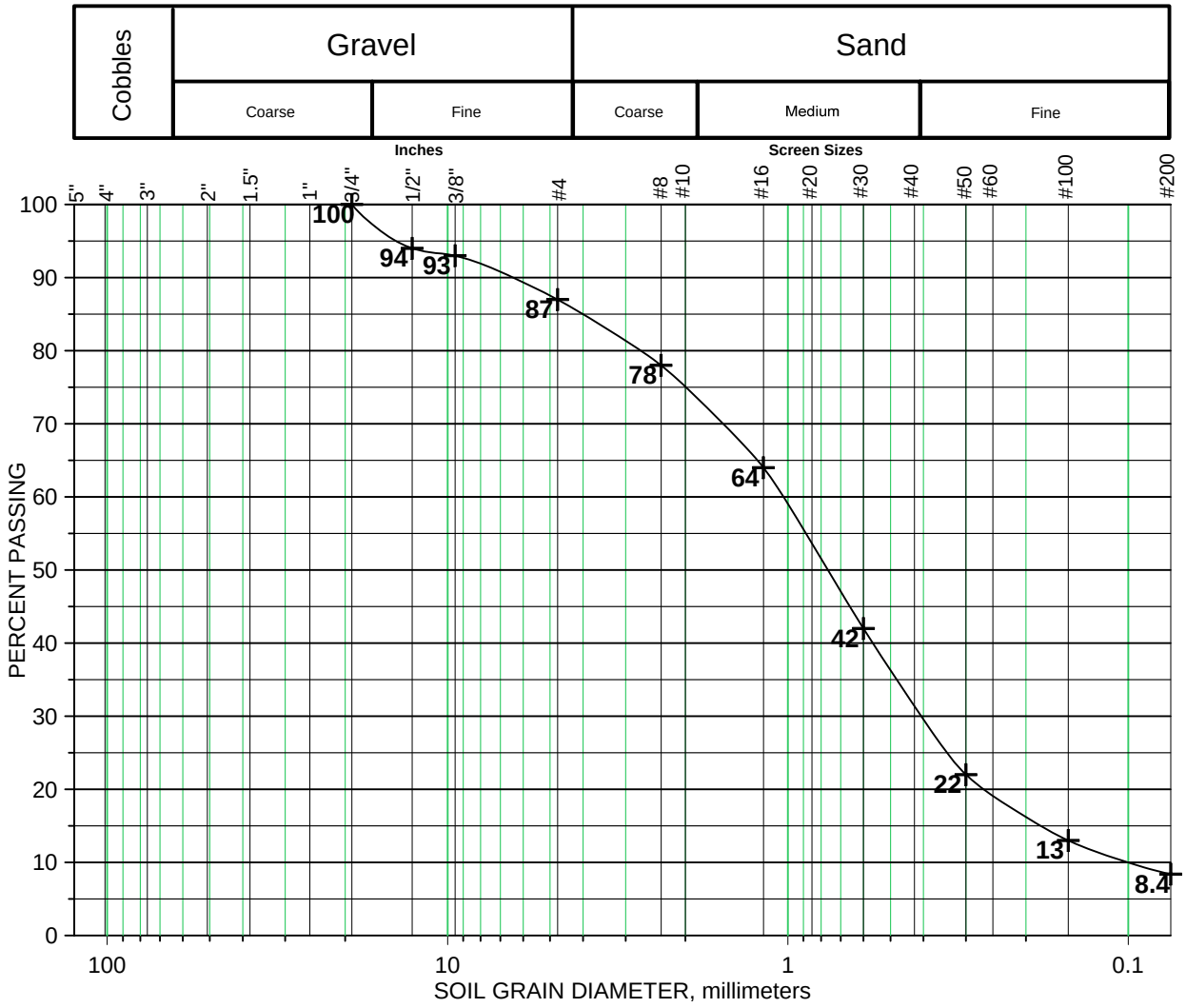


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GRADATION ANALYSIS
ASTM D 6913

Project: Grassy Mountain Mine
Client: Calico Resources USA Corp
Project Number: BO19059A
Sample Number: BL190311
Sample Location: TP-A6 @ 4'-5'
Sample Classification: Well-graded Sand with Silt and Gravel (SW-SM)
Moisture Content: 13.2%
Date tested: 4/25/19 By: K. Irwin

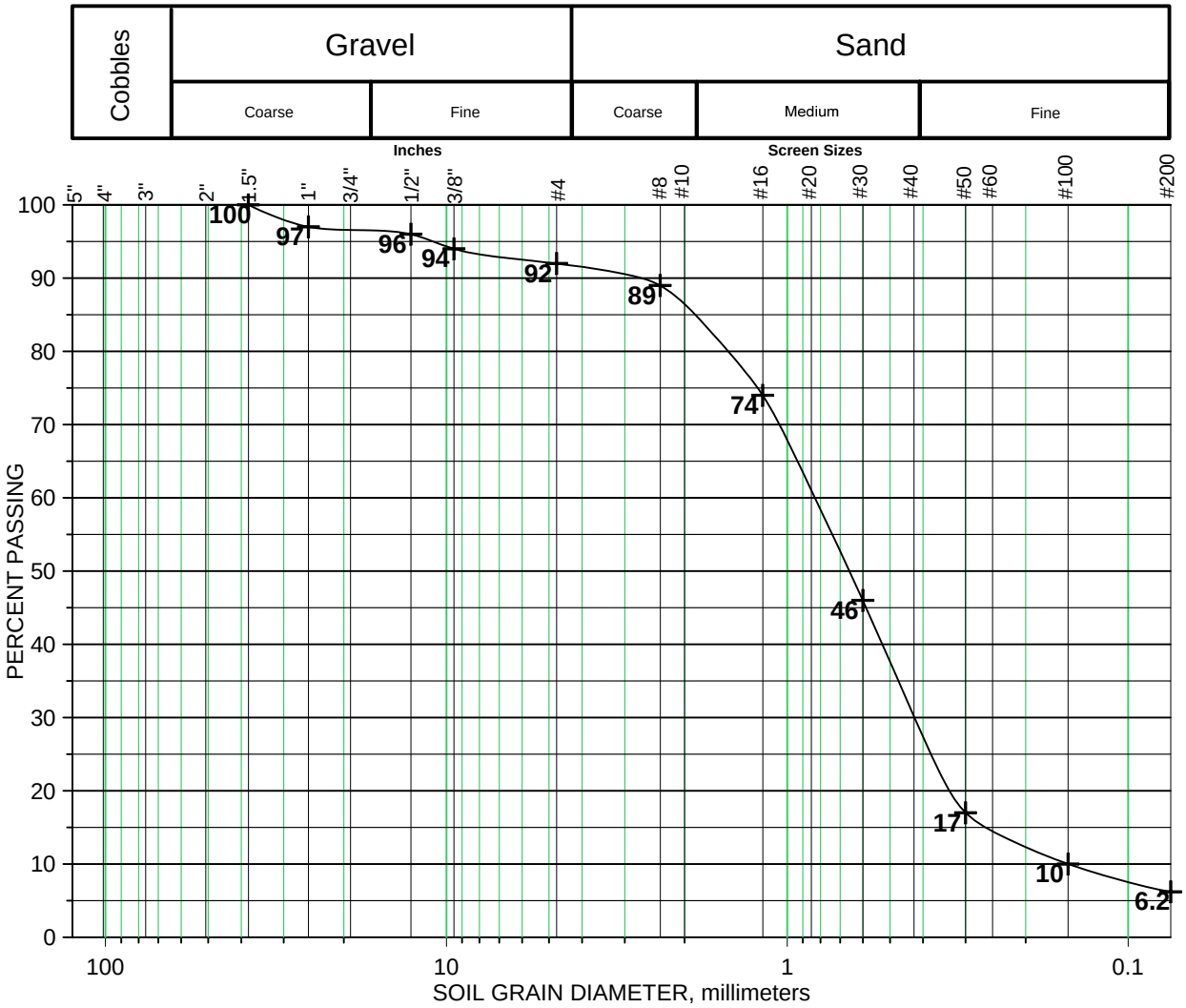


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GRADATION ANALYSIS
ASTM D 6913

Project: Grassy Mountain Mine
Client: Calico Resources USA Corp
Project Number: BO19059A
Sample Number: BL190316
Sample Location: TP-B5 @ 3'-3.5'
Sample Classification: Poorly-graded Sand with Silt and Gravel (SP-SM)
Moisture Content: 15.8%
Date tested: 4/25/19 By: K. Irwin



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Summary of Test Results

Project: Grassy Mountain Mine
Client: Calico Resources USA Corp

Project Number: BO19059A
Date: 5/10/2019

Test Pit	Depth (Feet)	Lab Number	Soil Classification (remarks)	In Situ Moisture, %	Passing No. 200,%	Atterberg Limits LL	Atterberg Limits PI	Fines Class.
TP-A1	2'-3'	BL190304	Poorly-graded Sand with Silt and Gravel (SP-SM)	6.3	7.7	-	-	ML
TP-A3	1.5'-2.5'	BL190305	Poorly-graded Gravel with Silt and Sand (GP-GM)	11.1	8.8	-	-	ML
TP-A4	0'-1'	BL190306	Clayey Sand (SC)	27.7	48.5	43	24	CL
TP-A4	3'-3.5'	BL190307&308	Clayey Sand (SC)	22.4	13.1	50	21	CH
TP-A4	4'-5'	BL190309	Poorly-graded Sand with Silt and Gravel (SP-SM)	9.6	8.1	-	-	ML
TP-A5	3'-4'	BL190310	Silty Sand with Gravel (SM)	10.9	13.7	-	-	ML
TP-A6	4'-5'	BL190311	Well-graded Sand with Silt and Gravel (SW-SM)	13.2	8.4	-	-	ML
TP-B2	3'-4'	BL190312&313	Silty Sand (SM)	28.8	28.9	NV	NP	ML
TP-B5	1'-1.5'	BL190314&315	Silty Sand (SM)	20.3	31.1	46	13	ML
TP-B5	3'-3.5'	BL190316	Poorly-graded Sand with Silt and Gravel (SP-SM)	15.8	6.2	-	-	ML
TP-C2	3'-4'	BL190317&318	Clayey Sand (SC)	30.6	21.6	58	29	CH

Reviewed By: _____

8653 West Hackamore Drive, Boise, Idaho 83709 Phone 208.376.8200 Fax 208.376.8201
www.stratageotech.com

Appendix E
ODEQ Email

Matt Rasmusson

From: BROWN Larry <Larry.BROWN@state.or.us>
Sent: Thursday, May 16, 2019 9:19 AM
To: Matt Rasmusson
Cc: GEDDES Craig; Jason Thompson
Subject: Calico/Grassy Mountain Site Evaluation for Onsite sewage treatment and disposal

Follow Up Flag: Follow up
Flag Status: Flagged

Good Morning Matt:

The purpose of the site evaluation was to locate suitable soils in an area that is large enough for both the initial drainfield area and the replacement drainfield area. The criteria used for this site evaluation can be found in Oregon Administrative Rules (OAR) 340-071. Soil test pits and other site features were evaluated during the site visit. In the site inspection, the following features were evaluated:

- Soil types - how well they drain and other evidence of good soil structure for treatment
- Depth to groundwater or if groundwater is present.
- Slopes, escarpments, ground surface variations, topography
- Creeks or springs on the site or adjacent properties
- Whether the soils have been disturbed
- Setbacks from property lines, buildings, water lines, and other utilities
- Other site features that could affect the placement of the on-site septic system.

I have reviewed the site evaluation soil notes from Malheur County and discussed the findings with Craig Geddes. The majority of soils at this site include Class C soils which normally require a minimum of 125 linear feet of disposal trench per 150 gpd flow based on the soil depth observed. If pretreatment is utilized then 50 linear feet of disposal trench per 150 gpd flow would be required. With 10% slopes one would normally need to install a septic system as serial distribution. However, considering the flows and with large systems requiring pressurization, I am requiring equal distribution via a hydrosplitter; 18 to 24 inch trench depths. The 24 inch trench depth limitation is a conservative action due to the presence of a durapan observed at this site. Both areas A and B are approved. Do not extend drainlines past the large sage plant vegetation areas.

This system must be installed under dry soil conditions to reduce smearing. If smearing occurs, the sidewalls are to be raked. The site of disturbance must be reseeded. New vegetative growth (root development) will aid in any compaction/smearing created during the installation process. Both the initial and replacement disposal areas are to be protected from traffic, cover, development or other potential disturbance of natural soil conditions. Any road cuts downslope of the system will require 25 to 50 foot setback between the road cut to the lowest drainline. The area must not be subjected to excessive saturation due to; but not limited to: artificial drainage of ground surfaces, roads, driveways and building down spouts. Placement of a well within 100 feet of the approved areas invalidate this approval. Additionally, any alteration of natural soil conditions (i.e. cutting or filling) in the acceptable area may void this approval as well.

With predicted peak flows of 4,320 gpd, a standard system would require 3,600 linear feet of disposal trench for the initial system, 3,600 linear feet for the repair. In either situation pretreatment could be utilized thus reducing the linear footage requirement to 1,440 linear feet. Large system rules apply as stipulated in OAR 340-071-0520.

Now we need to wait until the written assessment concerning the impact of the proposed system on the quality of public waters and public health is conducted; and accepted and approved by DEQ before finalizing the sewage treatment and disposal septic system requirements.

If you have any questions, please contact me.

Sincerely,

Lawrence (Larry) Brown REHS
Environmental Health Specialist
DEQ Eastern Region - Water Quality Land Application
475 NE Bellevue Drive - Suite 110
Bend, OR 97701
Phone: (541) 633-2025
Fax: (541) 388-8283

Appendix D
O&M Manual

Grassy Mountain Gold Project
Wastewater Facilities

Operations and Maintenance Manual

Prepared for

Calico Resources USA Corp
665 Anderson Street
Winnemucca, Nevada 89445

Prepared by

SPF Water Engineering, LLC
300 East Mallard, Suite 350
Boise, Idaho 83706
(208) 383-4140

August 19, 2019



SPF WATER ENGINEERING

Summary and Notice to Contractor

SPF Water Engineering, LLC has prepared a draft Operations and Maintenance (O&M) manual for a wastewater disposal system at the proposed Grassy Mountain Gold Mine in Malheur County, Oregon. The contractor shall update this O&M manual to include component specifications of the As-built system and all deviations from the design plans.

The Mine and Process Area will be located in Malheur County, Oregon, approximately 22 miles south-southwest of Vale. The daily average domestic wastewater design flow is estimated to be 3,920 gpd. This value assumes 112 workers at the mine per day and an average day potable water demand of 35 gpd (based on OAR 340-071-0220 for factories with shower facilities). The plant and mine offices and associated change houses are expected to include showers, wash basins, and toilets. There will not be on-site laundry facilities.

Strata advanced 20 soil test pits on April 22 and 23, 2019. Shallow soil characteristics, including soil type and infiltration capacity, were characterized from these test pits. The test pits were divided into three test areas: A, B, and C. Test Area B is where the primary drainfield is located. Test Area A is where the replacement drainfield is located. Test Area C, located approximately 800 feet to the east, was found to be unsuitable for a drainfield location due to impermeable soils. During test pit excavation, groundwater was not encountered. Three field infiltration rate tests were performed, two in Test Area A and one in Test Area B, with all three soils tested to have an infiltration rate of 9 inches per hour. Larry Brown, with the Oregon Department of Environmental Quality, has also written a site evaluation email based on the test pits and other site features (Appendix A of the PER).

The new wastewater disposal system has been designed to accommodate a daily design flow of 4,320-gallons per day (GPD). The disposal rate for type C soils is 0.4 gpd/SF which results in a 3,600 SF drainfield. Because the design flow is over 2,500 GPD, a pressurized drainfield system was required. The system generally consists of an 8,800 gallon septic tank, a 1,200 gallon dose tank, an effluent filter, duplex effluent pumps, 2-inch PVC transport piping and manifolds and 2-inch PVC laterals with 1/8” orifices. The system is design to dose on demand based on level indicated by a float assembly.

This manual provides information and documents to conduct adequate operation and maintenance of the wastewater disposal system. For reference, the Project Drawing Plan Set is included in Appendix A, Wastewater System Component Specifications are included in Appendix B, Manufacturer Installation, Maintenance and Troubleshooting Manuals are included in Appendix C, and the Wastewater System Inspection Report Form is included in Appendix D.

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Appendix A: Project Design Drawing Set

Appendix B: Wastewater System Component Specifications

Appendix C: Manufacturer Installation, Maintenance, & Troubleshooting Guides

Appendix D: Inspection Report Form

1. WASTEWATER SYSTEM

1.1. Project Components

The Grassy Mountain Gold Site wastewater disposal system consists generally of the following components:

- (1) 8,800 gallon single compartment precast concrete septic tank
- (1) 1,200 gallon dose tank
- (1) 8" diameter Orenco Biotube effluent filter
- (2) 1-hp submersible effluent pumps single phase 230 volt. The pumps are designed to work alternately under normal operation and will both turn on when activated by the high water alarm. The design operating point of each pump is 60-gpm with a total dynamic head of 60-feet.
- (1) Four float control switch assembly consisting of one low level alarm float, an emergency high-level alarm/both pumps on float, and lead pump on and lead pump off floats. The float control switches are UL listed and CSA certified for use in sewage, and are non-mercury mechanical types.
- (1) Duplex control panel with liquid level alarm. The control panel is UL-508 rated, programmable for timed/demand-dosing applications, pump alternation continues during override conditions, and has an audible and a visual alarm with an automatic reset function.
- Flexible pipe connections at septic tank
- 2-inch diameter transport piping and manifolds
- (24) – 150-ft long pressurized distribution laterals with 11-ft spacing. Laterals are 2-inch diameter SCH 40 PVC. Each lateral contains 38, 1/8", orifices at the bottom of the pipe at 4-ft spacing and long sweep elbows at each end for cleanings and maintenance.
- (24) Drainfield absorption trenches. The bed is 10,800 square feet with (2) observation ports. Please see the detail drawing on Sheet C506 in Appendix A of the PER for bed profile specifications.
- Distribution valve
- Ribbed PVC manhole risers

The Oregon Department of Environmental Quality, Chapter 340, Division 71 Onsite Wastewater Treatment Systems was used as a guide for the design.

2. OPERATION AND MAINTENANCE

2.1. Operation

The system owner/operator is responsible for the successful operation of the wastewater system. The primary maintenance responsibilities include monitoring sludge levels in the septic and dose tanks and cleaning the effluent filter. The observation ports within the drainfield should be inspected to check for evidence of ponding.

2.2. Maintenance & Reporting

The owner/operator is responsible for the maintenance and inspection of the wastewater disposal system. The maintenance and inspection of the wastewater system shall be done in accordance with the schedule below and the inspection form provided in Appendix D. Inspections should be conducted at a minimum of every 6-months. Additional inspections may be necessary if any degradation of performance is observed.

The owner/operator is responsible for a minimum of the following:

- Maintaining unobstructed gravity sewer flow from the cleanout to the septic tank
- Maintaining the acceptable sludge levels in the septic chamber
- Ensuring that the pumps are operating properly
- Ensuring that the float switches and alarms are functioning properly
- Inspecting and cleaning effluent filter
- Monitoring of observation ports to look for evidence of ponding
- Maintaining documentation of the inspection and maintenance performed on the wastewater system.

Maintenance & Reporting Schedule		
Activity	**Interval**	**Special Issues Related to Activity**
Test pump alarms	Semi-annually	Ensure test alarms work properly
Inspect septic and dose tank level	Semi-annually	Remove scum and solids if scum fills the air space at the top of the tank and/or sludge fills more than 40% of the tank volume.
Inspect biotube effluent filter	Semi-annually	Clean the filter per manufacturer recommendations and as needed to prevent flow restriction, fouling of pump, and/or plugging of drainfield lateral orifices.
Inspect float switch assembly	Semi-annually	Ensure that the floats are able to operate freely and no corrosion of the floats is occurring. Clean floats per manufacturer recommendations. Replace floats as needed
Flush Pressure Laterals	As required	If pump times are taking longer than they should for the set dose volume, laterals or orifices may be plugged. Contact a maintenance contractor for lateral flushing.
Submit Monitoring and Reporting plan	Required prior to permit issuance	Includes at a minimum, the following reporting activities.
Record Influent Flows	Monthly	Record from dosing system counter
Recording and inspection for ponding through all observation ports	Semi-Annual	Perform inspection during dry weather after pumps have been off for at least 5 minutes. If water is present in the observation ports there is a drainfield permeability issue. If during extremely cold weather, receiving soils may be frozen. If during warmer weather, determine extent of problem by recording which ports have measurable water and report issue to the Health Department. Excavation and partial/whole drainfield refurbishment may be necessary to correct.
Prepare annual pressure distribution system report	Annually	File with the CDHD Director no later than January 31 of each year for the last (12) month period and include section on operation, maintenance and monthly and annual monitoring data.

Table 1 Maintenance & Reporting Schedule

Maintain documentation of the inspection and maintenance performed on the wastewater system for 10 years.

2.3. General Guidelines

The following practices will help to prevent damage to the wastewater system and ensure its proper function.

- Do not permit vehicles to pass over the septic/dose tank or the drainfields. The septic tank is H-20 traffic rated with 3-feet cover; however, the manhole risers are not traffic rated.
- Be aware of the location of the drainfield and do not allow excavation in these areas. Delineate drainfield extents if needed.
- Do not allow any materials or contaminants other than sewage to enter the septic system.
- Follow the operation and maintenance schedule presented in this section.
- Do not plant trees or shrubs on the drainfield, or within the mature rooting radius of the tree or shrub from the drainfield. Trees with roots that aggressively seek water should not be planted at least 50 feet from the drainfield (e.g., poplar, willow, cottonwood, maple, and elm).

3. TROUBLESHOOTING

3.1. General

The information in this section is only a guide in the general determination of the wastewater system problems and their solutions. The manufacturer of the wastewater system products typically will include details of the product's warranty. Read the owner's manual of each product before troubleshooting and/or disassembling as to not damage the product or void warranties. Manufacturer troubleshooting guides provided in Appendix B are to be only used as reference tools. Installation, repairs, and replacements should be done by qualified persons.

4. SAFETY INFORMATION

4.1. Inspections

Maintenance and inspection personnel should have the proper safety equipment and training before performing any maintenance on the wastewater system. The following is a list of safety precautions that maintenance personnel should be aware of when they perform maintenance or troubleshooting of systems.

- Operate equipment safely and in accordance with manufacturer's specifications. Equipment operators should be aware of site personnel at all times to avoid causing injury to others.
- Contact utility companies before excavating at a site. Cover or clearly mark excavated areas that cannot be filled in at the end of the day. Be aware of overhead electrical wires that could come in contact with maintenance equipment.
- Identify where you will dispose or remove raw sewage or septic waste prior to cleaning the system. Use mechanical equipment such as a high-suction vacuum to remove wastes. Do not clean out wastes with bare hands, as it may be hazardous.
- Wear gloves and other protective clothing to handle any mechanical parts or structure components, this will reduce the risk of cuts, abrasions and exposure to disease.
- Never enter a confined space unless you have proper Occupational Health and Safety Administration (OSHA) training and/or permits. Do not enter a confined space until the atmosphere has been checked and proper safety equipment is worn or erected.
- Do not enter tanks without another individual present. If the structural integrity of a tank is questionable, do not enter it.
- Check the ventilation in the septic system before using any ignitable materials. Some septic systems may be sealed and have poor ventilation, posing a safety hazard if vapors come into contact with an open flame.
- Lift manhole lids and other covers with care. Use correct lifting techniques to avoid injury to the back. These items can be very heavy and difficult to maneuver.
- Many very significant diseases, including many that will pass in urine and feces, can be found in sewage. Therefore, septage may contain some or all of them. The bacterial diseases of diarrhea (Salmonella, Shigella, and Clostridium) and Typhoid (Salmonella typhi) may be present. Parasites, such as Pinworm, Roundworm, and Hookworm can often be found, especially in the scum layer. The organisms that cause Amoebic Dysentery, Polio, and Hepatitis could also exist in septage. Do not allow septage to contact bare skin and always wash hands thoroughly after performing inspections.

5. CLOSURE

5.1. Limitations

Recommendations contained in this operations and maintenance manual are based on our calculations, drawings, and our understanding of the proposed system.

This plan has been prepared for specific application to this project in accordance with the generally accepted standards of practice at the time and place our services were provided. No warranty, express or implied, is made.

This report may be used only by the Client for the purposes stated herein. Land use, site conditions (both on- and off-site), or other factors, including advances in the understanding of applied science, may change over time and could materially affect the operations and maintenance.

6. REFERENCES

State of Oregon Dept. of Environmental Quality (ODEQ). November 1, 2017, Chapter 340, Division 71 Onsite Wastewater Treatment Systems

Orenco Systems. 2019. Orenco Systems Website: https://www.orenco.com/document-library, accessed July 2019.

Appendix A
Project Drawing Plan Set

SEPTIC TANK
SEE SHEET C508

123°

0+00

MH – 1
STA: 0+00

MH – 2
STA: 0+84

151°

1+00

10' MIN.
SEPARATION

TRANSPORT LINES

3700.00

STOCKPILE &
RECLAIM AREA

SEWER SERVICE CLEANOUT
SEE SHEET DETAIL 4
SHEET C506

3708.00

4" SANITARY SEWER
SERVICE LINE

135°

0+00

2+00

135°

MH – 3
STA: 0+00

MH – 3
STA: 2+01

3710.00

ABSORPTION TRENCH
AREA BOUNDARY
SEE SHEET C401

10' MIN.
SEPARATION

3+00

GRINDING AREA

CRUSHING AREA

4" SANITARY SEWER
SERVICE LINE

10' MIN.
SEPARATION

1+00

1+91

MH – 3A
STA: 1+91

3-SEWER SERVICE
CONNECTIONS
SEE SHEET DETAIL 5
SHEET C504

3-SEWER SERVICE CROSSINGS
SEE SHEET DETAIL 5 SHEET C506

ELUTION AREA

GOLD ROOM

REAGENT AREA

CIL AREA

3706.00

3704.00

3702.00

WATER SERVICE AREA

MH – 5A
STA: 0+88

SEWER SERVICE CROSSINGS
SEE SHEET DETAIL 5 SHEET C506

FM

FM

10' MIN.
SEPARATION

4+00

5+00

90°

MH – 4
STA: 3+67

MH – 5
STA: 5+65

6+00

TRUCK WASH

3706.00

3710.00

3720.00

3724.00

SEWER SERVICE CONNECTION
SEE SHEET DETAIL 5 SHEET C504

TRUCK WORKSHOP
& WAREHOUSE

4" SANITARY SEWER
SERVICE LINE

TSS

MH – 6
STA: 6+86

6+86

SEWER SERVICE CLEANOUT
SEE SHEET DETAIL 4 SHEET C506

MINE OFFICE &
CHANGE HOUSE

3728.00

20 0 20 40
SCALE OF FEET

CONSTRUCTION NOTES

1. PROPOSED PAD ELEVATIONS ARE BASED ON THE LANDXML SURFACE PROVIDED TO SPF ON 8/20/2019 BY AUSENCO. IF FINAL PAD ELEVATIONS DIFFER FROM THE ASSUMED ELEVATIONS, CONTRACTOR SHALL ADJUST FINAL MANHOLE AND GRAVITY SANITARY SEWER PIPES ACCORDINGLY. GRADE AREA AROUND EACH MANHOLE TO DIVERT SURFACE WATER AWAY.

SPF WATER ENGINEERING
300 East Mallard Drive, Suite 350
Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156

GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

SEWER COLLECTION SYSTEM SITE PLAN

REGISTERED PROFESSIONAL ENGINEER
MATTHEW W. RASMUSSEN
21703
8/22/2019
OREGON
MAR. 13, 2015
RENEWS: 12/31/2020

ITEM	DESCRIPTION	DATE
0	FINAL PERMIT SET	8/22/19

REVISIONS

VERIFY SCALE
0 1/2 1
BAR MEASURES ONE-INCH ON FULL SIZE DRAWING.

PROJECT:	1294.0050
DESIGNED:	EH/SM/JL
DRAWN:	JL/SM/KN
CHECKED:	JT

C400

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Xref Filename: | X-TITLE | X-LINEWORK | X-PLANT SITE BASE_7-23-19 | X-TITLE (2) |

CONSTRUCTION NOTES

1. CONTRACTOR SHALL FOLLOW OAR 340-071-0520 RULES AND REGULATIONS.
2. THIS SYSTEM SHALL BE INSTALLED UNDER DRY SOIL CONDITIONS TO REDUCE SMEARING. IF SMEARING OCCURS, THE SMEARED AREAS SHALL BE RAKED.
3. THE SITE OF DISTURBANCE MUST BE RE-SEEDED.
4. BOTH THE INITIAL AND REPLACEMENT ABSORPTION TRENCH AREAS ARE TO BE PROTECTED FROM TRAFFIC, COVER, DEVELOPMENT OR OTHER POTENTIAL DISTURBANCE OF NATURAL SOIL CONDITIONS.
5. THE ABSORPTION TRENCH AREAS MUST NOT BE SUBJECTED TO EXCESSIVE SATURATION DUE TO: BUT NOT LIMITED TO; ARTIFICIAL DRAINAGE OF GROUND SURFACES, ROADS, DRIVEWAYS AND BUILDING DOWN SPOUTS.
6. IF ROADS ARE CUT DOWNSLOPE OF THE ABSORPTION TRENCH AREAS THE CONTRACTOR SHALL PROVIDE A MINIMUM SETBACK OF 50-FT.
7. ABSORPTION TRENCHES SHALL NOT BE CONSTRUCTED WITHIN 100-FT OF A WELL.
8. ALL WORK IN ABSORPTION TRENCH AREAS SHALL BE DONE WITH TRACK MACHINERY. NO WHEELED MACHINERY SHALL BE ALLOWED IN THE ABSORPTION TRENCH AREAS.
9. NO STOCKPILING OF MATERIALS SHALL BE ALLOWED WITHIN THE ABSORPTION TRENCH AREAS.
10. ALL HOLES IN LATERALS SHALL BE ORIENTED DOWN.
11. PROPOSED PAD ELEVATIONS ARE BASED ON THE LANDXML SURFACE PROVIDED TO SPF ON 8/20/2019 BY AUSENCO. IF FINAL PAD ELEVATIONS DIFFER FROM THE ASSUMED ELEVATIONS, CONTRACTOR SHALL ADJUST FINAL MANHOLE AND GRAVITY SANITARY SEWER PIPES ACCORDINGLY. GRADE AREA AROUND EACH MANHOLE TO DIVERT SURFACE WATER AWAY.

ABSORPTION TRENCHES

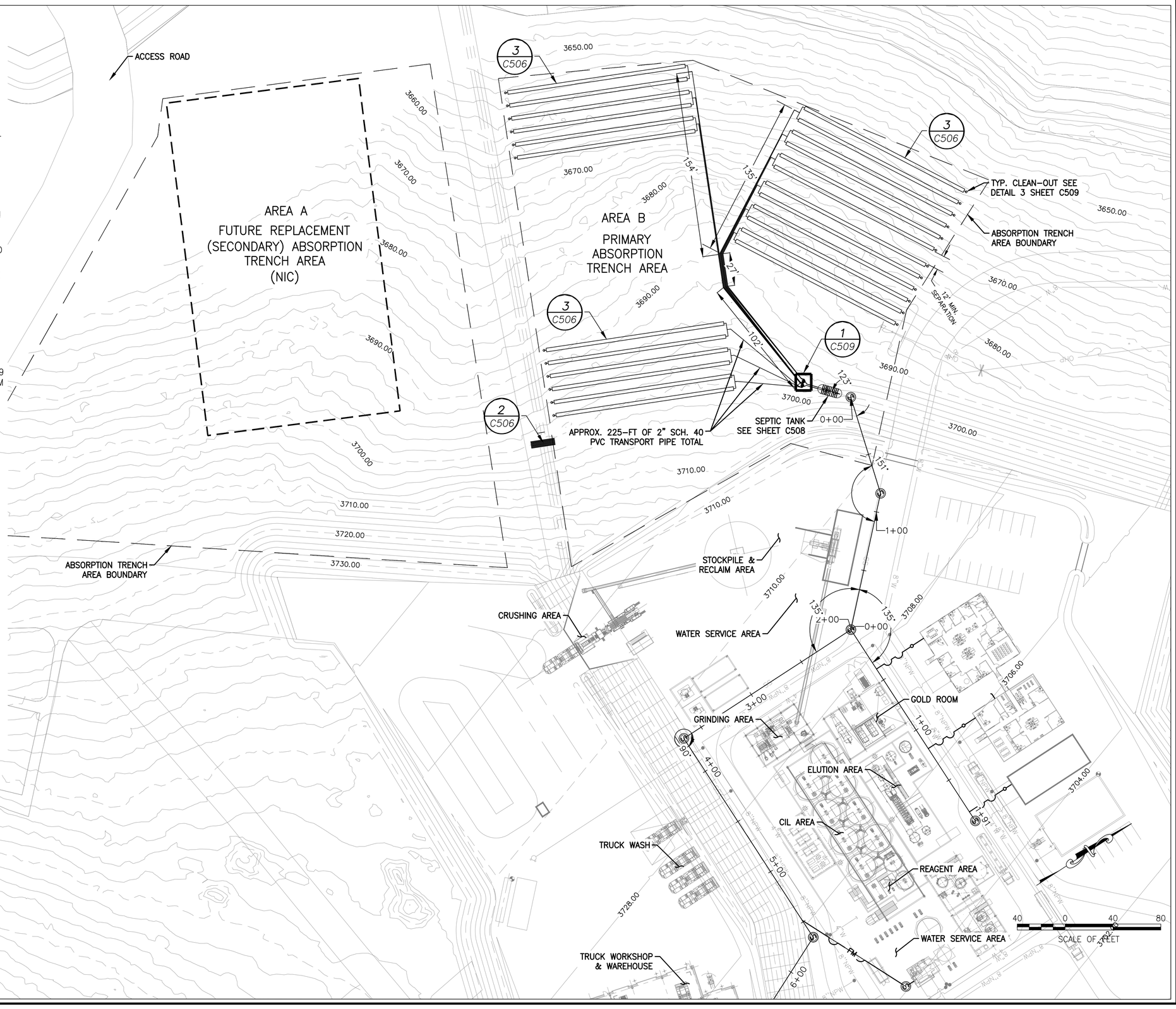
- 150'L X 3'W (24), 10,800 SF
- (4) ZONES PER AREA, 12-FT SPACING BETWEEN ZONES, 6 LATERALS PER ZONE, 2 LATERALS DISCHARGING PER DOSE, 11-FT SPACING BETWEEN LATERALS
- 1/8" DIA. ORIFICES, 4-FT SPACING, 38 ORIFICES PER LATERAL, 228 PER ZONE
- PLAN FOR 5-FT RESIDUAL HEAD AT END OF EACH LATERAL
- FLOW RATE PER ZONE = 60 GPM

PIPING AND VALVES

- TRANSPORT PIPING = 2" SCH. 40, 3168-FT
- MANIFOLD = 2" SCH. 40., 11-FT EACH, 132-FT
- LATERALS = 2" SCH. 40., 150-FT EACH, 3,600-FT

DUPLEX EFFLUENT PUMPS

- OPERATING POINT = 60 GPM @ 60-FT HEAD, APPROX.
- ALTERNATE BETWEEN DOSES
- AT LEVEL BETWEEN "PUMP OFF" AND HIGH LEVEL ALARM, BOTH PUMPS TURN ON
- DOSE ≈ 180 GALLONS, 6 TIMES PER DAY



SPF WATER ENGINEERING
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GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

ABSORPTION TRENCH & REPLACEMENT AREAS SITE PLAN

REGISTERED PROFESSIONAL ENGINEER
OREGON
MATTHEW W. RASMUSSON
MAR. 13, 2015
8/22/2019
RENEWS: 12/31/2020

ITEM	DESCRIPTION	DATE
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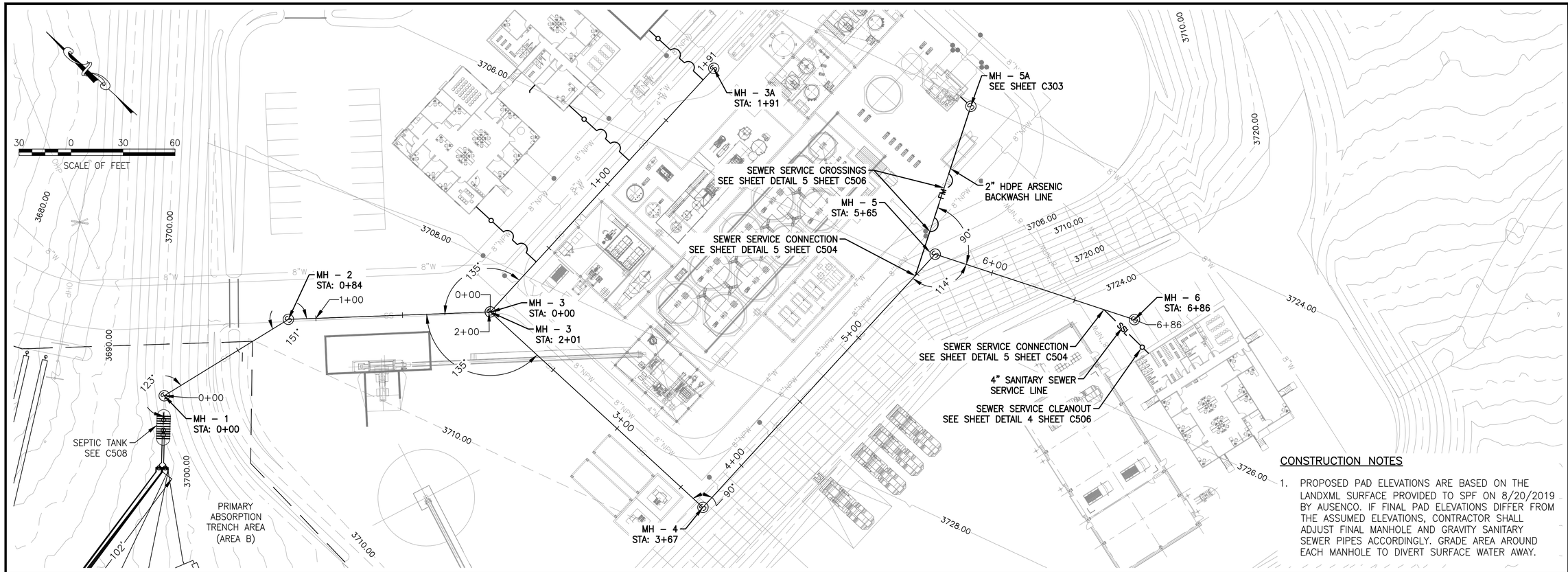
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DESIGNED:	EH/SM/JL
DRAWN:	JL/SM/KN
CHECKED:	JT

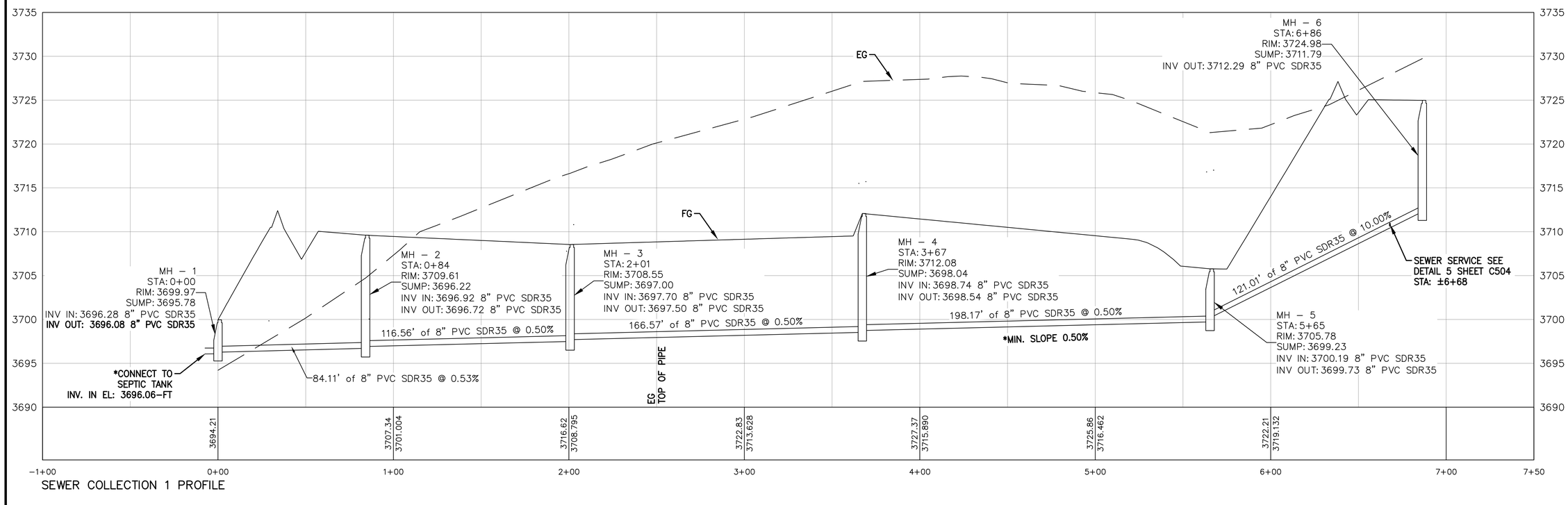
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CONSTRUCTION NOTES

1. PROPOSED PAD ELEVATIONS ARE BASED ON THE LANDXML SURFACE PROVIDED TO SPF ON 8/20/2019 BY AUSENCO. IF FINAL PAD ELEVATIONS DIFFER FROM THE ASSUMED ELEVATIONS, CONTRACTOR SHALL ADJUST FINAL MANHOLE AND GRAVITY SANITARY SEWER PIPES ACCORDINGLY. GRADE AREA AROUND EACH MANHOLE TO DIVERT SURFACE WATER AWAY.



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Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156

GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

SEWER COLLECTION 1

REGISTERED PROFESSIONAL ENGINEER
MATTHEW W. RASMUSSON
OREGON
MAR. 13, 2015
RENEWS: 12/31/2020

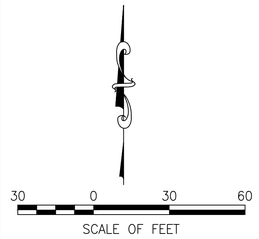
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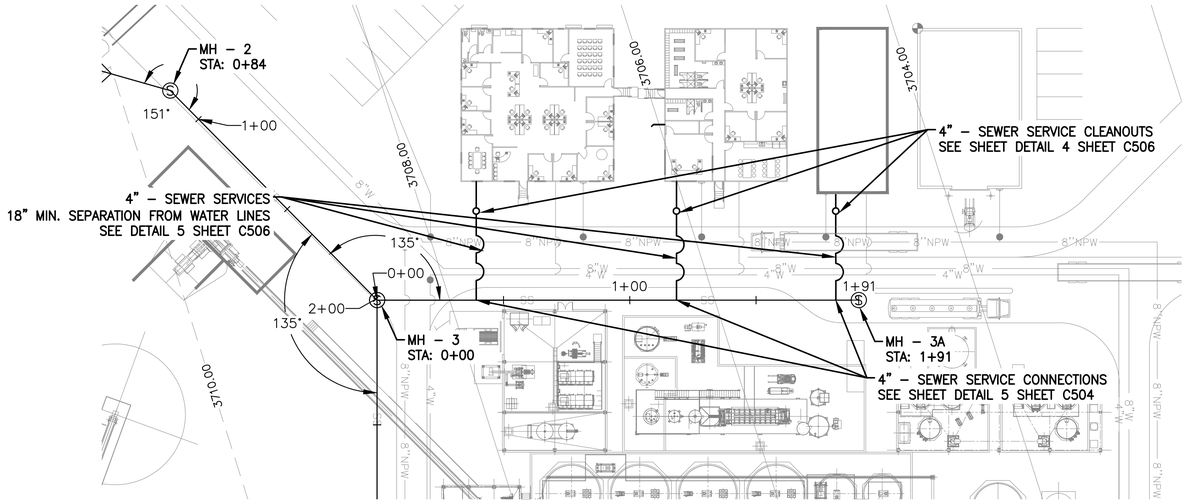
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DRAWN:	JL/SM/KN
CHECKED:	JT

C402

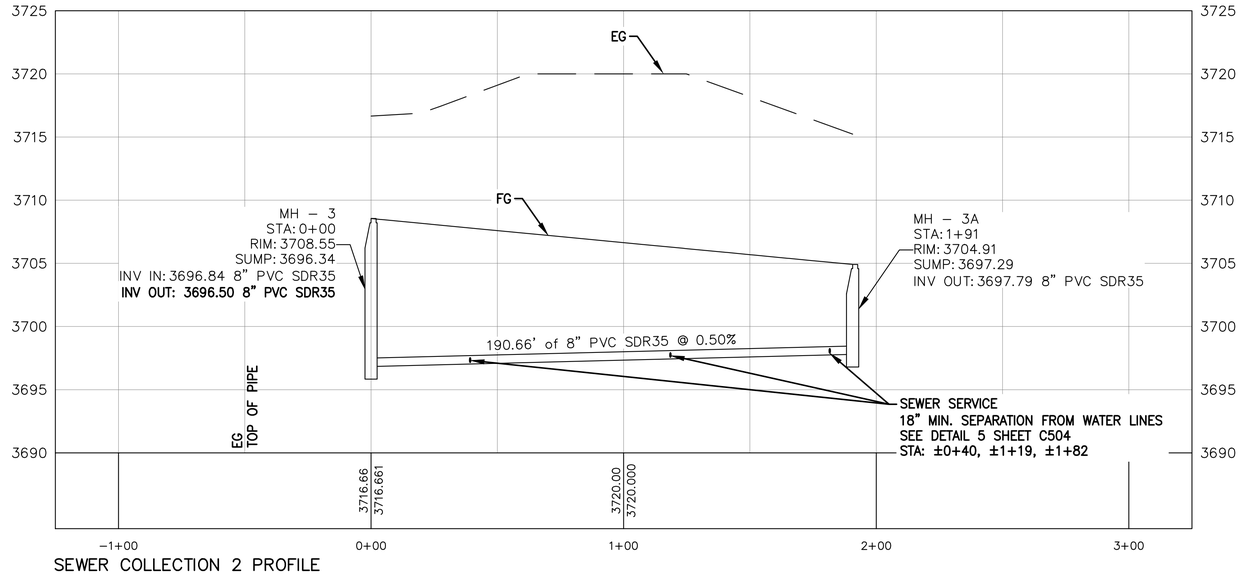
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CONSTRUCTION NOTES

1. PROPOSED PAD ELEVATIONS ARE BASED ON THE LANDXML SURFACE PROVIDED TO SPF ON 8/20/2019 BY AUSENCO. IF FINAL PAD ELEVATIONS DIFFER FROM THE ASSUMED ELEVATIONS, CONTRACTOR SHALL ADJUST FINAL MANHOLE AND GRAVITY SANITARY SEWER PIPES ACCORDINGLY. GRADE AREA AROUND EACH MANHOLE TO DIVERT SURFACE WATER AWAY.



SEWER COLLECTION 2 PROFILE

SPF WATER ENGINEERING
300 East Mallard Drive, Suite 350
Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156

GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

SEWER COLLECTION 2

REGISTERED PROFESSIONAL ENGINEER
MATTHEW W. RASMUSSON
No. 17872
OREGON
MAR. 13, 2015
8/22/2019
RENEWS: 12/31/2020

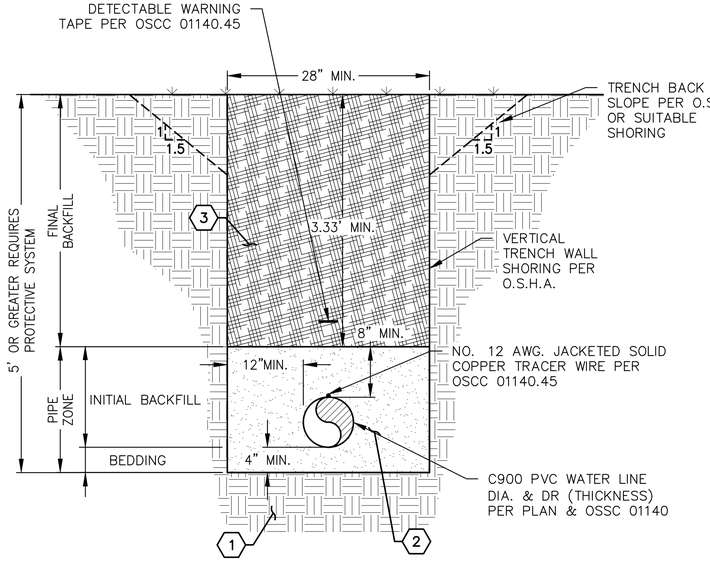
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ITEM	DESCRIPTION	DATE	
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VERIFY SCALE
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BAR MEASURES ONE-INCH ON FULL SIZE DRAWING.

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DESIGNED:	EH/SM/JL
DRAWN:	JL/SM/KN
CHECKED:	JT

C403

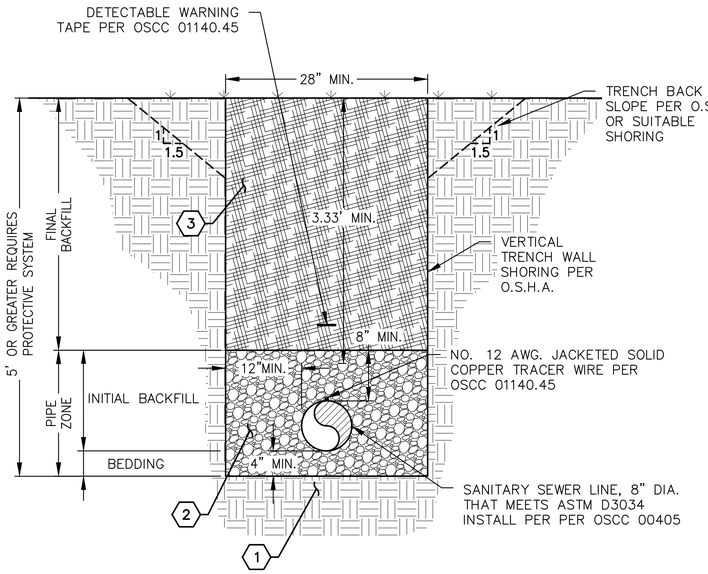
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1 WATER LINE TRENCH DETAIL
NOT TO SCALE

LEGEND

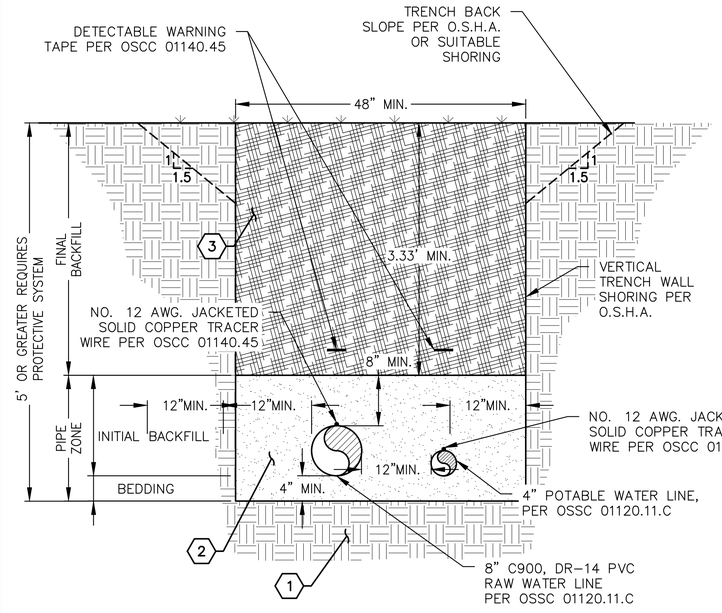
1. UNSTABLE SUBGRADE SHALL BE EXCAVATED AND BACKFILLED WITH APPROVED PIPE BEDDING MATERIAL AND COMPACTED PER OSCC 00405.44
2. PIPE BEDDING & INITIAL BACKFILL SHALL BE REASONABLY WELL-GRADED, FROM MAXIMUM SIZE TO DUST, SAND WITH 100% PASSING THE 3/8" SIEVE. BEDDING & INITIAL BACKFILL SHALL BE COMPACTED ACCORDING TO ASTM-D698 (STANDARD PROCTOR)
3. FINAL BACKFILL SHALL BE CLASS A BACKFILL ACCORDING TO OSCC 00405.14.A. FINAL BACKFILL SHALL BE 3" MINUS, FREE OF ORGANIC MATERIAL, FREE OF FROST CHUNKS, AND FREE OF TOXIC WASTE AND HAZARDOUS CHEMICALS. SEE OSCC 00405.12 FOR WET CONDITIONS



2 SANITARY SEWER TRENCH DETAIL
NOT TO SCALE

LEGEND

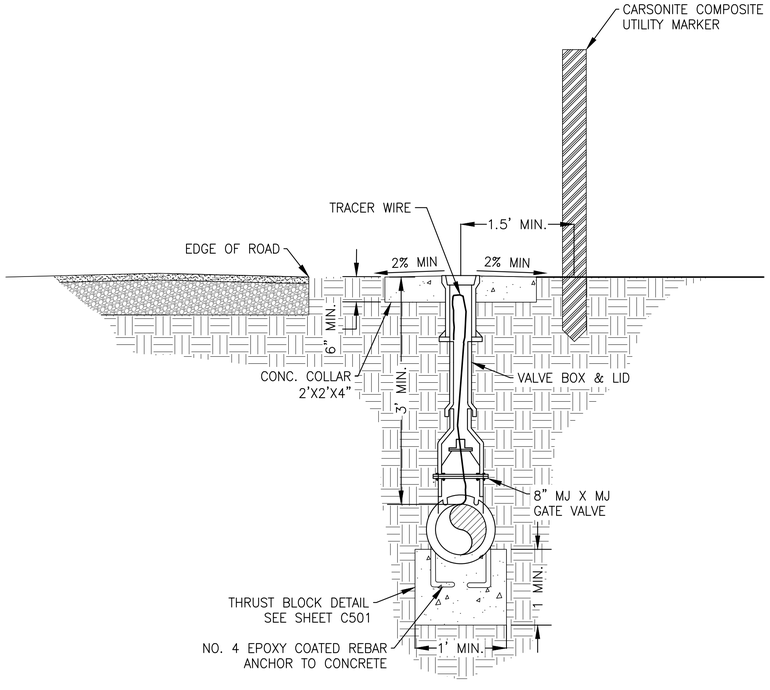
1. UNSTABLE SUBGRADE SHALL BE EXCAVATED AND BACKFILLED WITH APPROVED PIPE BEDDING MATERIAL AND COMPACTED PER OSCC 00405.44
2. PIPE BEDDING & INITIAL BACKFILL SHALL BE COMMERCIALLY AVAILABLE 3/8" ROCK CHIPS.
3. FINAL BACKFILL SHALL BE CLASS A BACKFILL (NATIVE BACKFILL) ACCORDING TO OSCC 00405.14.A. FINAL BACKFILL SHALL BE 3" MINUS, FREE OF ORGANIC MATERIAL, FREE OF FROST CHUNKS, AND FREE OF TOXIC WASTE AND HAZARDOUS CHEMICALS. SEE OSCC 00405.12 FOR WET CONDITIONS



3 JOINT TRENCH DETAIL
NOT TO SCALE

LEGEND

1. UNSTABLE SUBGRADE SHALL BE EXCAVATED AND BACKFILLED WITH APPROVED PIPE BEDDING MATERIAL AND COMPACTED PER OSCC 00405.44
2. PIPE BEDDING & INITIAL BACKFILL SHALL BE REASONABLY WELL-GRADED, FROM MAXIMUM SIZE TO DUST, SAND WITH 100% PASSING THE 3/8" SIEVE. BEDDING & INITIAL BACKFILL SHALL BE COMPACTED ACCORDING TO ASTM-D698 (STANDARD PROCTOR)
3. FINAL BACKFILL SHALL BE CLASS A BACKFILL ACCORDING TO OSCC 00405.14.A. FINAL BACKFILL SHALL BE 3" MINUS, FREE OF ORGANIC MATERIAL, FREE OF FROST CHUNKS, AND FREE OF TOXIC WASTE AND HAZARDOUS CHEMICALS. SEE OSCC 00405.12 FOR WET CONDITIONS



4 TYP. GATE VALVE & VALVE BOX
NOT TO SCALE

SPF WATER ENGINEERING
300 East Mallard Drive, Suite 350
Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156

GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

TRENCH DETAILS

REGISTERED PROFESSIONAL ENGINEER 17236 7-31-19 OREGON MAY. 10, 2016 JUSTIN P. LEHARS
EXPIRES: 12-31-20

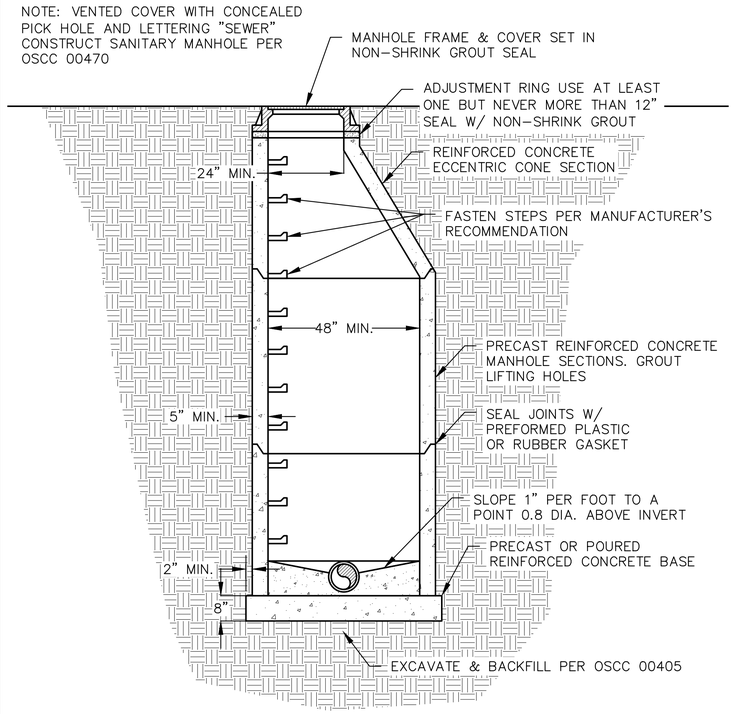
REVISIONS			
ITEM	DESCRIPTION	DATE	
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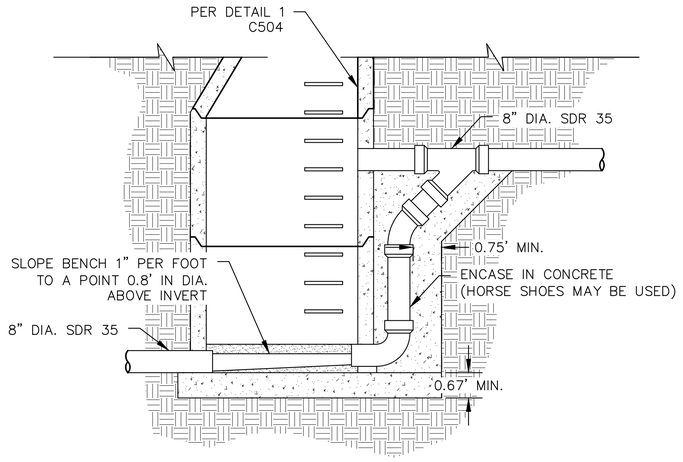
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DESIGNED:	EH/SM/JL
DRAWN:	JL/SM/KN
CHECKED:	JT

C500

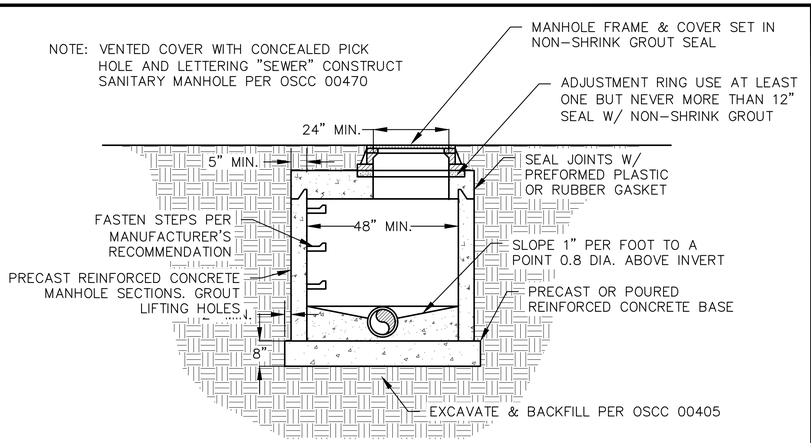
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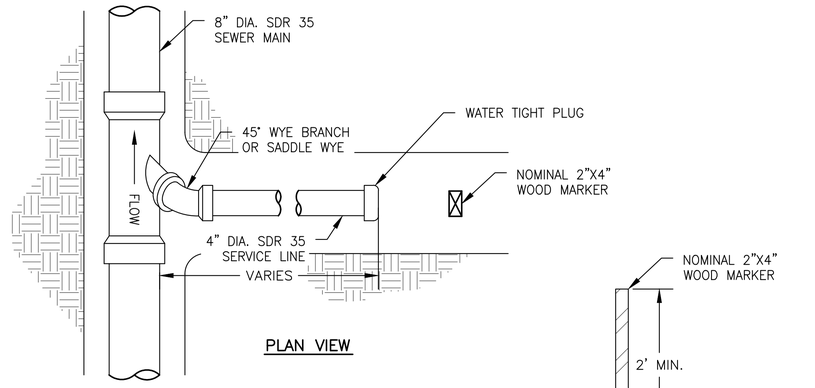
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NOT TO SCALE



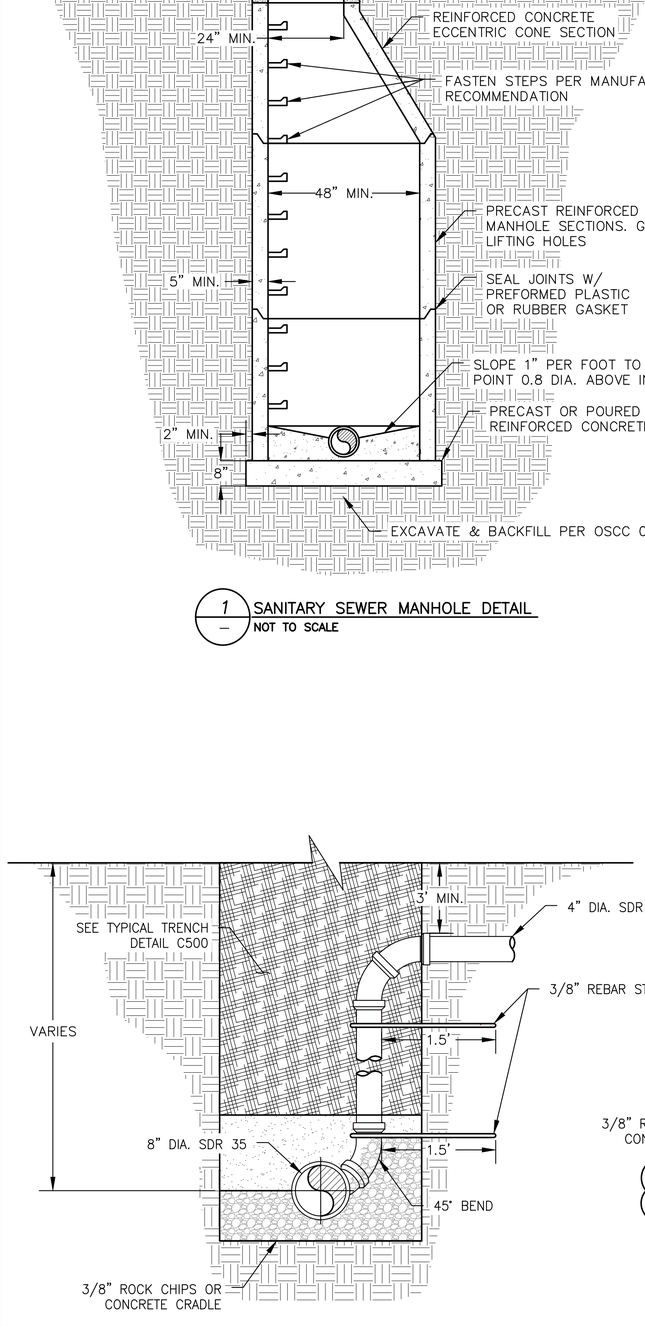
2 — DROP SANITARY SEWER MANHOLE DETAIL
NOT TO SCALE



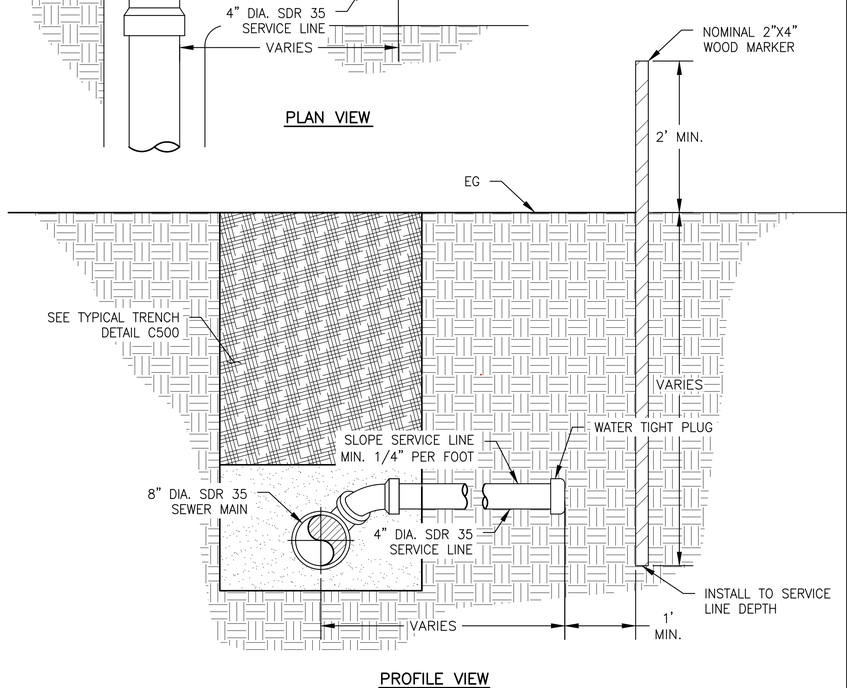
3 — SHALLOW SANITARY SEWER MANHOLE DETAIL
NOT TO SCALE



PLAN VIEW



4 — SANITARY SEWER RISER DETAIL
NOT TO SCALE



PROFILE VIEW

5 — SANITARY SEWER SERVICE DETAIL
NOT TO SCALE

SPF WATER ENGINEERING
300 East Mallard Drive, Suite 350
Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156

PARAMOUNT GOLD NEVADA CORP.
GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

SANITARY SEWER DETAILS

REGISTERED PROFESSIONAL ENGINEER
MATTHEW W. RASMUSSON
MAR. 13, 2019
OREGON
RENEWS: 12/31/2020

ITEM	DESCRIPTION	DATE
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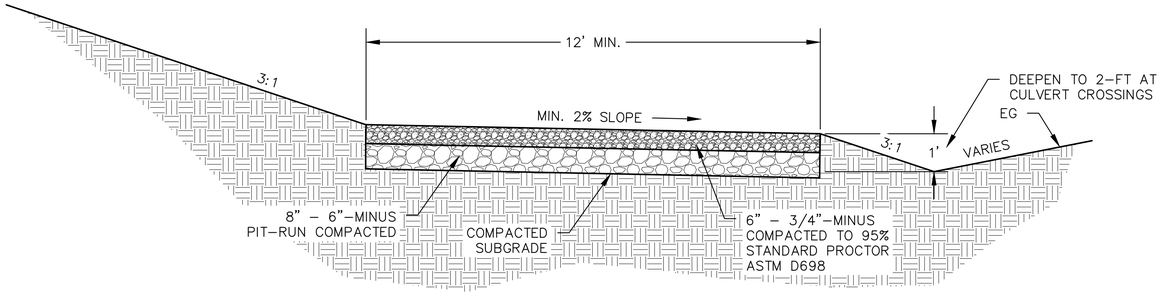
REVISIONS

VERIFY SCALE
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BAR MEASURES ONE-INCH ON FULL SIZE DRAWING.

PROJECT:	1294.0050
DESIGNED:	EH/SM/JL
DRAWN:	JL/SM/KN
CHECKED:	JT

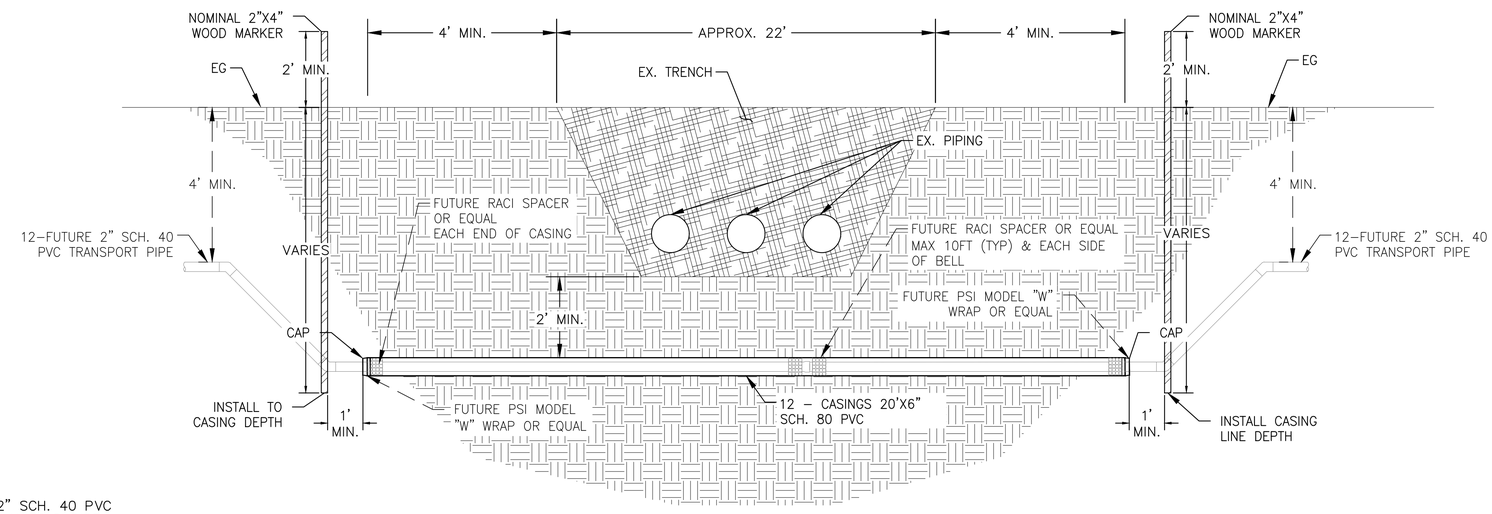
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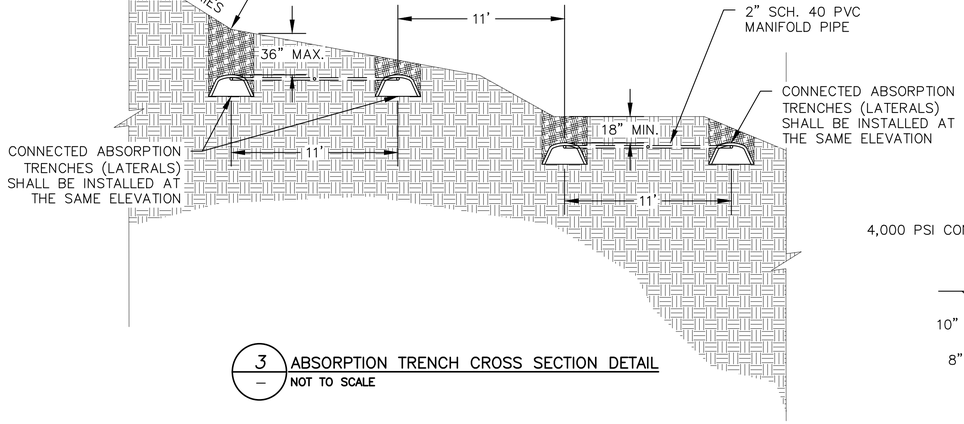


*NOTE: IF ROAD IS IN A CUT SECTION, NO PIT RUN GRAVEL IS REQURED.

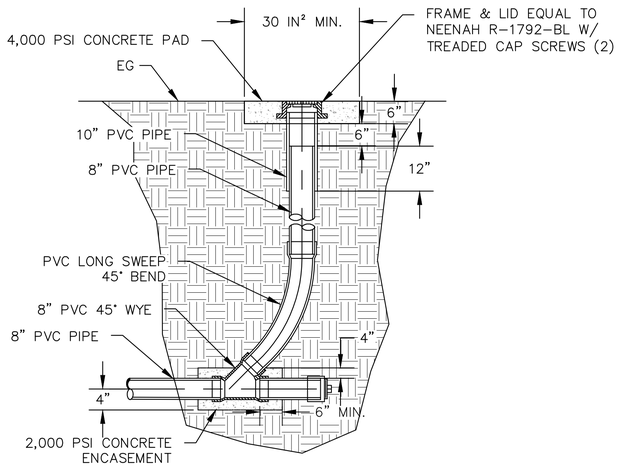
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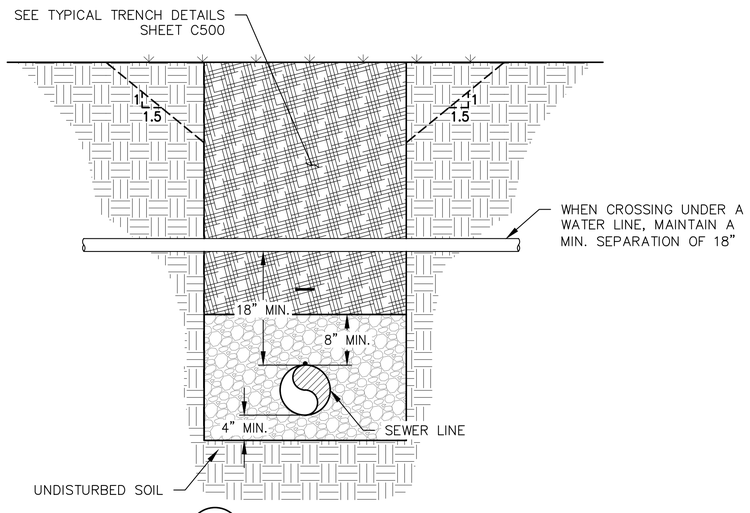
2 — DOSING TRANSPORT PIPE TRENCH CROSSING DETAIL
NOT TO SCALE



3 — ABSORPTION TRENCH CROSS SECTION DETAIL
NOT TO SCALE



4 — SEWER SERVICE CLEAN-OUT TYP. DETAIL
NOT TO SCALE



5 — SEWER/WATER LINE CROSSING TYP. DETAIL
NOT TO SCALE

SPF WATER ENGINEERING
300 East Mallard Drive, Suite 350
Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156

GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

TYP. ROAD AND SEWER DETAILS

REGISTERED PROFESSIONAL ENGINEER
OREGON
MAR. 13, 2015
MATTHEW W. RASMUSSON
8/22/2019
RENEWS: 12/31/2020

ITEM	DESCRIPTION	DATE
0	FINAL PERMIT SET	8/22/19

REVISIONS

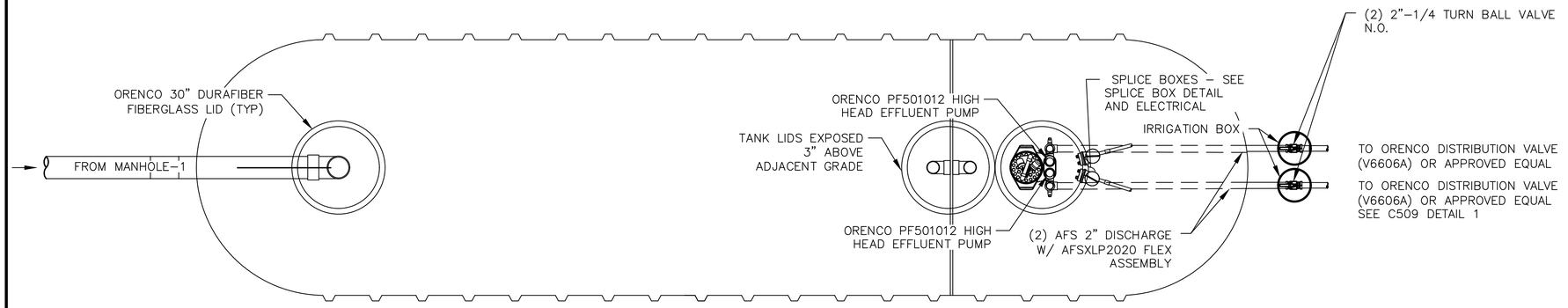
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DESIGNED:	EH/SM/JL
DRAWN:	JL/SM/KN
CHECKED:	JT

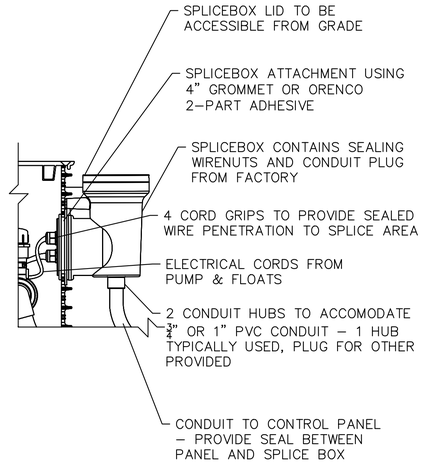
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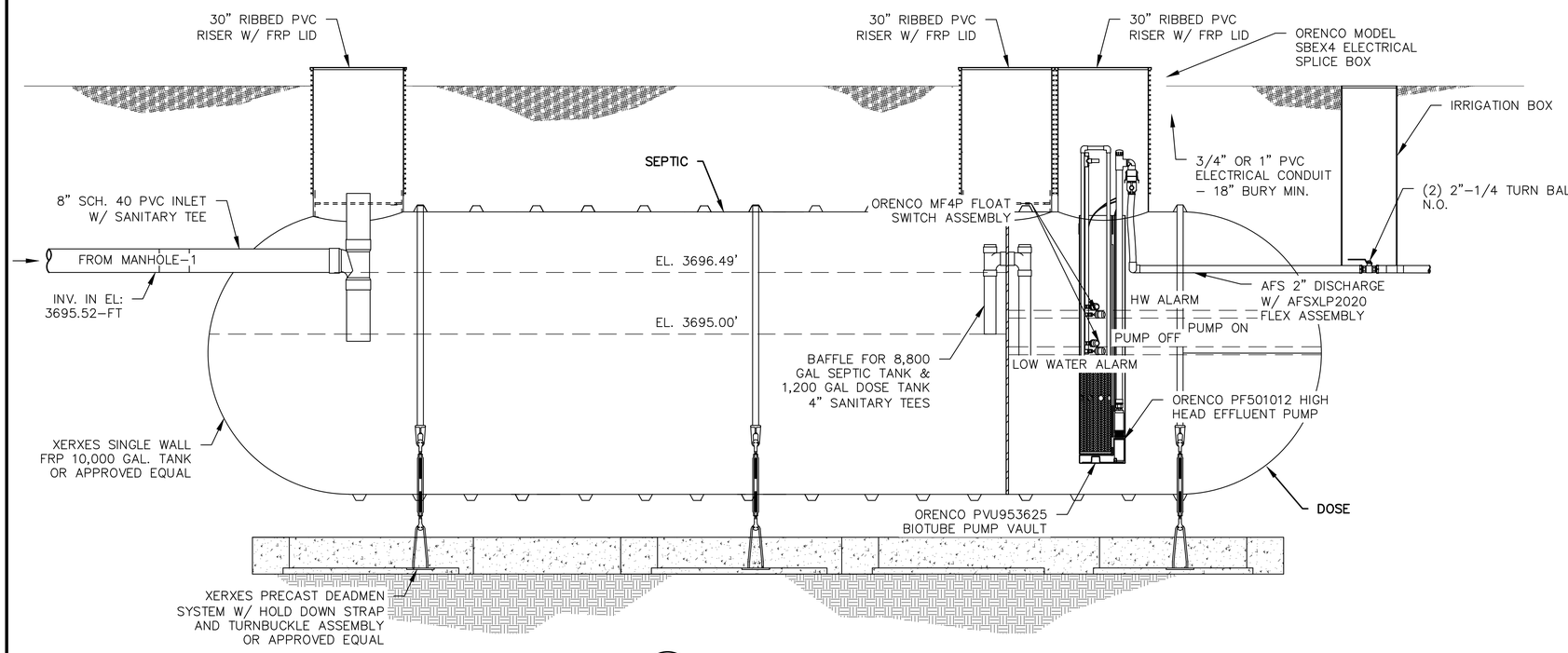
NOTE:
ALL PRODUCT BRANDS THIS SHEET ARE "OR APPROVED EQUAL" ITEMS.
CONTRACTOR TO PROVIDE SUBMITTALS.



1 — 10,000 GAL. FIBERGLASS SEPTIC TANK PLAN VIEW
NOT TO SCALE



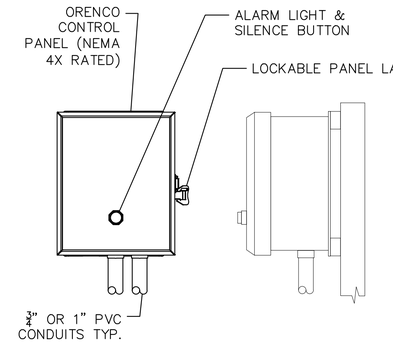
3 — SPLICE BOX DETAILS
NOT TO SCALE



2 — 10,000 GAL. FIBERGLASS SEPTIC TANK PROFILE
NOT TO SCALE

PANEL MOUNTING REQUIREMENTS

- PANEL SHALL BE MOUNTED ON 4X4 WOODEN POST IN LOCATION SHOWN PER SHEET C2 AND ELECTRICAL
- PANEL DIMENSIONS: DAXMVP PANELS: 9.5" HIGH X 7.3" WIDE X 5.4" DEEP



4 — MVPDAX2 DM CONTROL PANEL
NOT TO SCALE

SPF WATER ENGINEERING
300 East Mallard Drive, Suite 350
Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156

GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

SEPTIC TANK DETAILS

REGISTERED PROFESSIONAL ENGINEER
MATTHEW W. RASMUSSON
OREGON
MAR 13, 2019
RENEWS: 12/31/2020

ITEM	DESCRIPTION	DATE
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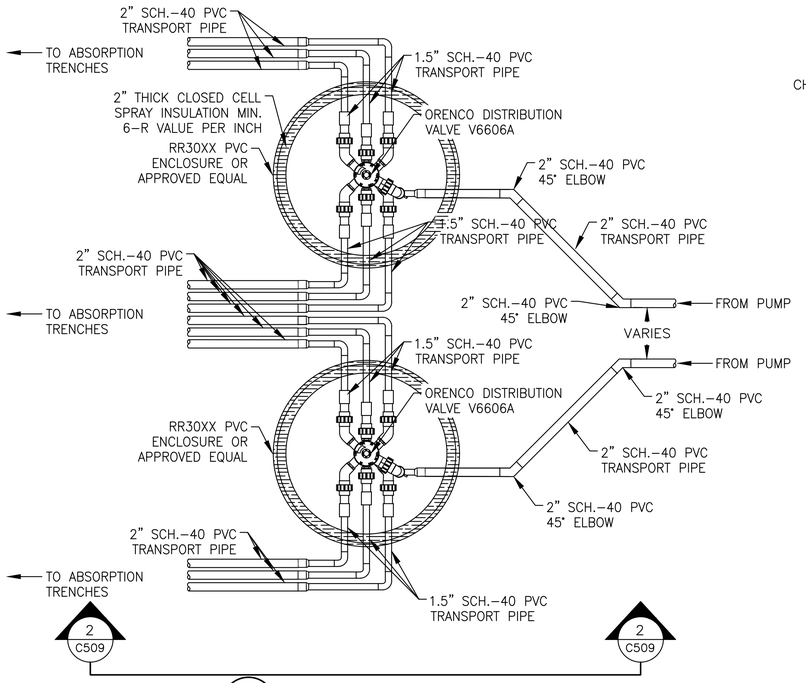
REVISIONS

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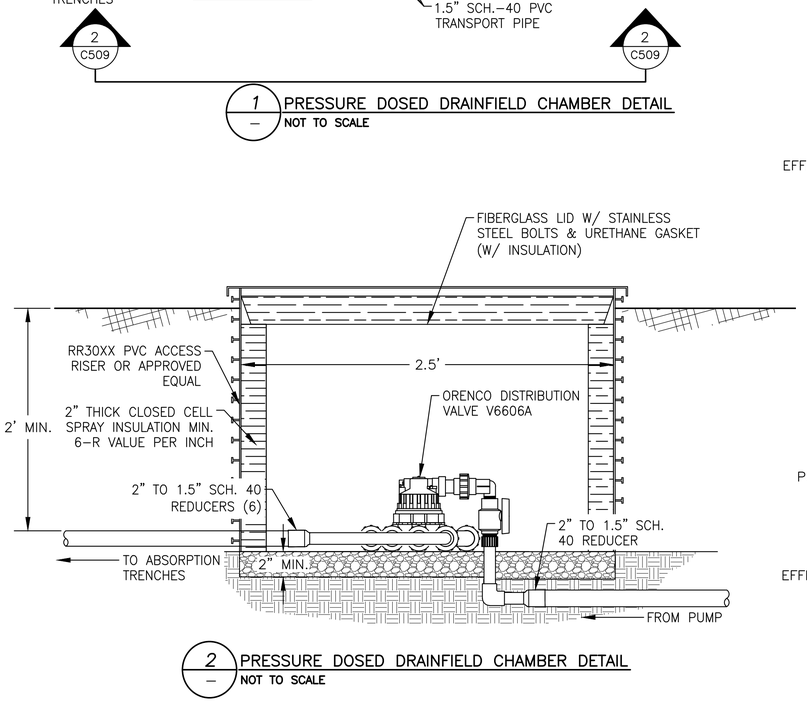
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CHECKED:	JT

C508

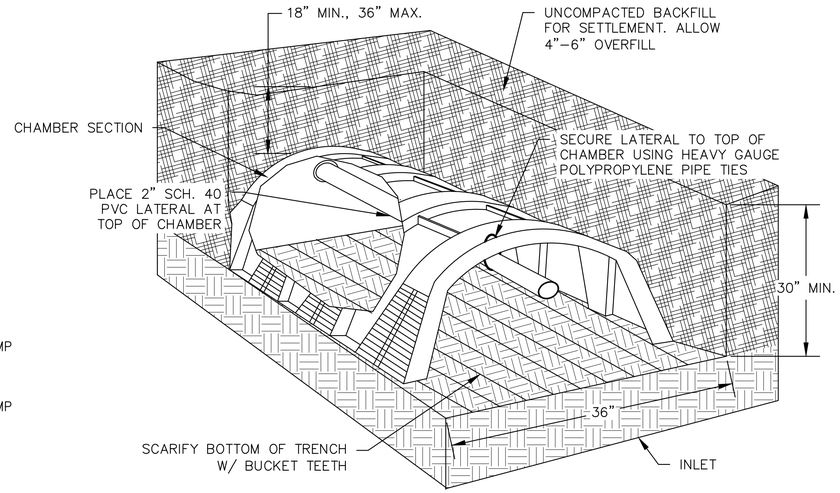
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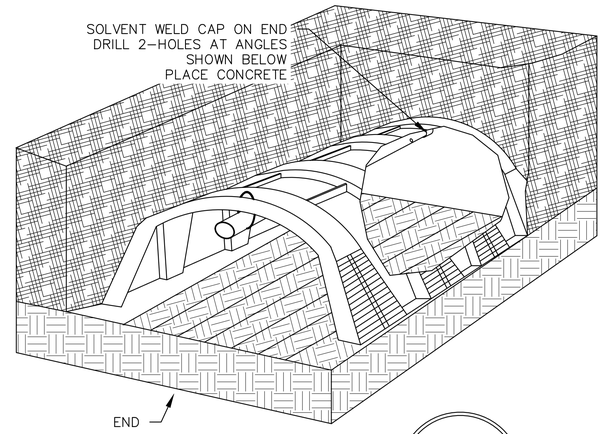
1 — PRESSURE DOSED DRAINFIELD CHAMBER DETAIL
NOT TO SCALE

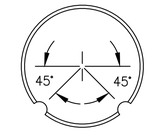


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NOT TO SCALE

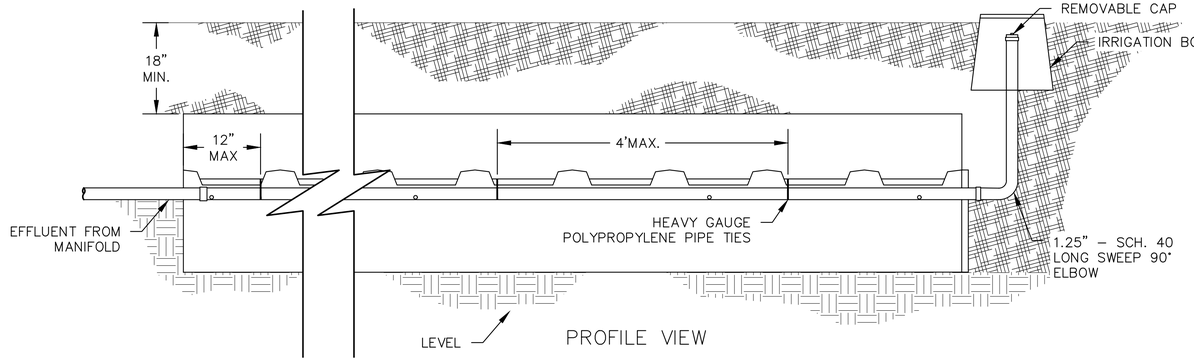


ISOMETRIC VIEW



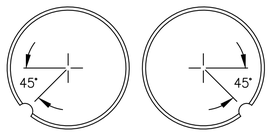


PERFORATIONS END OF PIPE

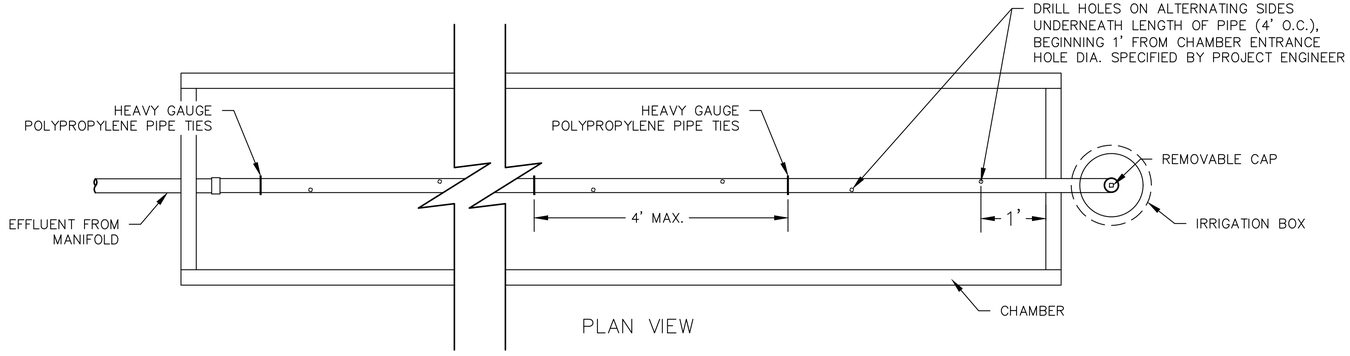


PROFILE VIEW

NOTE: ALTERNATE DIRECTION OF PERFORATION EVERY 4-FT



PERFORATIONS ALONG 2" SCH. 40 PVC PIPE



PLAN VIEW

3 — PRESSURE DOSED DRAINFIELD CHAMBER DETAIL
NOT TO SCALE

SPF WATER ENGINEERING
300 East Mallard Drive, Suite 350
Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156

GRASSY MOUNTAIN GOLD MINE WATER & SEWER
CALICO RESOURCES USA CORP.

ABSORPTION TRENCH AND CHAMBER DETAILS

REGISTERED PROFESSIONAL ENGINEER
20170??
8/22/2019
OREGON
MAR 13, 2019
MATTHEW W. RASMUSSON
RENEWS: 12/31/2020

ITEM	DESCRIPTION	DATE
0	FINAL PERMIT SET	8/22/19

REVISIONS

VERIFY SCALE
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BAR MEASURES ONE-INCH ON FULL SIZE DRAWING.

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DESIGNED:	EH/SM/JL
DRAWN:	JL/SM/KN
CHECKED:	JT

C509

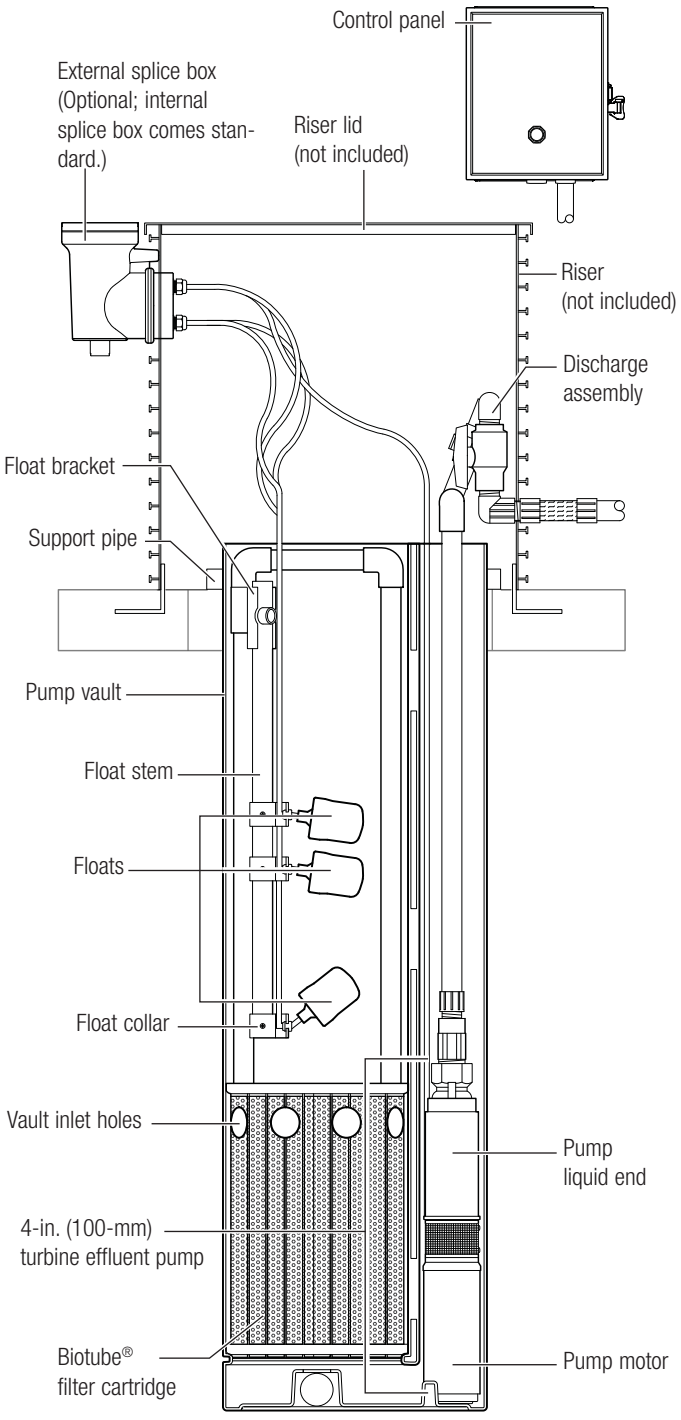
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Appendix B
Wastewater Disposal System Component Specifications

Technical Data Sheet

Biotube® ProPak™ Pump Package

60-Hz Series Pump Packages



Biotube® ProPak™ pump package components.

Applications

The Biotube ProPak is designed to filter and pump effluent to either gravity or pressurized discharge points. It is intended for use in a septic tank (one- or two-compartment) and can also be used in a pump tank.

The Biotube ProPak is designed to allow the effluent filter to be removed for cleaning without the need to remove the pump vault or pump, simplifying servicing.

Complete packages are available for on-demand or timed dosing systems with flow rates of 10, 20, 30, and 50-gpm* (0.6, 1.3, 1.9, and 3.2 L/sec), as well as with 50 Hz and 60 Hz power supplies.

General

Orenco's Biotube® ProPak™ is a complete, integrated pump package for filtering and pumping effluent from septic tanks. And its patented pump vault technology eliminates the need for separate dosing tanks.

This document provides detailed information on the ProPak pump vault and filter, 4-in. (100-mm) 60-Hz turbine effluent pump, and control panel. For more information on other ProPak components, see the following Orenco technical documents:

- Float Switch Assemblies (NTD-MF-MF-1)
- Discharge Assemblies (NTD-HV-HV-1)
- Splice Boxes (NTD-SB-SB-1)
- External Splice Box (NTD-SB-SB-1)

Standard Models

BPP10DD, BPP20DD, BPP20DD-SX, BPP30TDA, BPP30TDD-SX, BBPP50TDA, BPP50TDD-SX

Product Code Diagram

BPP □ □ - □

Standard options:
Blank = 57-in. (1448-mm) vault height, internal splice box, standard discharge assembly
68 = 68-in. (1727-mm) vault height
SX = external splice box
CW = cold weather discharge assembly
DB = drainback discharge assembly

Panel Application:
DD = demand dosing
TDA = timed dosing, analog timer
TDD = timed dosing, digital timer, elapsed time meter & counters

Pump flow rate (nominal):
10 = 10 gpm (0.6 L/sec)
20 = 20 gpm (1.3 L/sec)
30 = 30 gpm (1.9 L/sec)
50 = 50 gpm (3.2 L/sec)

Biotube® ProPak™ pump vault

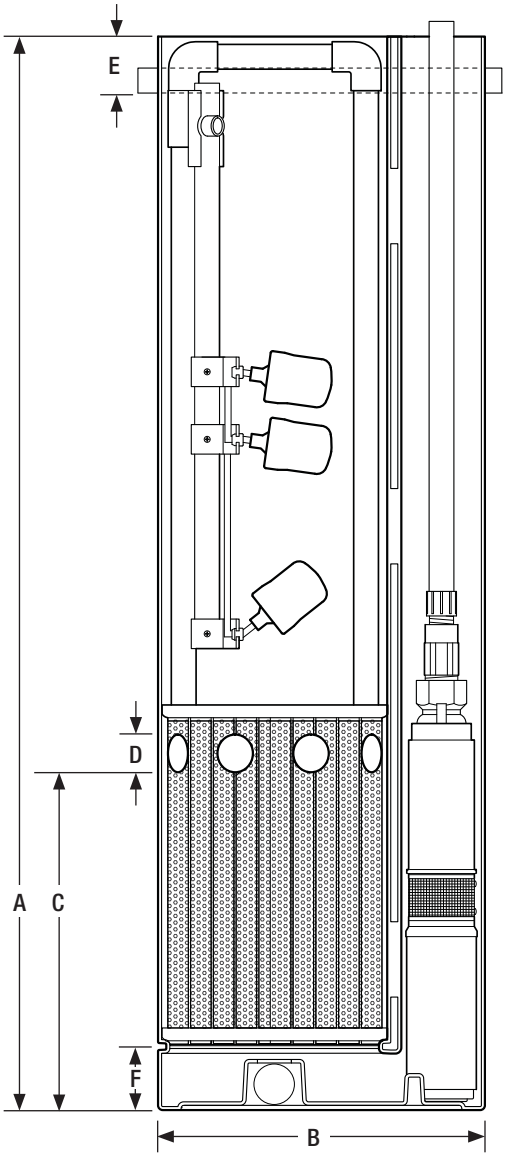
ProPak™ Pump Vault

Materials of Construction	
Vault body	Polyethylene
Support pipes	PVC
Dimensions, in. (mm)	
A - Overall vault height	57 (1448) or 68 (1727)
B - Vault diameter	17.3 (439)
C - Inlet hole height	19 (475)
D - Inlet hole diameter (eight holes total)	2 (50)
E - Vault top to support pipe bracket base	3 (76)
F - Vault bottom to filter cartridge base	4 (102)

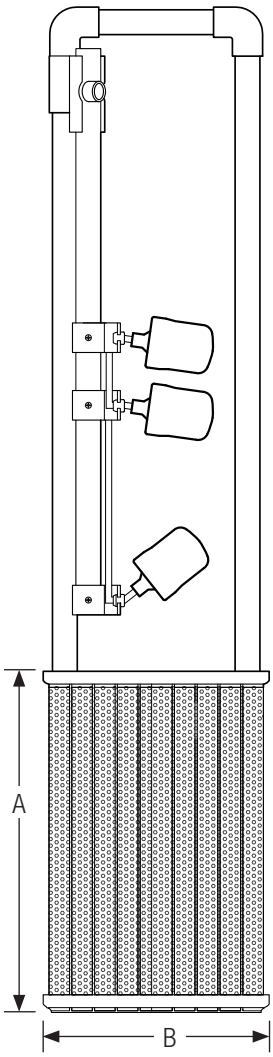
Biotube® Filter Cartridge

Materials of Construction	
Filter tubes	Polyethylene
Cartridge end plates	Polyurethane
Handle assembly	PVC
Dimensions, in. (mm)	
A - Cartridge height	18 (457)
B - Cartridge width	12 (305)
Performance	
Biotube® mesh opening	0.125 in. (3 mm)*
Total filter flow area	4.4 ft^2 (0.4 m^2)
Total filter surface area	14.5 ft^2 (1.35 m^2)
Maximum flow rate	140 gpm (8.8 L/sec)

**0.062-in. (1.6-mm) filter mesh available*



ProPak™ pump vault (shown with Biotube filter and effluent pump)



Biotube® filter cartridge (shown with float switch assembly)

Orenco Systems® Inc. , 814 Airway Ave., Sutherlin, OR 97479 USA • 800-348-9843 • 541-459-4449 • www.orenco.com

Orenco SYSTEMS

Technical Data Sheet

PF Series 60-Hz, 4-inch (100-mm) Submersible Effluent Pumps

Applications

Our 4-inch (100-mm) Submersible Effluent Pumps are designed to transport screened effluent (with low TSS counts) from septic tanks or separate dosing tanks. All our pumps are constructed of lightweight, corrosion-resistant stainless steel and engineered plastics; all are field-serviceable and repairable with common tools; 60-Hz PF Series models are CSA certified to the U.S. and Canadian safety standards for effluent pumps, meeting UL requirements.

Orenco's Effluent Pumps are used in a variety of applications, including pressurized drainfields, packed bed filters, mounds, aerobic units, effluent irrigation, effluent sewers, wetlands, lagoons, and more. These pumps are designed to be used with a Biotube® pump vault or after a secondary treatment system.



C US
LR80980
LR2053896

Powered by Franklin Electric

Features/Specifications

To specify this pump for your installation, require the following:

- Minimum 24-hour run-dry capability with no deterioration in pump life or performance*
- Patented 1⁄8-inch (3-mm) bypass orifice to ensure flow recirculation for motor cooling and to prevent air bind
- Liquid end repair kits available for better long-term cost of ownership
- TRI-SEAL™ floating impeller design on 10, 15, 20, and 30 gpm (0.6, 1.0, 1.3, and 1.9 L/sec) models; floating stack design on 50 and 75 gpm (3.2 and 4.7 L/sec) models
- Franklin Electric Super Stainless motor, rated for continuous use and frequent cycling
- Type SOOW 600-V motor cable

** Not applicable for 5-hp (3.73 kW) models*

Standard Models

See specifications chart, pages 2-3, for a list of standard pumps. For a complete list of available pumps, call Orenco.

Product Code Diagram

PF [50] [10] [1] [2] [ ] - [ ]

Cord length, ft (m):‡
Blank = 10 (3) 20 = 20 (6)
30 = 30 (9) 50 = 50 (15)

Check valve:
Blank = no internal check valve
CV = internal check valve†

Voltage, nameplate:
1 = 115* 200 = 200
2 = 230 4 = 460

Frequency:
1 = single-phase 60 Hz
3 = three-phase 60 Hz

Horsepower (kW):
03 = ⅓ hp (0.25) 05 = ½ hp (0.37)
07 = ¾ hp (0.56) 10 = 1 hp (0.75)
15 = 1½ hp (1.11) 20 = 2 hp (1.50)
30 = 3 hp (2.24) 50 = 5 hp (3.73)

Nominal flow, gpm (L/sec):
10 = 10 (0.6) 15 = 15 (1.0)
20 = 20 (1.3) 30 = 30 (1.9)
50 = 50 (3.2) 75 = 75 (4.7)

Pump, PF Series

* ½-hp (0.37kW) only
† Available for 10 gpm (0.6 L/sec), 1/2 hp (0.37 kW) only
‡ Note: 20-ft cords are available only for single-phase pumps through 1½ hp

Specifications

Pump Model	Design gpm (L/sec)	Horsepower (kW)	Phase	Nameplate voltage	Actual voltage	Design flow amps	Max amps	Impellers	Discharge size and material [1]	Length, in. (mm)	Min. liquid level, [2] in. (mm)	Weight, [3] lb (kg)	Rated cycles/day
PF100511	10 (0.6)	0.50 (0.37)	1	115	120	12.7	12.7	6	1 ¼ in. GFP	23.0 (660)	16 (406)	26 (12)	300
PF100511CV	10 (0.6)	0.50 (0.37)	1	115	120	12.7	12.7	6	1 ¼ in. GFP	23.0 (660)	16 (406)	26 (12)	300
PF100512	10 (0.6)	0.50 (0.37)	1	230	240	6.3	6.3	6	1 ¼ in. GFP	23.0 (660)	16 (406)	26 (12)	300
PF10053200	10 (0.6)	0.50 (0.37)	3	200	208	3.8	3.8	6	1 ¼ in. GFP	23.0 (660)	16 (406)	26 (12)	300
PF100712 [4, 5]	10 (0.6)	0.75 (0.56)	1	230	240	8.3	8.3	8	1 ¼ in. GFP	25.9 (658)	17 (432)	30 (14)	300
PF10073200 [4, 5]	10 (0.6)	0.75 (0.56)	3	200	208	5.1	5.2	8	1 ¼ in. GFP	25.4 (645)	17 (432)	31 (14)	300
PF101012 [5, 6]	10 (0.6)	1.00 (0.75)	1	230	240	9.6	9.6	9	1 ¼ in. GFP	27.9 (709)	18 (457)	33 (15)	100
PF10103200 [5, 6]	10 (0.6)	1.00 (0.75)	3	200	208	5.5	5.5	9	1 ¼ in. GFP	27.3 (693)	18 (457)	37 (17)	300
PF102012 [5, 6, 7, 8]	10 (0.6)	2.00 (1.49)	1	230	240	12.1	12.1	18	1 ¼ in. SS	39.5 (1003)	22 (559)	48 (22)	100
PF102032 [5, 6, 8]	10 (0.6)	2.00 (1.49)	3	230	240	7.5	7.6	18	1 ¼ in. SS	37.9 (963)	20 (508)	44 (20)	300
PF10203200 [5, 6, 8]	10 (0.6)	2.00 (1.49)	3	200	208	8.7	8.7	18	1 ¼ in. SS	37.9 (963)	20 (508)	44 (20)	300
PF150311	15 (1.0)	0.33 (0.25)	1	115	120	8.7	8.8	3	1 ¼ in. GFP	19.5 (495)	15 (380)	23 (10)	300
PF150312	15 (1.0)	0.33 (0.25)	1	230	240	4.4	4.5	3	1 ¼ in. GFP	19.5 (495)	15 (380)	23 (10)	300
PF200511	20 (1.3)	0.50 (0.37)	1	115	120	12.3	12.5	4	1 ¼ in. GFP	22.3 (566)	18 (457)	25 (11)	300
PF200512	20 (1.3)	0.50 (0.37)	1	230	240	6.4	6.5	4	1 ¼ in. GFP	22.5 (572)	18 (457)	26 (12)	300
PF20053200	20 (1.3)	0.50 (0.37)	3	200	208	3.7	3.8	4	1 ¼ in. GFP	22.3 (566)	18 (457)	26 (12)	300
PF201012 [4, 5]	20 (1.3)	1.00 (0.75)	1	230	240	10.5	10.5	7	1 ¼ in. GFP	28.4 (721)	20 (508)	33 (15)	100
PF20103200 [4, 5]	20 (1.3)	1.00 (0.75)	3	200	208	5.8	5.9	7	1 ¼ in. GFP	27.8 (706)	20 (508)	33 (15)	300
PF201512 [4, 5]	20 (1.3)	1.50 (1.11)	1	230	240	12.4	12.6	9	1 ¼ in. GFP	34.0 (864)	24 (610)	41 (19)	100
PF20153200 [4, 5]	20 (1.3)	1.50 (1.11)	3	200	208	7.1	7.2	9	1 ¼ in. GFP	30.7 (780)	20 (508)	35 (16)	300
PF300511	30 (1.9)	0.50 (0.37)	1	115	120	11.8	11.8	3	1 ¼ in. GFP	21.3 (541)	20 (508)	28 (13)	300
PF300512	30 (1.9)	0.50 (0.37)	1	230	240	6.2	6.2	3	1 ¼ in. GFP	21.3 (541)	20 (508)	25 (11)	300
PF30053200	30 (1.9)	0.50 (0.37)	3	200	208	3.6	3.6	3	1 ¼ in. GFP	21.3 (541)	20 (508)	25 (11)	300
PF300712	30 (1.9)	0.75 (0.56)	1	230	240	8.5	8.5	5	1 ¼ in. GFP	24.8 (630)	21 (533)	29 (13)	300
PF30073200	30 (1.9)	0.75 (0.56)	3	200	208	4.9	4.9	5	1 ¼ in. GFP	24.6 (625)	21 (533)	30 (14)	300
PF301012 [4]	30 (1.9)	1.00 (0.75)	1	230	240	10.4	10.4	6	1 ¼ in. GFP	27.0 (686)	22 (559)	32 (15)	100
PF30103200 [4]	30 (1.9)	1.00 (0.75)	3	200	208	5.8	5.8	6	1 ¼ in. GFP	26.4 (671)	22 (559)	33 (15)	300
PF301512 [4, 5]	30 (1.9)	1.50 (1.11)	1	230	240	12.6	12.6	8	1 ¼ in. GFP	32.8 (833)	24 (610)	40 (18)	100
PF30153200 [4, 5]	30 (1.9)	1.50 (1.11)	3	200	208	6.9	6.9	8	1 ¼ in. GFP	29.8 (757)	22 (559)	34 (15)	300
PF301534 [4, 5]	30 (1.9)	1.50 (1.11)	3	460	480	2.8	2.8	8	1 ¼ in. GFP	29.5 (685)	22 (559)	34 (15)	300
PF302012 [5, 6, 7]	30 (1.9)	2.00 (1.49)	1	230	240	11.0	11.0	10	1 ¼ in. SS	35.5 (902)	26 (660)	44 (20)	100
PF30203200 [5, 6]	30 (1.9)	2.00 (1.49)	3	200	208	9.3	9.3	10	1 ¼ in. SS	34.0 (864)	24 (610)	41 (19)	300
PF303012 [5, 6, 7, 8]	30 (1.9)	3.00 (2.23)	1	230	240	16.8	16.8	14	1 ¼ in. SS	44.5 (1130)	33 (838)	54 (24)	100
PF303032 [5, 6, 8]	30 (1.9)	3.00 (2.23)	3	230	240	10.0	10.1	14	1 ¼ in. SS	44.3 (1125)	27 (686)	52 (24)	300
PF305012 [5, 6, 7, 8]	30 (1.9)	5.00 (3.73)	1	230	240	25.6	25.8	23	1 ¼ in. SS	66.5 (1689)	53 (1346)	82 (37)	100
PF305032 [5, 6, 8]	30 (1.9)	5.00 (3.73)	3	230	240	16.6	16.6	23	1 ¼ in. SS	60.8 (1544)	48 (1219)	66 (30)	300
PF30503200 [5, 6, 8]	30 (1.9)	5.00 (3.73)	3	200	208	18.7	18.7	23	1 ¼ in. SS	60.8 (1544)	48 (1219)	66 (30)	300
PF500511	50 (3.2)	0.50 (0.37)	1	115	120	12.1	12.1	2	2 in. SS	20.3 (516)	24 (610)	27 (12)	300
PF500512	50 (3.2)	0.50 (0.37)	1	230	240	6.2	6.2	2	2 in. SS	20.3 (516)	24 (610)	27 (12)	300
PF500532	50 (3.2)	0.50 (0.37)	3	230	240	3.0	3.0	2	2 in. SS	20.3 (516)	24 (610)	28 (13)	300
PF50053200	50 (3.2)	0.50 (0.37)	3	200	208	3.7	3.7	2	2 in. SS	20.3 (516)	24 (610)	28 (13)	300
PF500534	50 (3.2)	0.50 (0.37)	3	460	480	1.5	1.5	2	2 in. SS	20.3 (516)	24 (610)	28 (13)	300
PF500712	50 (3.2)	0.75 (0.56)	1	230	240	8.5	8.5	3	2 in. SS	23.7 (602)	25 (635)	31 (14)	300
PF500732	50 (3.2)	0.75 (0.56)	3	230	240	3.9	3.9	3	2 in. SS	23.7 (602)	25 (635)	32 (15)	300

Specifications, cont.

Pump Model	Design gpm (L/sec)	Horsepower (kW)	Phase	Nameplate voltage	Actual voltage	Design flow amps	Max amps	Impellers	Discharge size and material [1]	Length, in. (mm)	Min. liquid level, [2] in. (mm)	Weight, [3] lb (kg)	Rated cycles/day
PF50073200	50 (3.2)	0.75 (0.56)	3	200	208	4.9	4.9	3	2 in. SS	23.1 (587)	26 (660)	32 (15)	300
PF500734	50 (3.2)	0.75 (0.56)	3	460	480	1.8	1.8	3	2 in. SS	34.8 (884)	25 (635)	31 (14)	300
PF501012	50 (3.2)	1.00 (0.75)	1	230	240	10.1	10.1	4	2 in. SS	27.0 (686)	26 (660)	35 (16)	100
PF50103200	50 (3.2)	1.00 (0.75)	3	200	208	5.7	5.7	4	2 in. SS	26.4 (671)	26 (660)	39 (18)	300
PF501034	50 (3.2)	1.00 (0.75)	3	460	480	2.2	2.2	4	2 in. SS	26.4 (671)	26 (660)	39 (18)	300
PF501512[4]	50 (3.2)	1.50 (1.11)	1	230	240	12.5	12.6	5	2 in. SS	32.5 (826)	30 (762)	41 (19)	100
PF50153200[4]	50 (3.2)	1.50 (1.11)	3	200	208	7.0	7.0	5	2 in. SS	29.3 (744)	26 (660)	35 (16)	300
PF503012 [4, 5, 7, 8]	50 (3.2)	3.00 (2.23)	1	230	240	17.7	17.7	8	2 in. SS	43.0 (1092)	37 (940)	55 (25)	100
PF50303200 [4, 5, 8]	50 (3.2)	3.00 (2.23)	3	200	208	13.1	13.1	8	2 in. SS	43.4 (1102)	30 (762)	55 (25)	300
PF503034 [4, 5, 8]	50 (3.2)	3.00 (2.23)	3	460	480	5.3	5.3	8	2 in. SS	40.0 (1016)	31 (787)	55 (25)	300
PF505012 [5,6,7,8]	50 (3.2)	5.00 (3.73)	1	230	240	26.2	26.4	13	2 in. SS	65.4 (1661)	55 (1397)	64 (29)	300
PF505032 [5,6,7,8]	50 (3.2)	5.00 (3.73)	3	230	240	16.5	16.5	13	2 in. SS	59.3 (1506)	49 (1245)	64 (29)	300
PF751012	75 (4.7)	1.00 (0.75)	1	230	240	9.9	10.0	3	2 in. SS	27.0 (686)	27 (686)	34 (15)	100
PF751512	75 (4.7)	1.50 (1.11)	1	230	240	12.1	12.3	4	2 in. SS	33.4 (848)	30 (762)	44 (20)	100

1 GFP = glass-filled polypropylene; SS = stainless steel. The 1 ¼-in. NPT GFP discharge is 2 7⁄8 in. octagonal across flats; the 1 ¼-in. NPT SS discharge is 2 1⁄8 in. octagonal across flats; and the 2-in. NPT SS discharge is 2 7⁄8 in. hexagonal across flats. Discharge is female NPT threaded, U.S. nominal size, to accommodate Orenco® discharge hose and valve assemblies. Consult your Orenco Distributor about fittings to connect hose and valve assemblies to metric-sized piping.

2 Minimum liquid level is for single pumps when installed in an Orenco Biotube® Pump Vault or Universal Flow Inducer. In other applications, minimum liquid level should be top of pump. Consult Orenco for more information.

3 Weight includes carton and 10-ft (3-m) cord.

4 High-pressure discharge assembly required.

5 Do not use cam-lock option (Q) on discharge assembly.

6 Custom discharge assembly required for these pumps. Contact Orenco.

7 Capacitor pack (sold separately or installed in a custom control panel) required for this pump. Contact Orenco.

8 Torque locks are available for all pumps, and are supplied with 3-hp and 5-hp pumps.

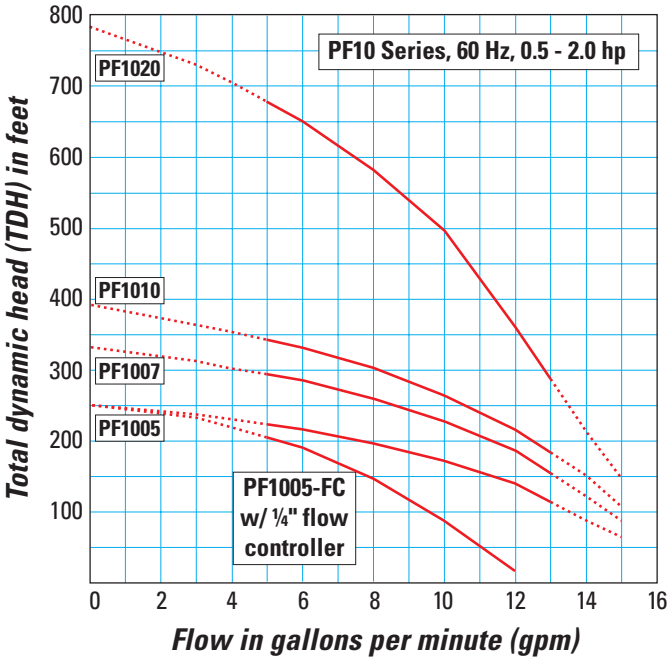
Materials of Construction

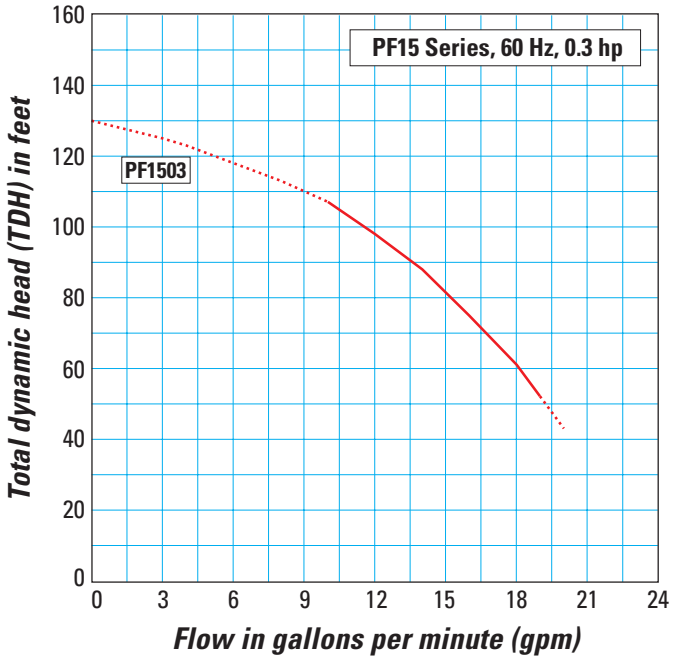
Discharge	Glass-filled polypropylene or stainless steel
Discharge bearing	Engineered thermoplastic (PEEK)
Diffusers	Glass-filled PPO (Noryl GFN3)
Impellers	Celcon® acetal copolymer on 10-, 20, and 30-gpm models; 50-gpm impellers are Noryl GFN3
Intake screen	Polypropylene
Suction connection	Stainless steel
Drive shaft	7/16 inch hexagonal stainless steel, 300 series
Coupling	Sintered stainless steel, 300 series
Shell	Stainless steel, 300 series
Motor	Franklin motor exterior constructed of stainless steel. Motor filled with deionized water and propylene glycol for constant lubrication. Hermetically sealed motor housing ensures moisture-free windings. All thrust absorbed by Kingsbury-type thrust bearing. Rated for continuous duty. Single-phase motors and 200 and 230 V 3-phase motors equipped with surge arrestors for added security. Single-phase motors through 1.5 hp (1.11 kW) have built-in thermal overload protection, which trips at 203-221˚ F (95-105˚ C).

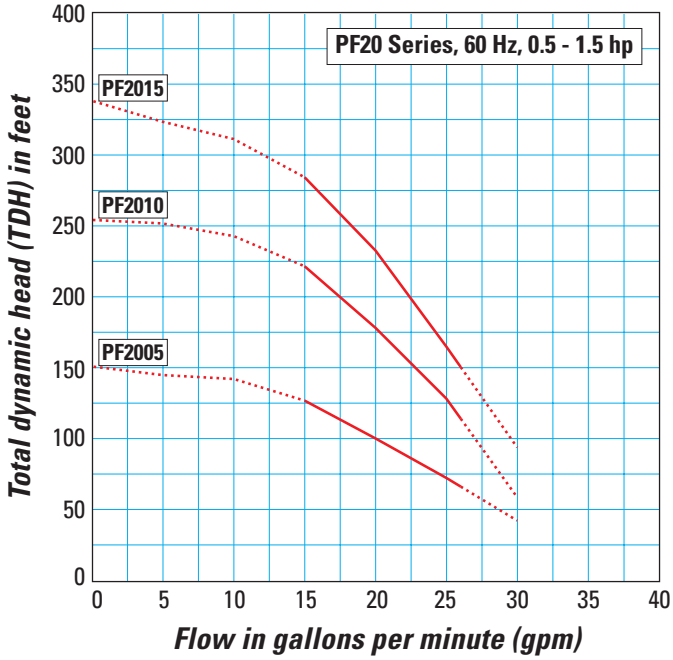
Using a Pump Curve

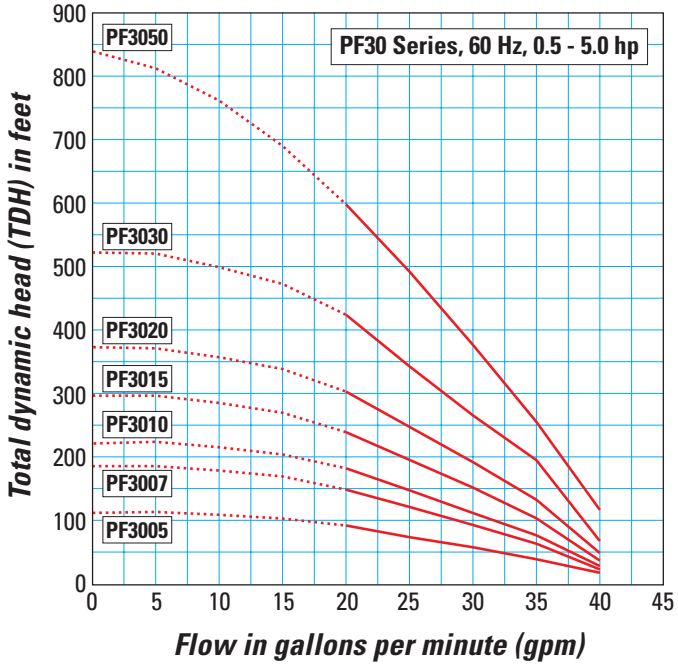
A *pump curve* helps you determine the best pump for your system. Pump curves show the relationship between flow and pressure (total dynamic head, or TDH), providing a graphical representation of a pump's optimal performance range. Pumps perform best at their nominal flow rate. These graphs show optimal pump operation ranges with a solid line and show flow rates outside of these ranges with a dashed line. For the most accurate pump specification, use Orenco's PumpSelect™ software.

Pump Curves



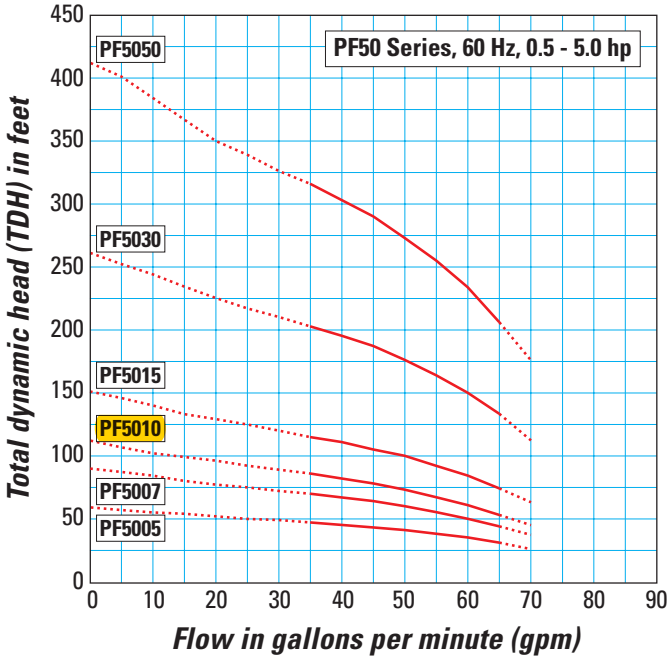


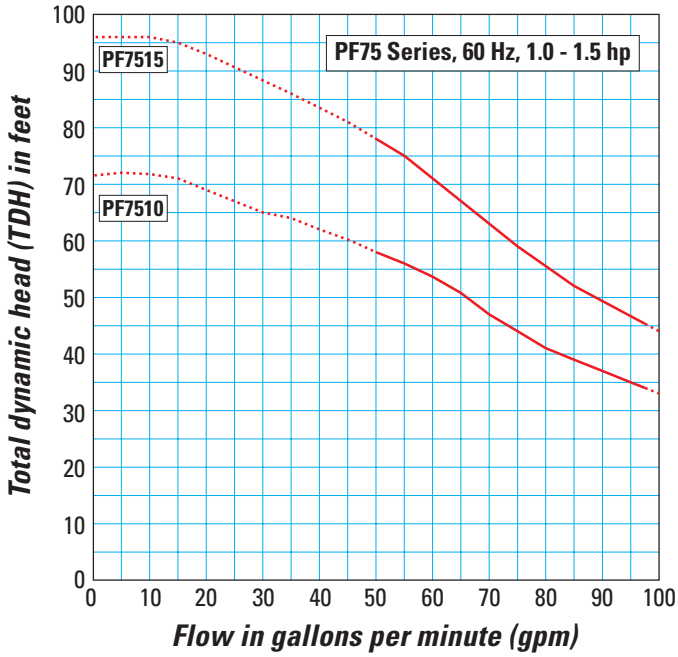




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Pump Curves, cont.





Control Panel (Demand Dose)

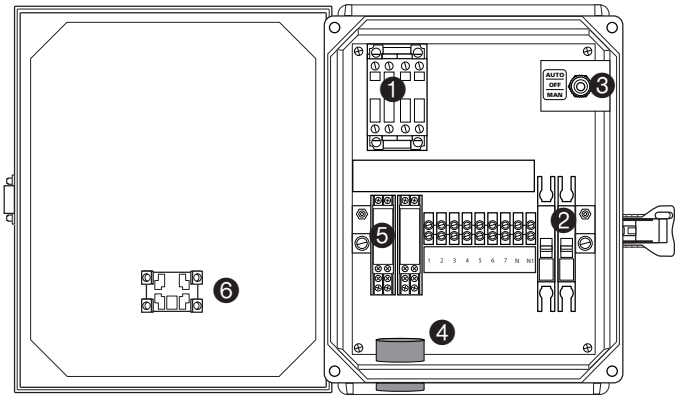
Orenco's ProPak™ demand dose control panels are specifically engineered for the ProPak pump package and are ideal for applications such as demand dosing from a septic tank into a conventional gravity drainfield.

Materials of Construction	
Enclosure	UV-resistant fiberglass, UL Type 4X
Hinges	Stainless steel
Dimensions, in. (mm)	
A - Height	11.5 (290)
B - Width	9.5 (240)
C - Depth	5.4 (135)
Specifications	
Panel ratings	120 V, 3/4 hp (0.56 kW), 14 A, single phase, 60 Hz
1. Motor-start contactor	16 FLA, 1 hp (0.75 kW), 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA)
2. Circuit breakers	120 V, 10 A, OFF/ON switch, Single pole
3. Toggle switch	Single-pole, double-throw HOA switch, 20 A
4. Audio alarm	95 dB at 24 in. (600 mm), warble-tone sound, UL Type 4X
5. Audio alarm silence relay	120 V, automatic reset, DIN rail mount
6. Visual alarm	7/8-in. (22-mm) diameter red lens, "Push-to-silence," 120 V LED, UL Type 4X

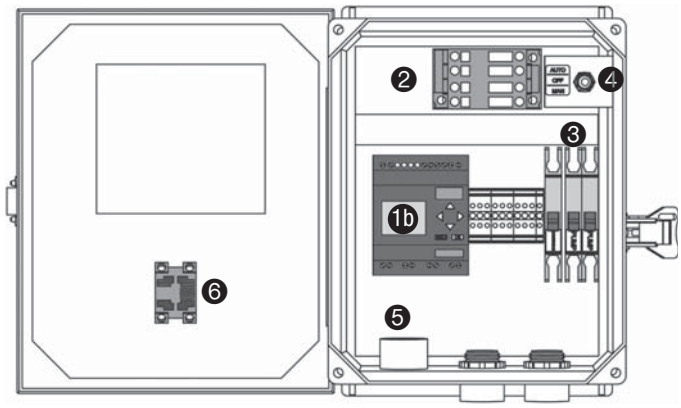
Control Panel (Timed Dose)

Orenco's ProPak timed dose control panels are specifically engineered for the ProPak pump package and are ideal for applications such as timed dosing from a septic tank into a pressurized drainfield or mound. Analog or digital timers are available.

Materials of Construction	
Enclosure	UV-resistant fiberglass, UL Type 4X
Hinges	Stainless steel
Dimensions, in. (mm)	
A - Height	11.5 (290)
B - Width	9.5 (240)
C - Depth	5.4 (135)
Specifications	
Panel ratings	120 V, 3/4 hp (0.56 kW), 14 A, single phase, 60 Hz
Dual-mode	Programmable for timed- or demand-dosing (digital timed-dosing panels only)
1a. Analog timer	120 V, repeat cycle from 0.05 seconds to 30 hours. Separate variable controls for OFF and ON time periods
1b. Digital timer	120-V programmable logic unit with built-in LCD screen and programming keys. Provides control functions and timing for panel operation
2. Motor-start contactor	16 FLA, 1 hp (0.75 kW), 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA)
3. Circuit breakers	120 V, 10 A, OFF/ON switch. Single pole 120 V
4. Toggle Switch	Single-pole, double-throw HOA switch, 20 A
5. Audio alarm	95 dB at 24 in. (600 mm), warble-tone sound, UL Type 4X
6. Visual alarm	7/8-in. (22-mm) diameter red lens, "Push-to-silence", 120 V LED, UL Type 4X



Control panel, demand-dose



Control panel, timed-dose (digital timer model shown)

Orenco Systems® Inc. , 814 Airway Ave., Sutherlin, OR 97479 USA • 800-348-9843 • 541-459-4449 • www.orenco.com

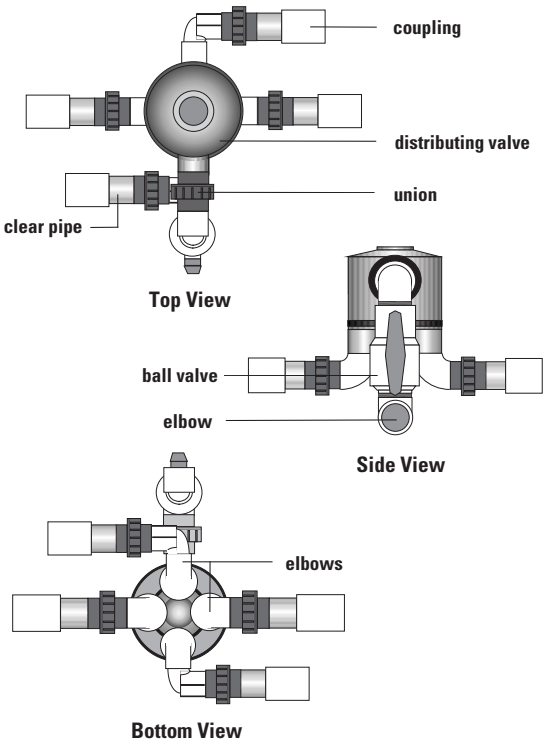
Distributing Valves

Submittal
Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

Applications

Automatic Distributing Valve Assemblies are used to pressurize multiple zone distribution systems including textile filters, sand filters and drainfields.



General

Orenco's Automatic Distributing Valve Assemblies are mechanically operated and sequentially redirect the pump's flow to multiple zones or cells in a distribution field. Valve actuation is accomplished by a combination of pressure and flow. Automatic Distributing Valve Assemblies allow the use of smaller horsepower pumps on large sand filters and drainfields. For example, a large community drainfield requiring 300 gpm can use a six-line Valve Assembly to reduce the pump flow rate requirement to only 50 gpm.

Orenco only warrants Automatic Distributing Valves when used in conjunction with High-Head Effluent Pumps with Biotube® Pump Vaults to provide pressure and flow requirements, and to prevent debris from fouling valve operation. An inlet ball valve and a section of clear pipe and union for each outlet are provided for a complete assembly that is easy to maintain and monitor. Ideal valve location is at the high point in the system. Refer to Automatic Distributing Valve Assemblies (NTP-VA-1) for more information.

Standard Models

V4402A, V4403A, V4404A, V4605A, V4606A, V6402A, V6403A, V6404A, V6605A, V6606A.

Nomenclature

V □□ □□ A

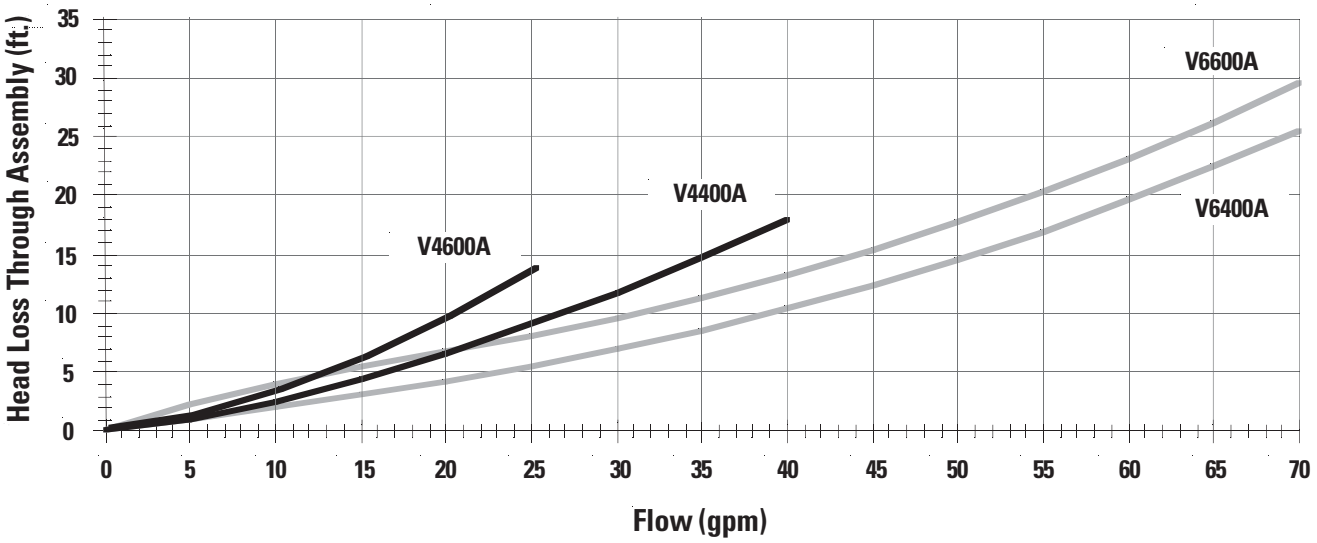
- A — Indicates assembly
- □□ — Number of active outlets
- □□ — Model series:
  - 44 = 4400 series (2-4 outlets)
  - 46 = 4600 series (5-6 outlets)
  - 64 = 6400 series (2-4 outlets)
  - 66 = 6600 series (5-6 outlets)
- V — Distributing valve

Specifications

Materials of Construction

All Fittings:	Sch. 40 PVC per ASTM specification
Unions:	Sch. 80 PVC per ASTM specification
Ball Valve:	Sch. 40 PVC per ASTM specification
Clear Pipe:	Sch. 40 PVC per ASTM specification
V4XXX Distributing Valves:	High-strength noncorrosive ABS polymer and stainless steel
V6XXX Distributing Valves:	High-strength noncorrosive ABS polymer, stainless steel, and die cast metal

Distributing Valves (continued)



Model	Inlet Size (in.)	Outlets Size (in.)	Flow range (gpm)	Max Head (ft.)	Min. Enclosure
V4402A	1.25	1.25	10 - 40	170	VB1217
V4403A	1.25	1.25	10 - 40	170	VB1217
V4404A	1.25	1.25	10 - 40	170	VB1217
V4605A	1.25	1.25	10 - 25	170	RR2418
V4606A	1.25	1.25	10 - 25	170	RR2418
V6402A	1.5	1.5	15 - 100	345	RR2418
V6403A	1.5	1.5	15 - 100	345	RR2418
V6404A	1.5	1.5	15 - 100	345	RR2418
V6605A	1.5	1.5	15 - 100	345	RR2418
V6606A	1.5	1.5	15 - 100	345	RR2418

Appendix C
Manufacturer Installation, Maintenance, and Troubleshooting Guides

This article may describe design criteria that was in effect at the time the article was written. FOR CURRENT DESIGN CRITERIA, call Orenco Systems, Inc. at 1-800-348-9843.

Orenco Automatic Distributing Valve Assemblies

Orenco Systems®
Incorporated
1-800-348-9843

For Wastewater Effluent Systems

Introduction

Orenco's automatic distributing valve assemblies, pressurized with small high-head effluent pumps, are useful for distributing effluent to multiple zones. These zones can be segments of sand filter manifolds, drainfields, or other effluent distribution systems. Distributing valve assemblies can substantially simplify the design and installation of a distribution system and reduce installation costs. This is particularly true where a distributing valve assembly is used instead of multiple pumps and/or electrically operated valves. Additionally, a reduction in long term operation and maintenance costs is realized due to a reduced size and/or number of pumps. More even distribution can be achieved on sloping sites by zoning laterals at equal elevations. This eliminates drainback to lower lines and the unequal distribution of effluent that occurs at the beginning of a cycle.

Valve Operation

The valve itself has only a few moving parts, requires no electricity, and alternates automatically each cycle. Refer to Figure 1 for the following valve operation description. The flow of the incoming effluent forces the rubber flap disk ❶ to seat against the valve bottom ❷. The opening ❸ in the rubber flap disk aligns with an opening in the valve bottom to allow flow to only one valve outlet. The stem ❹ houses a stainless steel spring which pushes the rubber flap disk away from the valve bottom after the flow of effluent stops. The stem acts as a cam follower and rotates the rubber flap disk as the stem is raised and lowered through the cam ❺. The force from the flow of effluent pushes the stem down through the cam and the stainless steel spring pushes the stem back up through the cam when the flow of effluent stops. Each linear motion of the stem allows the rubber flap disk to rotate half the distance necessary to reach the next outlet. When there is no flow, the rubber flap disk is in the "up" position and is not seated against the valve bottom.

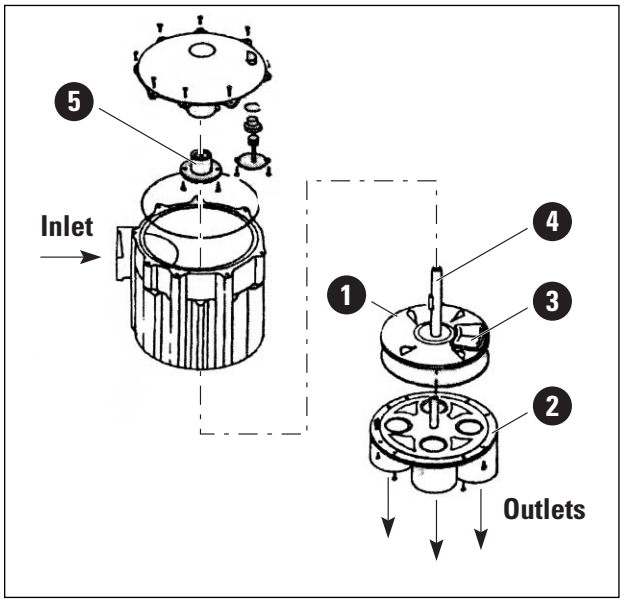


Figure 1:
6000 Series Valve

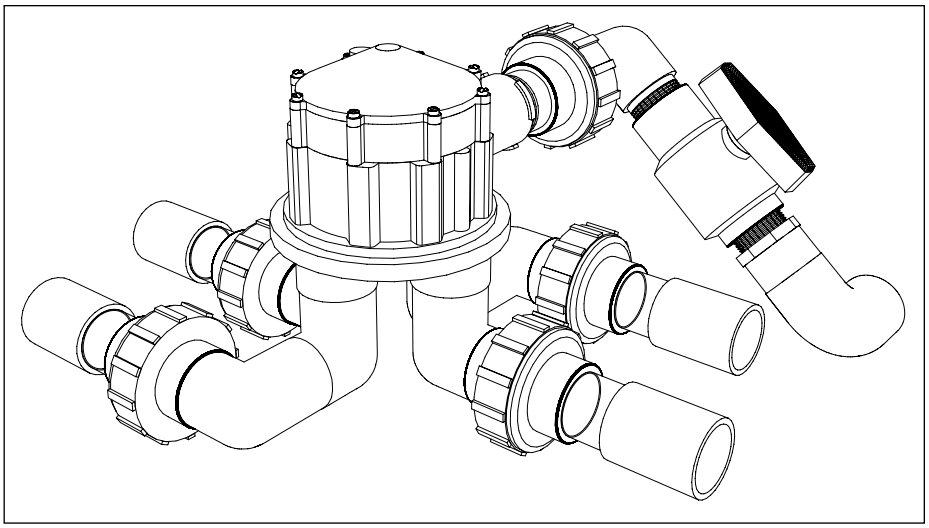


Figure 2:
Orenco Distributing Valve Assembly (6000 Series Valve)

The Distributing Valve Assembly

The Orenco Automatic Distributing Valve Assembly combines the distributing valve itself and several other components to give a complete preassembled unit that is easy to install, monitor, and maintain. Figure 2 shows a complete assembly. Because distributing valves with several outlets can be difficult to line up and glue together in the field, the discharge lines in the assemblies are glued in place at Orenco. The unions (1) allow removal and maintenance of the valve. The clear PVC pipe sections (2) give a visual check of which discharge line is being pressurized. The inlet ball valve (3) allows a quick, simple method to test for proper valve cycling. The ball valve also stops the flow of effluent in case the pump is activated unexpectedly during maintenance or inspection. Check valves may be necessary on the discharge lines. Use of check valves is discussed in the valve positioning section.

Valve Assembly Hydraulics

Liquid flowing through the valve assembly must pass through fairly small openings and make several changes in direction. Because of this, headlosses through the valve assembly are fairly high. Table 1 gives the headloss equations for several different assemblies and Figure 3 shows the graphical representations of these equations. Orenco recommends that high-head turbine pumps be used to pressurize the valve assemblies to ensure enough head is available for proper system operation. High-head turbine pumps are also recommended because the use of a distributing valve usually requires more frequent pump cycling. The high-head turbine pumps are designed for high cycling systems and will outlast conventional effluent pumps by a factor of 10 or more in a high cycling mode. Furthermore, the high-head turbine pump intake is 12 inches or more above the bottom of the pump and tends to prevent any settled solids from being pumped into the distribution valve and obstructing its operation. A minimum flow rate through the distributing valve is required to ensure proper seating of the rubber flap disk. Minimum flow rates for the various models are given in Table 1.

Table 1. Automatic Distributing Valve Assembly Headloss Equations

Model Series	Equation	Operating Range (gpm)
V4400A	$H_L = 0.085 \times Q^{1.45}$	10 - 40
V4600A	$H_L = 0.085 \times Q^{1.58}$	10 - 25
V6400A	$H_L = 0.0045 \times Q^2 + 3.5 \times (1 - e^{-0.06Q})$	15 - 70
V6600A	$H_L = 0.0049 \times Q^2 + 5.5 \times (1 - e^{-0.1Q})$	15 - 70

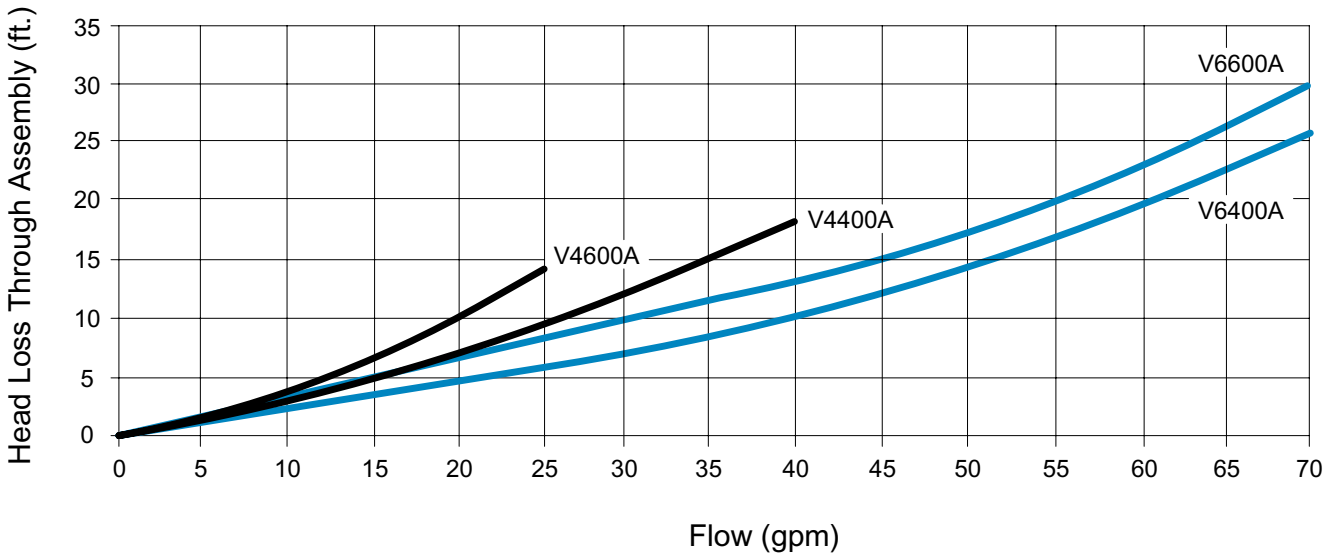


Figure 3:
Automatic distributing valve assembly headloss curves

The Pumping System

Although the distributing valve was designed for the irrigation industry, it has started to gain fairly wide acceptance in the effluent pumping industry. However, because of the mechanical movements of the valve, it is necessary to take steps to prevent solids from reaching the distributing valve that may impede the operation of the valve. Orenco Biotube® Pump Vaults — when properly sized and installed — provide the necessary protection to prevent valve malfunction. The Biotube® pump vault accepts effluent only from the clear zone between a tank's scum and sludge layers and then filters this effluent through a very large surface area screen cartridge. Without this protection in effluent systems, the valve has very little chance of reliable long-term operation.

Valve Positioning

The physical position of the valve in relation to the pump and the discharge point is very important for proper valve operation. The most reliable operation occurs when the valve is placed at the high point in the system and as close to the pump as possible. The transport line between the pump and valve should be kept full if possible. If the line is empty at the beginning of each cycle, pockets of air during filling can cause random rotation of the valve. The valve is particularly vulnerable to this erratic rotation with empty lines that are long and not laid at a constant grade. An ideal valve location is shown in Figure 4.

If the final discharge point is more than about 2 feet above the valve and the system does not drain back into the dosing tank, check valves should be installed on the lines immediately following the valve and a pressure release hole or line should be installed just prior to the valve. This pressure release hole or line can go into a return line to the dosing tank or to a "minidrainfield" near the valve. In order for the valve to rotate reliably, no more than about 2 feet of head should remain against the valve to allow the rubber flap disk to return to its up position. In many cases, it may take from one minute to several minutes for the pressure in the valve to be lowered enough for proper rotation to occur. Special care should be taken when installing systems controlled by programmable timers to ensure cycling does not occur too rapidly. Figure 5 illustrates a valve assembly using check valves. Pumping downhill to the valve should be avoided unless the transport line is very short and the elevation between the discharge line out of the tank and the valve is less than about 2 feet. If the valve is located many feet below the dosing tank, random cycling may occur while the transport line drains through the valve at the end of the cycle. A pressure sustaining valve located just before the distributing valve may overcome this problem in some instances.

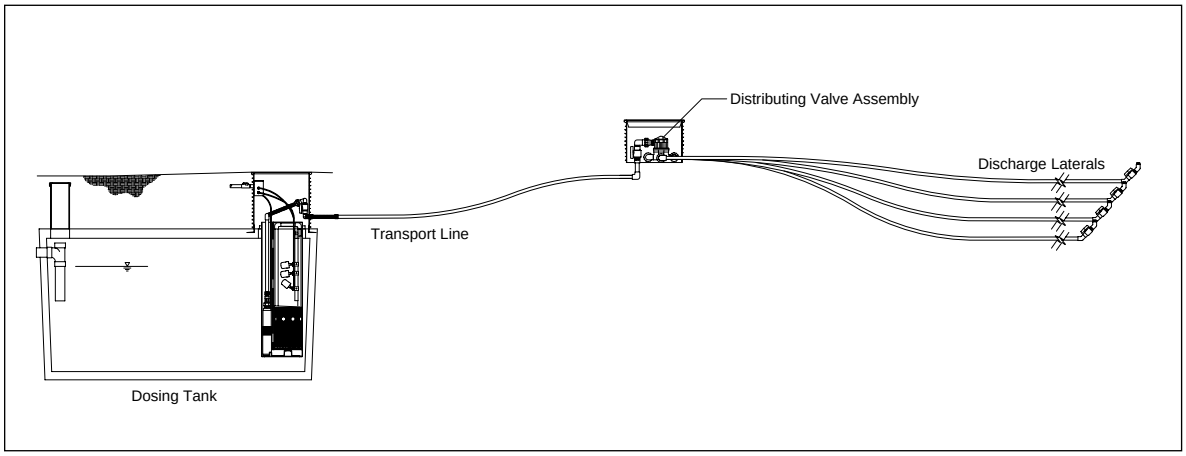


Figure 4:
Ideal valve location

System Startup

Refer to the Hydrotek Valve booklet that is provided with the distributing valve assembly for the sequencing of the valve outlets. The transport line should always be flushed with clean water before installing the valve. Any sand, gravel, or other foreign objects that may have been in the pipe during installation can easily become lodged in the distributing valve, causing malfunction.

With the pump running, alternately close and open the ball valve on the distributing valve assembly to check proper rotation of the valve. (Note: If check valves are used on the lines after the distributing valve, the pump may need to be turned on and off to allow the pressure to be released from the valve.) If visual operation of which zone is operating is not possible, watch the clear pipe on each line for indication of which zone is operating.

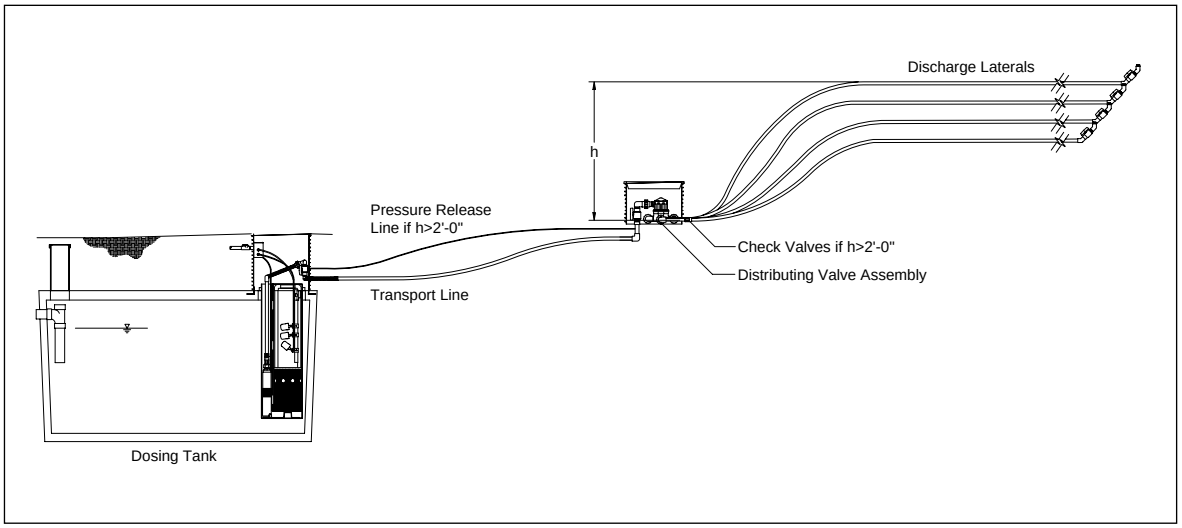


Figure 5:
Valve assembly below final discharge point

Maintenance

Annually check for proper operation by following procedures listed in the Hydrotek Valve booklet and system startup procedures listed above.

Troubleshooting

1. PROBLEM: Valve does not change or cycle to next zone or outlet

CAUSE: The stem and disk assembly is not rotating when water flow is turned off and then back on.

SOLUTION 1: Ensure that there is no debris inside the cam. Clean and carefully reinstall the cam.
SOLUTION 2: If fewer than the maximum number of outlets are being used, check the installation of the cam. Ensure that the stem and disk assembly is not being held down by an improperly installed cam. Refer to the cam replacement instructions.

SOLUTION 3: Remove the valve top and check for proper movement of stem and disk assembly. Check for and remove any debris or foreign objects that may jam or retard the movement of the disk.

SOLUTION 4: Check for freedom of movement of stem and disk assembly up and down over the center pin in bottom of valve. Scale deposits may build up on the pin and hold stem and disk assembly down. Clean pin and again check for freedom of movement.

SOLUTION 5: Be sure that all operating outlets are not capped and that the flow to operating zones is not restricted in any manner. This would cause pressure to build up in the valve and lock the stem and disk assembly in the down position.

SOLUTION 6: The backflow of water from uphill lines may be preventing the valve from cycling properly. This can happen when the valve is placed too far below an elevated line. If the valve cannot be placed close to the high point of the system, a check valve should be installed near the valve in the outlet line that runs uphill from the valve and a drain line installed just prior to the valve to relieve the pressure.

2. PROBLEM: Water comes out of all the valve outlets

CAUSE: Stem and disk assembly not seating properly on valve outlet.

SOLUTION 1: Check for sufficient water flow. A minimum flow rate is required to properly seat the disk as shown in Table 1.

SOLUTION 2: Remove the valve top and check the inside walls to ensure that nothing is interfering with the up and down movement of the stem and disk assembly inside the valve.

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3. PROBLEM: Valve skips outlets or zones

CAUSE: Pumping into an empty transport line — especially downhill — may cause the valve to skip outlets from pockets of air allowing the rubber flap disk to raise during a cycle.

SOLUTION 1: Keep the transport line full.

SOLUTION 2: If the line must remain empty between cycles, use a larger diameter transport line laid at a constant grade to prevent air pockets from forming.

CAUSE: The stem and disk assembly is being advanced past the desired outlet.

SOLUTION 1: Ensure that the correct cam for the desired number of zones is installed and that the outlet lines are installed to the correct outlet ports of the valve as indicated by the zone numbers on the top of the cam.

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Orenco Automatic Distributing Valve Assemblies

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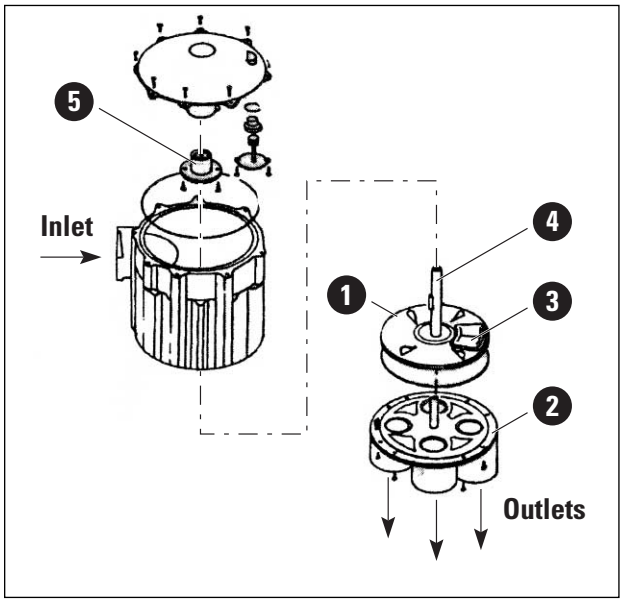


Figure 1:
6000 Series Valve

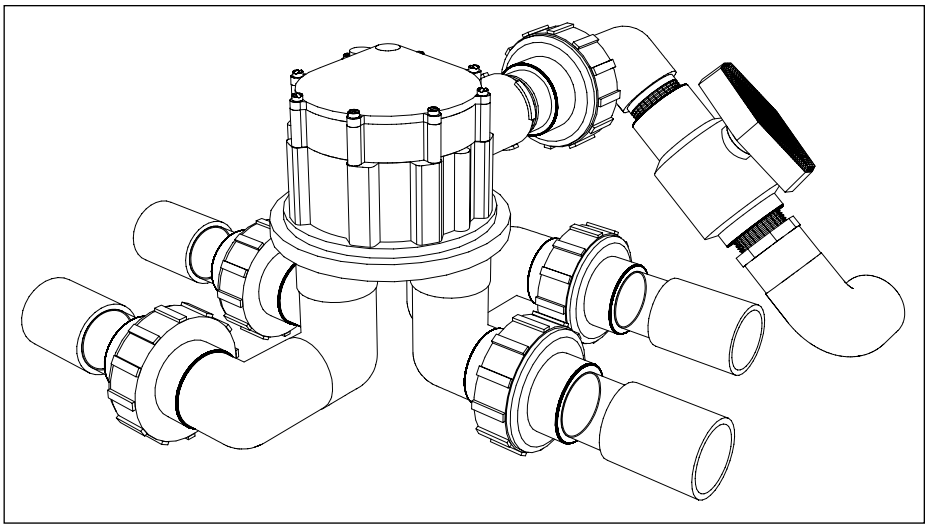


Figure 2:
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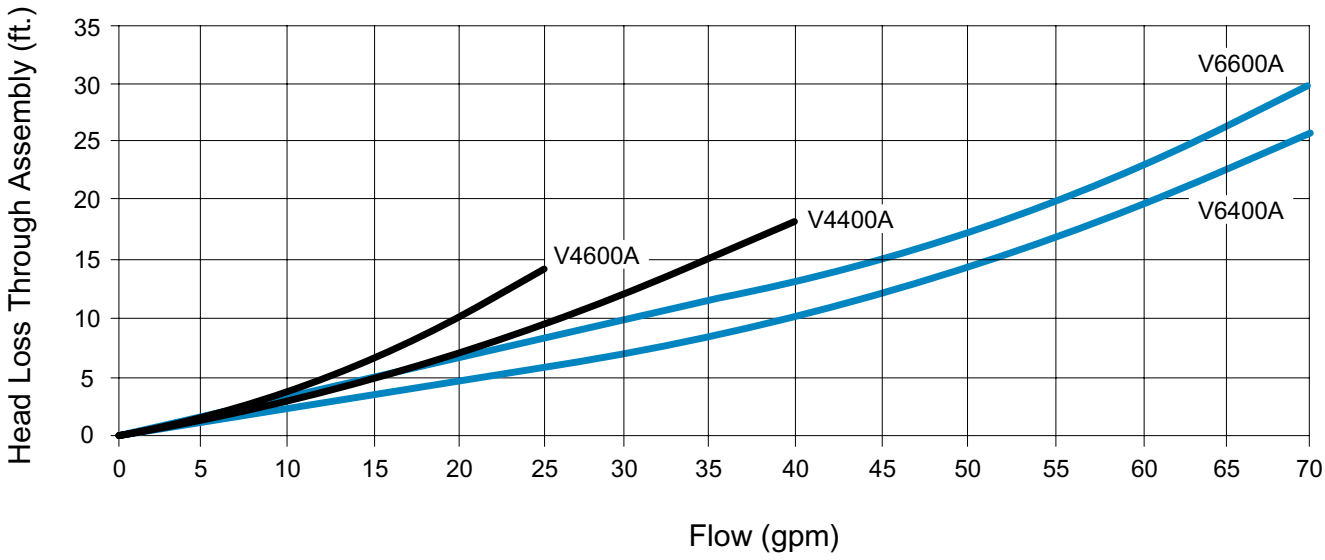


Figure 3:
Automatic distributing valve assembly headloss curves

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Valve Positioning

The physical position of the valve in relation to the pump and the discharge point is very important for proper valve operation. The most reliable operation occurs when the valve is placed at the high point in the system and as close to the pump as possible. The transport line between the pump and valve should be kept full if possible. If the line is empty at the beginning of each cycle, pockets of air during filling can cause random rotation of the valve. The valve is particularly vulnerable to this erratic rotation with empty lines that are long and not laid at a constant grade. An ideal valve location is shown in Figure 4.

If the final discharge point is more than about 2 feet above the valve and the system does not drain back into the dosing tank, check valves should be installed on the lines immediately following the valve and a pressure release hole or line should be installed just prior to the valve. This pressure release hole or line can go into a return line to the dosing tank or to a "minidrainfield" near the valve. In order for the valve to rotate reliably, no more than about 2 feet of head should remain against the valve to allow the rubber flap disk to return to its up position. In many cases, it may take from one minute to several minutes for the pressure in the valve to be lowered enough for proper rotation to occur. Special care should be taken when installing systems controlled by programmable timers to ensure cycling does not occur too rapidly. Figure 5 illustrates a valve assembly using check valves. Pumping downhill to the valve should be avoided unless the transport line is very short and the elevation between the discharge line out of the tank and the valve is less than about 2 feet. If the valve is located many feet below the dosing tank, random cycling may occur while the transport line drains through the valve at the end of the cycle. A pressure sustaining valve located just before the distributing valve may overcome this problem in some instances.

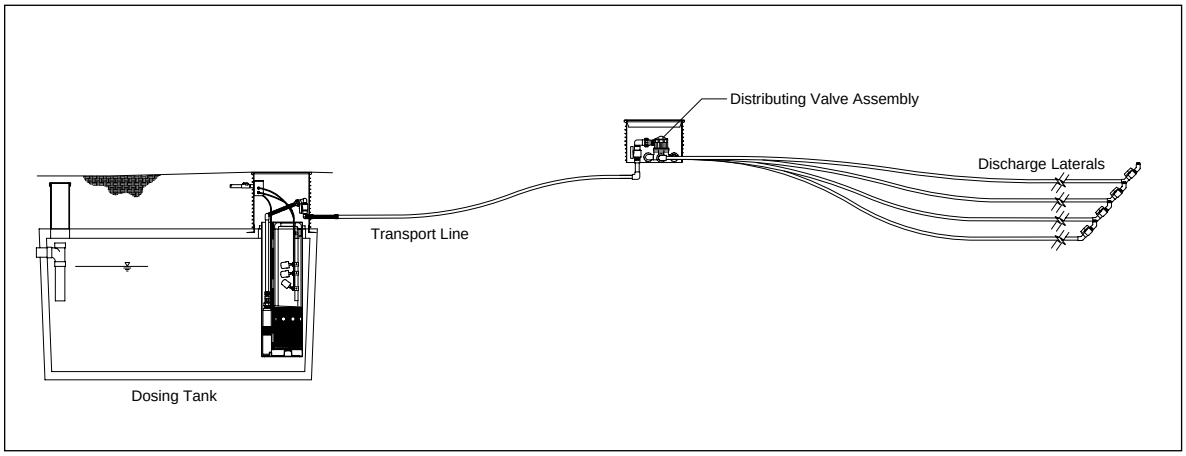


Figure 4:
Ideal valve location

System Startup

Refer to the Hydrotek Valve booklet that is provided with the distributing valve assembly for the sequencing of the valve outlets. The transport line should always be flushed with clean water before installing the valve. Any sand, gravel, or other foreign objects that may have been in the pipe during installation can easily become lodged in the distributing valve, causing malfunction.

With the pump running, alternately close and open the ball valve on the distributing valve assembly to check proper rotation of the valve. (Note: If check valves are used on the lines after the distributing valve, the pump may need to be turned on and off to allow the pressure to be released from the valve.) If visual operation of which zone is operating is not possible, watch the clear pipe on each line for indication of which zone is operating.

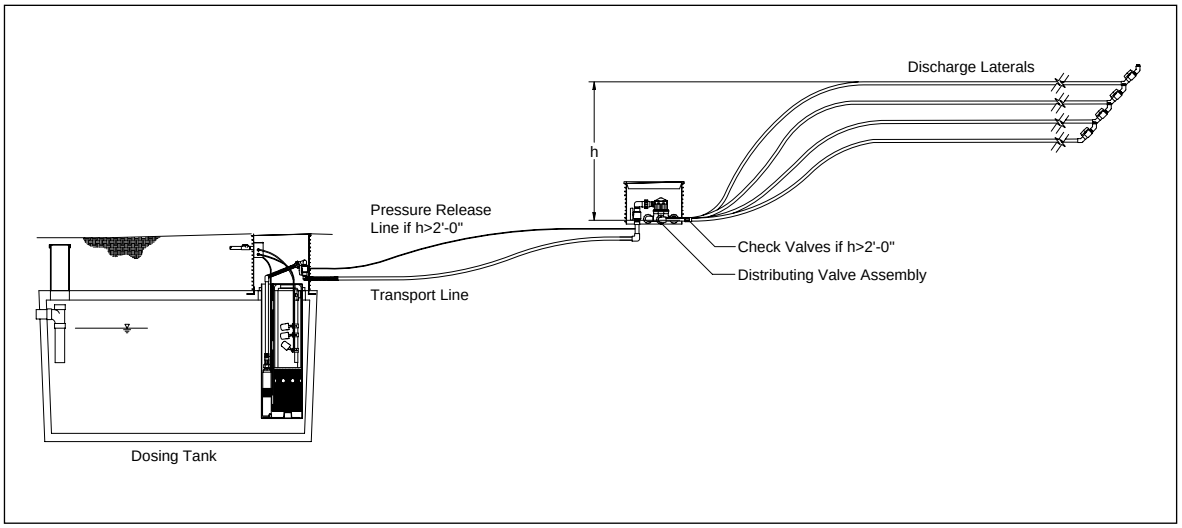


Figure 5:
Valve assembly below final discharge point

Maintenance

Annually check for proper operation by following procedures listed in the Hydrotek Valve booklet and system startup procedures listed above.

Troubleshooting

1. PROBLEM: Valve does not change or cycle to next zone or outlet

CAUSE: The stem and disk assembly is not rotating when water flow is turned off and then back on.

SOLUTION 1: Ensure that there is no debris inside the cam. Clean and carefully reinstall the cam.
SOLUTION 2: If fewer than the maximum number of outlets are being used, check the installation of the cam. Ensure that the stem and disk assembly is not being held down by an improperly installed cam. Refer to the cam replacement instructions.

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SOLUTION 4: Check for freedom of movement of stem and disk assembly up and down over the center pin in bottom of valve. Scale deposits may build up on the pin and hold stem and disk assembly down. Clean pin and again check for freedom of movement.

SOLUTION 5: Be sure that all operating outlets are not capped and that the flow to operating zones is not restricted in any manner. This would cause pressure to build up in the valve and lock the stem and disk assembly in the down position.

SOLUTION 6: The backflow of water from uphill lines may be preventing the valve from cycling properly. This can happen when the valve is placed too far below an elevated line. If the valve cannot be placed close to the high point of the system, a check valve should be installed near the valve in the outlet line that runs uphill from the valve and a drain line installed just prior to the valve to relieve the pressure.

2. PROBLEM: Water comes out of all the valve outlets

CAUSE: Stem and disk assembly not seating properly on valve outlet.

SOLUTION 1: Check for sufficient water flow. A minimum flow rate is required to properly seat the disk as shown in Table 1.

SOLUTION 2: Remove the valve top and check the inside walls to ensure that nothing is interfering with the up and down movement of the stem and disk assembly inside the valve.

SOLUTION 3: Make sure that the operating outlets are not capped and that the flow to the operating zones are not restricted in any manner.

3. PROBLEM: Valve skips outlets or zones

CAUSE: Pumping into an empty transport line — especially downhill — may cause the valve to skip outlets from pockets of air allowing the rubber flap disk to raise during a cycle.

SOLUTION 1: Keep the transport line full.

SOLUTION 2: If the line must remain empty between cycles, use a larger diameter transport line laid at a constant grade to prevent air pockets from forming.

CAUSE: The stem and disk assembly is being advanced past the desired outlet.

SOLUTION 1: Ensure that the correct cam for the desired number of zones is installed and that the outlet lines are installed to the correct outlet ports of the valve as indicated by the zone numbers on the top of the cam.

Orenco® SYSTEMS *Instructions*

Biotube® Effluent Filter Installation

Model FT08 and All Base Inlet Models

(U.S. Patent Nos. 5294635 / 4439323)

Before You Begin

Be sure the tank is empty before you attempt to perform this installation.

In existing tanks or in tanks with short outlet stubs, it may be necessary to extend the tank outlet stub by using a coupling and a pipe section. A coupling may also be needed to bush from 3034 PVC to the Schedule 40 outlet of the filter.

IMPORTANT: *Take proper precautions and wear personal protection equipment (PPE) whenever working in an enclosed area, such as a septic tank.*

Step 1: Dry Fit Vault

Step 1a: Remove the Biotube® filter cartridge from the vault.

Step 1b: Dry fit the vault's outlet to the tank outlet stub.

- Make sure there is enough clearance at the tank opening to remove the Biotube filter cartridge for cleaning and tank pumping.

Step 1c: Remove the vault from the tank outlet stub.

Step 2: Install Vault And Filter

Stainless steel self-drilling screws can be used in place of PVC cement in this step.

Step 2a: Apply PVC cement to the outside of the tank outlet stub and the inside of the vault's outlet.

- Don't use PVC cement if you are using stainless steel screws.

Step 2b: Press the vault into position on the tank stub.

- Make sure the vault is straight and vertical, adjust it if necessary.
- Secure the vault with the stainless steel screws, if you are using this method.

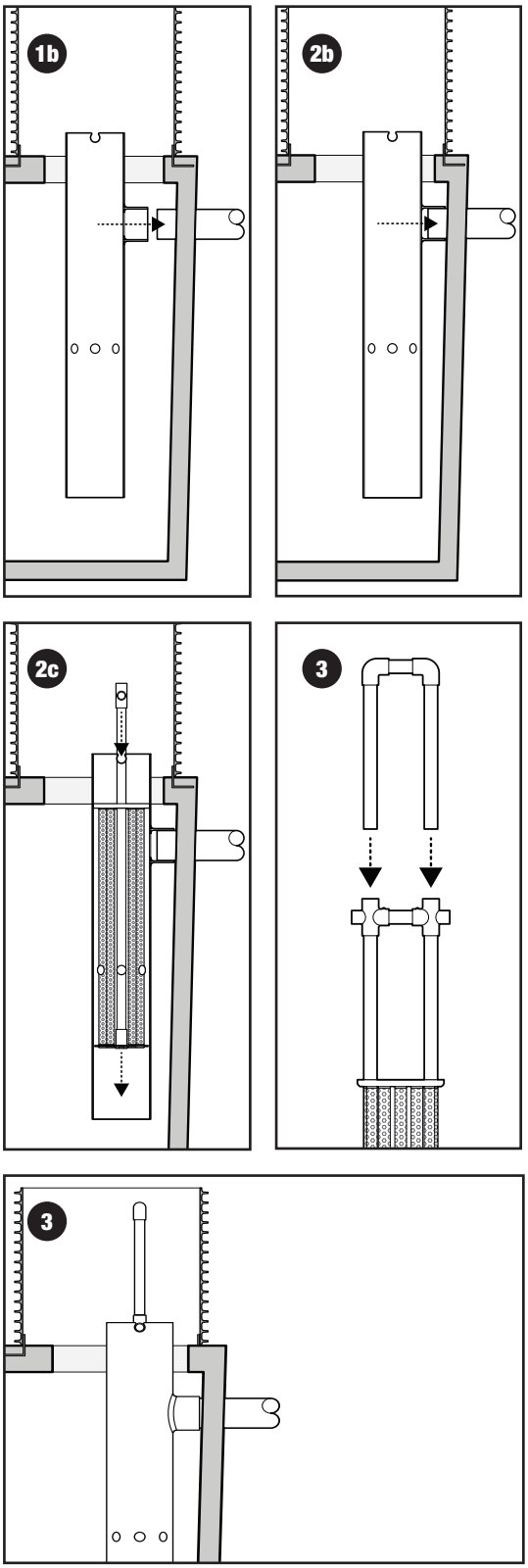
Step 2c: Install the Biotube filter cartridge into the vault.

- Makes sure the handle tees snap into the vault body.

Step 3: Adjust Handle Length, If Necessary

If necessary, extend the filter cartridge's handle to make access easier from the top of the riser.

- Use 1-in. (25-mm) Schedule 40 PVC for the handle extension.
- If the handle extension is longer than 4 feet (1.2 m), make a stiffening "ladder" with tees and horizontal pipe sections.
- Secure the extension on the handle with stainless steel self-drilling screws or PVC cement.



Orenco® SYSTEMS

Technical Data Sheet

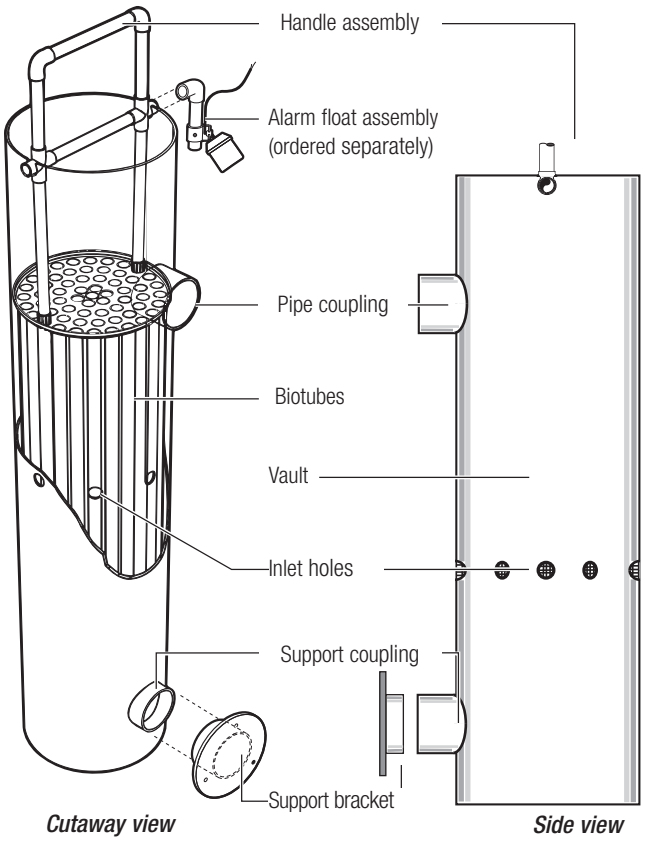
8-in. to 15-in. Dia. Biotube Effluent Filters

Applications

Orenco® 8-inch to 15-inch Biotube® Effluent Filters are designed to remove solids from effluent leaving commercial septic tanks. They can be used in new and existing tanks.

General

Orenco® 8-inch to 15-inch Biotube® Effluent Filters* are used to improve the quality of effluent exiting a commercial septic tank. The Biotube cartridge fits snugly in the vault and is removable for maintenance, the handle assembly snaps into the notches in the top of the vault, and the tee handle can be extended for easy removal of the cartridge. A "base inlet" model (see p. 2) is available for low-profile tanks. An optional slide rail system, available on larger models, simplifies installation and provides tank access for servicing.



** Orenco® Biotube® Effluent Filters are covered under multiple U.S. and international patents.*

Standard Models

FT0854-36, FT1254-36, FT1554-36, FT0822-14B, FT1254-36AR

Product Code Diagrams

FT ☐ ☐ ☐ ☐ **- 36** ☐

- Float switch bracket and slide rail options:
  Blank = no options selected
  A = float switch bracket installed
  R = slide rail installed†
- Cartridge height, in. (mm):
  36 = 36 (914), standard
- Housing height*, in. (mm):
  48 = 48 (1219)
  54 = 54 (1372)
  60 = 60 (1524)
  66 = 66 (1676-mm)
- Filter diameter, in. (mm):
  08 = 08 (200)
  12 = 12 (300)
  15 = 15 (375)
- Filter mesh option:
  Blank = ⅛-in. (3-mm) filter mesh
  P = 1/16-in. (1.6-mm) filter mesh
- Biotube® effluent filter

* Minimum liquid level (MLL) information:
48-in. (1219-mm) housing for MLL of 37-46 in. (940-1168 mm)
54-in. (1372-mm) housing for MLL of 47-63 in. (1194-1600 mm)
60-in. (1524-mm) housing for MLL of 64-84 in. (1626-2134 mm)
66-in. (1676-mm) housing for MLL of 85-112 in. (2159-2845 mm)

† For 12- and 15-in. (300- and 375-mm) only; use slide rail option when only one access is available for the filter chamber

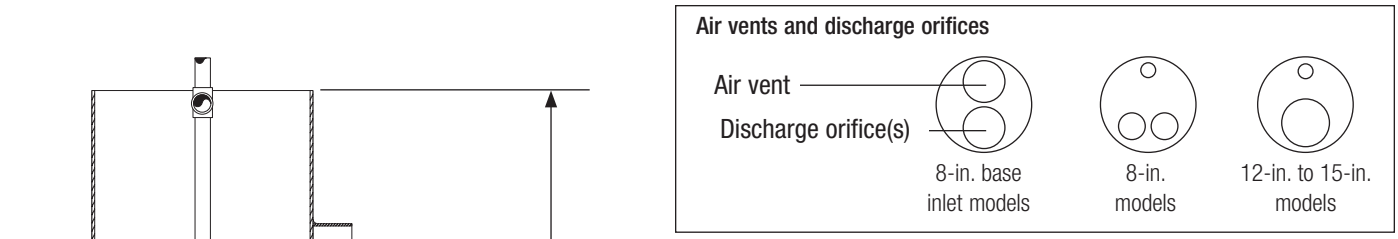
FT ☐ ☐ **22 - 14 B** ☐

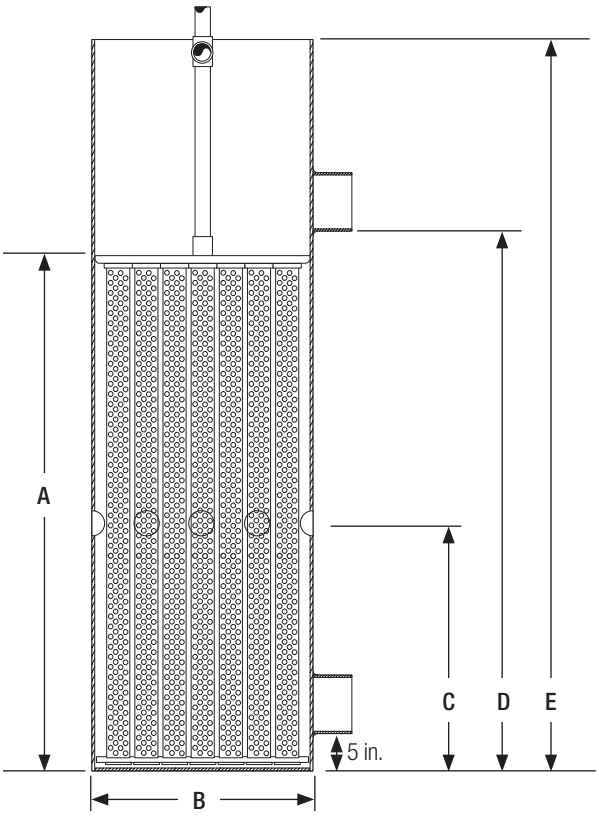
- Float switch bracket and overflow plate options:
  Blank = no options selected
  A = float switch elbow installed
  FSO = overflow plate installed
- Base inlet model
- Cartridge height, in. (mm):
  14 = 14 (356), standard
- Filter housing height, in. (mm):
  22 = 22 (558), standard
- Filter diameter, in. (mm):
  08 = 8 (200)
  12 = 12 (300)
- Filter mesh option:
  Blank = ⅛-in. (3-mm) filter mesh
  P = 1/16-in. (1.6-mm) filter mesh
- Biotube® effluent filter

Materials of Construction

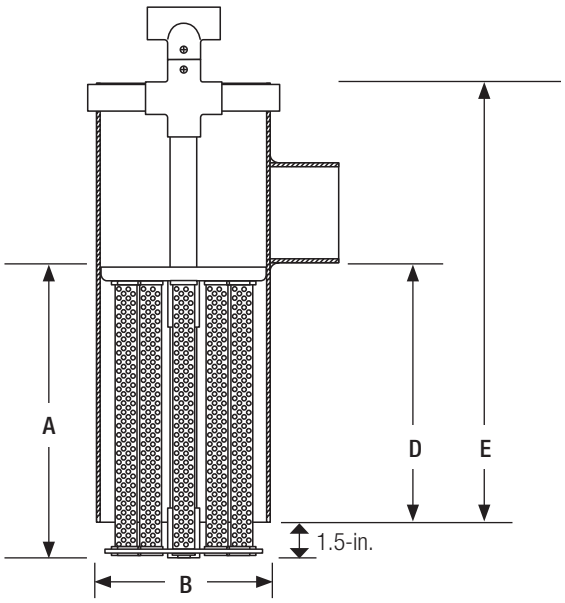
Vault	PVC
Pipe coupling	PVC
Handle components	PVC
Support coupling and bracket	PVC
Biotube® cartridge	Polypropylene and polyethylene

Note: Support coupling and support bracket are available on 12-inch and 15-inch filters only.





Standard model



Base inlet model

Specifications

Model	FT0854-36	FT0822-14B	FT1254-36	FT1254-36AR	FT1554-36
A - Cartridge height, in.	36	14	36	36	36
B - Nominal diameter, in.	8	8	12	12	15
C - Inlet hole height*, in.	22	n/a†	22	22	22
D - Vault base to invert height, in.	38	13	38	38	38
E - Vault height	54	22	54	54	54
Number of inlet holes	8	n/a	8	8	8
Inlet hole diameter, in.	1.375	n/a	1.375	1.375	1.375
Number of discharge orifices	2	1	1	1	1
Discharge orifice diameter, in.	1.125	1.750	2	2	2
Pipe coupling diameter, in.	4	4	4	4	4
Number of air vents	1	1	1	1	1
Air vent diameter, in.	0.75	1.750	0.75	0.75	0.75
Filter surface area‡, ft^2	14.6	6.0	30.0	30.0	50.5
Flow area**, ft^2	4.4	1.8	9.0	9.0	15.2

** Inlet hole height can vary depending on the configuration of the tank. Optimum hole height is 65-75% of the minimum liquid level.*

† No inlet holes required, because influent enters between the vault base and the bottom of the filter cartridge.

‡ Filter area is defined as the total surface area of all individual Biotubes® within the filter cartridge.

*** Flow area is defined as the total open area (area of the mesh openings) of all the individual Biotubes within the filter cartridge.*

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Appendix D
Inspection Report Form

WASTEWATER SYSTEM INSPECTION REPORT

General Information	
Site Location	**Grassy Mountain, 22 miles SW of Vale, OR**
Facility	**Grassy Mountain Gold Mine**
Date of Inspection	
Inspector's Name(s)	
Inspector's Title(s)	
Weather Information	
Describe the weather at the time of the inspection:	

Inspection Activity	Tested or Inspected	Notes
Test pump alarm. Does the visual alarm work?	❑Yes ❑No	
Test pump alarm. Does the audible alarm work?	❑Yes ❑No	
Test float switches. Do switches activate alarms?	❑Yes ❑No	
Inspect septic tank. Is there air space between the top of the scum layer and the inside top of the tank?	❑Yes ❑No	
Is less than 40% of the septic tank filled with sludge (28-5/8 inches or less from the tank bottom)	❑Yes ❑No	
Is the pumping chamber free of solids? (Floating or settled at the bottom of the tank)	❑Yes ❑No	
Inspect the effluent filter. Is the screen free of scum/solids?	❑Yes ❑No	
Inspect observation ports within the drainfield. Are pipes free of standing water?	❑Yes ❑No	
Check pump cycle counters. Does each pump have approximately the same count?	❑Yes ❑No	

If the answer to any of the questions above is No, then consult the Operations and Maintenance Manual for how to correct the failure or contact the system maintenance contractor/operator.

Print name: _____

Signature: _____

Date: _____