Onsite Wastewater Feasibility Study

For

Kidder Creek Camp

Master Site Plan

Prepared by:

Chris Cummings

Civil Engineer

3399 Dodson Lane

Anderson, Ca

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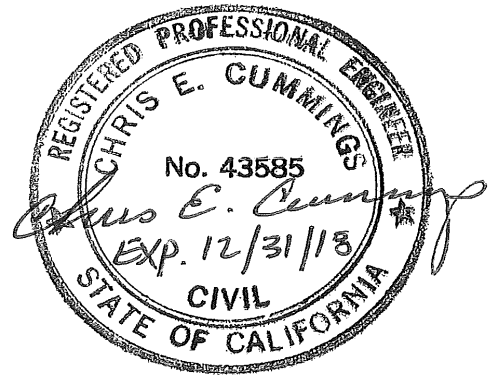


Study Scope

The scope of this feasibility study is to consider and investigate alternatives for wastewater treatment to meet the needs of future expansion identified in the Kidder Creek Camp Master Site Plan. The study considers increased wastewater treatment demands and includes a subsurface soils investigation along with recommendations for treatment alternatives.

Site Overview

The camp site is located on 580 acres in remote western Siskiyou County and is six miles Northwest of the town of Etna. Geology is primarily decomposed granite including areas of alluvial fans of sandy loam. The adjacent area to the North and West is mostly metavolcanic rock that has some intrusion into the decomposed granite in the Southwest portion of the site creating interspersed rock outcroppings. Lower areas of the site directly adjacent to Kidder Creek are alluvially deposited gravel beds containing medium to large metavolcanic and metasedimentary cobles and gravel. See the attached Regional Geologic Map, Attachment A.

Field Review of Soils

A field review was performed on December 3, 2016 by Civil Engineer Chris Cummings and David Skinner, wastewater and stormwater technician. Soil profiles were recorded at five backhoe test pits corresponding to preliminary locations for leach lines at proposed wastewater producing facilities. Test pit #1 is adjacent to the future Maintenance Facility (18 on the Master Site Plan). Test pit #2 is adjacent to the future Equestrian/Base Camp site mobile camping area (11 on the Master Site Plan). Test pit #3 is in the pasture adjacent to the future Ranch Camp area (7 on the Master Site Plan). Test pit #4 is in the apple orchard adjacent to the future Welcome Center and Dining Facility (2 on the Master Site Plan). Test pit #5 is approximately 200 yards West and South and across the road from the future mobile camping area and staff housing (11,12 on the Master Site Plan). See attachment B – Master Site Plan with test pits identified.

Soil Profiles

Test Pit #1 – Location: Adjacent to future Maintenance Facility (location 18 on Master Site Plan)

Soil	Depth	Texture	Structure	Color	Density	Drainage Class
Clay loam	0"-12"	Medium graininess	Weak cast	Brown	Medium dense (fat, short ribbon)	Class 3 – moderate to poorly drained*
Sandy clay loam	12"- 72"	Medium graininess	Weak cast	Reddish brown	Medium dense (thin ribbon)	Class 2 – moderate to well drained*
Sandy loam	72"-96"	Grainy, floury	Weak cast	Reddish brown	Loose (no ribbon)	Class 2 – well drained*

*no mottling and no free water when sample squeezed in cast

Test Pit #2 – Location: Adjacent to the future Equestrian/Base Camp site mobile camping area (location 11 on the Master Site Plan)

Soil	Depth	Texture	Structure	Color	Density	Drainage Class
Silty clay	0"-18"	Smooth	Strong cast	Medium brown	Medium dense (fat ribbon)	Class 3 – moderate to poorly drained*
Clay loam	18"- 48"	Medium graininess	Strong cast	Medium brown	Medium Dense (fat ribbon)	Class 2 – well to moderately drained*
Sandy loam	48"-84"	Grainy, floury	Weak cast	Light brown	Loose (no ribbon)	Class 2 – well drained*

*no mottling and no free water when sample squeezed in cast

Test Pit #3- Location: In the pasture, adjacent to the future Ranch Camp area (7 on the Master Site Plan)

Soil	Depth	Texture	Structure	Color	Density	Drainage Class
Sandy loam	0"-12"	Substantial graininess	Moderate cast	Dark brown	Loose (no ribbon)	Class 2 – well drained*
Sandy clay loam	12"- 24"	Substantial graininess	Moderate to strong cast	Brown	Medium dense (fat ribbon)	Class 2 – well drained*
Clay loam	24"-48"	Medium graininess	Strong cast	Brown	Dense (thin ribbon)	Class 2 – well drained*
Silty clay	48"-72"	Smooth	Strong cast	Brown	Dense (thin ribbon)	Class 2 to class 3 - moderately drained to poorly drained*
Clay	72"-96"	Smooth	Strong cast	Brown	Dense (thin ribbon)	Class 3 – poorly drained*

*no mottling and no free water when sample squeezed in cast

Test Pit #4- Location: In the apple orchard, adjacent to the future Welcome Center and Dining Facility (2 on the Master Site Plan)

Soil	Depth	Texture	Structure	Color	Density	Drainage Class
Loamy sand	0"-24"	Grainy, floury	Weak cast	Dark brown to Brown	Loose (no ribbon)	Class 2 – well drained*
Sandy loam	24"- 36"	Grainy, smooth	Moderate cast	Brown	Medium Dense (no ribbon)	Class 2 – well drained*
Sandy Clay	36"-48"	Grainy, smooth	Moderate cast	Brown	Medium Dense (thin ribbon)	Class 2 – well drained*
Loamy Clay	48"-64"	Grainy, smooth	Moderate cast	Grayish Brown	Medium dense (fat, short ribbon)	Class 2 well to moderately well drained*

Sandy Clay	64"-96"	Grainy, smooth	Moderate to strong cast	Brown	Dense (thin ribbon)	Class 2 well to moderately well drained*

*no mottling and no free water when sample squeezed in cast

Test Pit #5 – Location: approximately 200 yards West and South and across the road from the future mobile camping area and staff housing (11,12 on the Master Site Plan)

Soil	Depth	Texture	Structure	Color	Density	Drainage Class
Sandy loam	0"-12"	Smooth, grainy	Moderate cast	Dark brown	Medium dense (no ribbon)	Class 2 – well drained*
Sandy loam	12"- 72"	Smooth grainy	Moderate cast	Brown to reddish brown	Medium dense (no ribbon)	Class 2 – well drained*
Silty loam	72"-96"	Grainy, floury	Moderate cast	Light brown	Medium dense to lose (no ribbon)	Class 2 – well drained*

*no mottling and no free water when sample squeezed in cast

Soil Suitability Findings

The test pits were well distributed throughout the area proposed for wastewater producing facilities and showed varying soils from sandy loam to silty loam to sandy clay and clay. The predominant soil types found at depths most suitable for conventional leach fields was sandy loam or sandy/silty/loamy clay that are well to moderately well-draining. Test pits ranged in depth of seven to eight feet and no free ground water or soil mottling were found. Class 3 soils that are poor draining were the exception and were found at a depth of six feet in test pit #3 and at the surface in test pits one and two. Test pit #3 was located in the field directly adjacent to and down slope from the existing leach field by the existing Ranch Camp arena. The clay layer at the six-foot depth did not show perched or free water or mottling. This indicates that the clay loam and silty clay at the depths of 24"-72" is adequately functioning for conventional leaching without excessively migrating horizontally at that location.

The size of the site and availability of large areas representing the test pits indicate that conventional leach systems are feasible. It is also noted that past operations of existing conventional leach fields have been successful throughout the site. Future design of leach fields will require individual site-specific leach tests to accommodate specific facility wastewater volumes.

Estimated Wastewater Volumes

Onsite water usage monitoring over a three-year period during high usage months in 2008, 2009, and 2010 found total water usage to be 58.5 gallons per person per day with the existing older showers, toilets, fixtures and outdoor watering needs. Comparative EPA Onsite Wastewater Treatment and Disposal Systems Design Manual data indicates 30 to 45 gallons per person per day for resort cabins, dormitory/bunk houses, developed campgrounds and children's camp. Water saving measures such as low flush toilets and low flow shower heads can further reduce estimated usage volumes. Additional measures such as use of treated grey water from sinks and showers in toilets can also reduce daily wastewater volumes if found to be economical in the design of individual systems. Based on EPA and industry published flow rates, 45 gallons per day is a conservative estimate of typical wastewater flow rate for camp cabins, staff housing, retreat center and the guest houses. Dry camps are estimated at 15 gallons per person wastewater flow rate. Mobile camping areas are based on 100 gallons per space and converted to two persons per space and 50 gallons per person for summing total volumes.

The largest estimated wastewater volumes are at the Pines/Timberline camp area (#6 on the Master Site Plan). This location has 13 total cabins with 184 maximum persons and is estimated to generate 8,280 gallons per day based on EPA estimated typical flows. The 13 cabins are in groups of three and four and have ample space for a number of individual conventional wastewater systems/leach fields. Next highest in wastewater volume is Ranch Camp (#7 on the Master Site Plan). This location has 7 total cabins with 88 persons and is estimated to generate 3,960 gallons per day. The cabins are spread out in a manner that will also provide ample space for multiple individual conventional wastewater systems/leach fields. Staff housing and the three mobile camping areas estimated volumes are 1800 gallons per day and 1200 gallons per day respectively. They also have ample space for conventional wastewater systems/leach fields. Hi adventure camp (#10 on the Master Site Plan) has two areas that are estimated to produce 1720 and 600 gallons per day. They also have ample space for conventional wastewater systems/leach fields. Water saving measures and conservation oriented designs are likely to result in reduced actual wastewater generation and should be considered in the design phase of the project.

Wastewater volumes discussed above and shown in **Attachment C "Occupancy and Estimated Flow Rates"** represent the total estimated wastewater volumes. Addition of a dining hall will result in meals being prepared at a central location. When the dinning hall is added it will reduce the estimated volumes of the cabin, staff housing, adult retreat, guest houses and mobile camping areas due to occupant's partial use of bathrooms and food preparation activities that will occur in the dinning hall. Estimated typical wastewater volume for the dinning hall is 7 gallons per meal based on EPA Design Manual data. The dinning hall will have the capacity to serve 600 occupants three meals per day. This totals 1800 meals at 7 gallons per meal for 12,600 gallons of wastewater.

Wastewater Characteristics

The various proposed camp facilities will produce wastewater that differ from the values typically used for residential wastewater. The Pines/Timberline and Ranch Camp facilities cabins will have toilets, sinks and showers. The wastewater strength and nitrogen content are expected to be similar but somewhat higher than normal residential wastewater. The three mobile camping facilities are expected to have a higher organic strength and nitrogen concentration than residential wastewater. The Welcome Center and Dinning facility wastewater will have organic strength, fats, oils, grease (FOG) and nitrogen content substantially greater than residential wastewater. Comparable commercial and institutional facilities wastewater characteristics data show this difference.

Wastewater Characteristics of Comparable Commercial and Institutional Facilities

Facility Type	BOD, mean mg/L	TSS, mean mg/L	FOG, mean mg/L	TKN/TN mean mg/L	TP, mg/L
Summer Camp Dining Hall	1,633	465	106	79	14
High School	220	30	11	84	N/A
Roadside Rest	235	88	15	100	9
Health Care Facility	276	139	10	43	9.5

Source: "Guidance For Design Of Large-Scale-On-Site Wastewater Renovation Systems", Connecticut Department of Environmental Protection, Bureau of Materials Management And Compliance Assurance

Food service facilities in particular require special design consideration for handling FOG, high levels of BOD and TSS. Grease traps and solids pre-filters should be incorporated into the design of food service facilities.

Wastewater Treatment Alternatives

Alternative 1: Conventional septic system and leach fields. Conventional septic systems are the most often utilized and reliable systems for sites with ample space and deep soils without high ground water. The soil site investigation indicates that the soil profile and soil types found in the representative test pits are well suited for conventional septic systems and leach fields. Factors that can reduce performance of conventional septic systems are fats, oils and greases (FOG), large quantities of suspended solids (TSS) or low dilution rates of higher strength wastewater. Alternatives 2 and 3 can be designed to accommodate facilities with higher levels of FOG and TSS.

Alternative 2: Orenco/AdvanTex Type System. These systems utilize pretreatment with recirculation through filter medium and are more complex and costlier than a conventional septic system but can be designed to accommodate higher strength wastewater. This system can also be combined with a shallow drip dispersal leach field which accommodates larger volumes of wastewater. This system is also capable of secondary treatment of wastewater to potentially be recycled for use in toilets.

Alternative 3: Recirculating Sand Filter. This system is reliable and is not dependent upon a commercial system supplier for future repair or replacement needs. The initial cost can be higher than proprietary treatment designs but lower maintenance and repair costs may offset.

Alternative 4: Pit or Vault Toilets or Portable Temporary Toilets. Pit toilets can be considered where leaching is not viable or suitable such as areas close to the creek or ponds or more remote areas of the site that will get lesser usage. Portable temporary toilets are also suitable for large events or gatherings that occur infrequently and accommodate peak waste disposal needs.

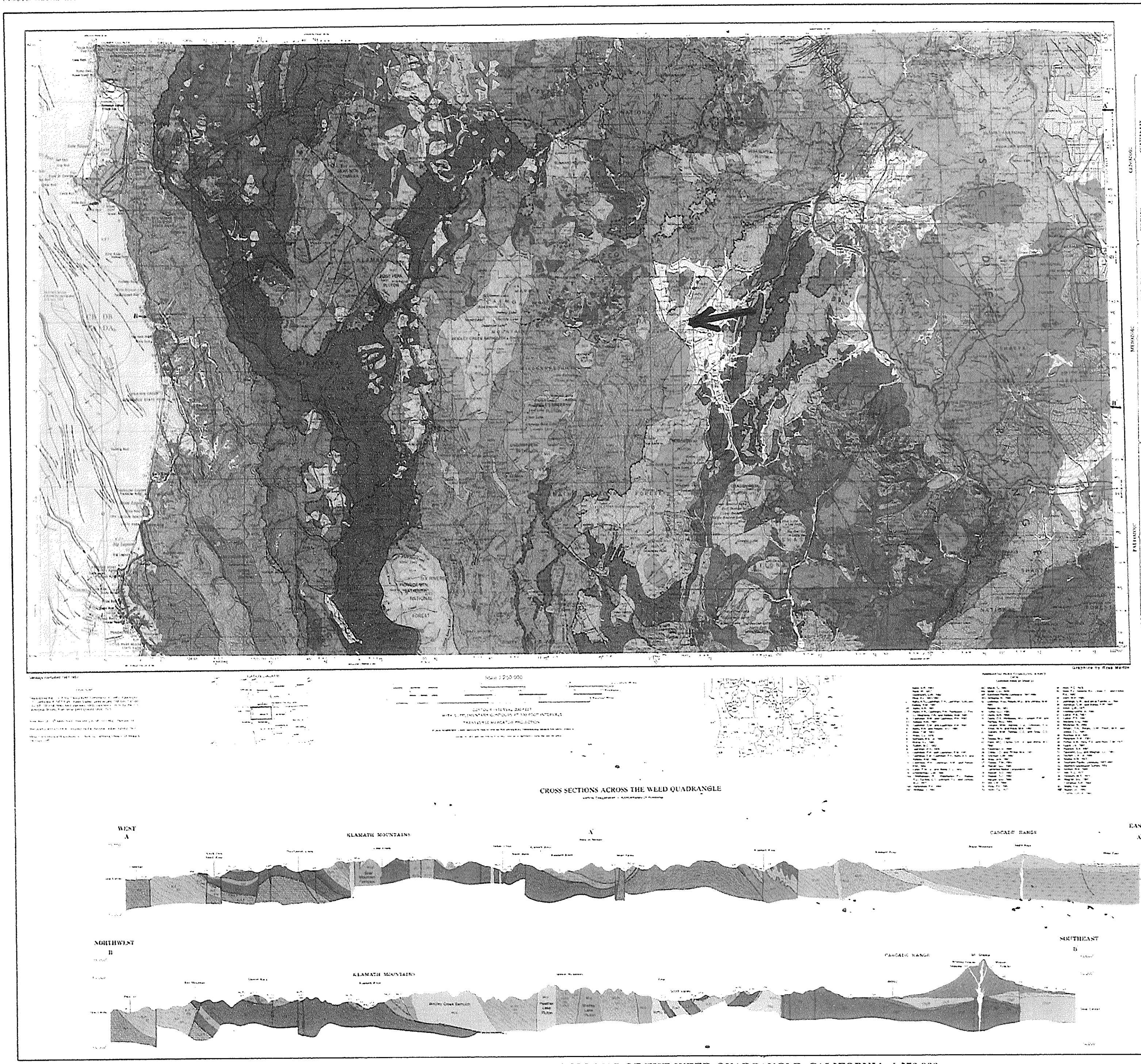
Summary of Recommendations

1) **Conventional Systems:** The existing site and areas proposed for expansion have ample space and suitable soil including soil depth that make them well suited for individual conventional septic systems and leach fields **(Alternative 1)**. Successful long-term operations of the existing leach fields demonstrate the past success of this alternative for onsite wastewater treatment. Holding tank capacities and leach line length of new systems will be dependent on specific soil and specific facility wastewater volumes and characteristics. Areas of the camp with multiple cabins or staff housing can utilize multiple conventional systems due to the number of acres and spread out nature of the areas within the proposed plan. Conventional systems **(Alternative 1)** are recommended for the areas with cabins (The Pines, Ranch Camp) and staff housing, residences and retreat center facilities.

    a) **Design of Conventional Systems:** The test pits indicated some soil variability. New test pits and percolation tests will be required for each specific facility septic system design. There was no ground water, mottling or free water found in any of the test pits. While all except potentially one of the leach field locations will be significant distances from the Kidder Creek channel, there is potential to locate a leach field in the lower soccer field area down slope from the orchard for the Base Campsites, Staff Housing & Retreat Center or mobile camping area (9,11 & 12 on the Master Site Plan). A minimum of 100 feet of setback from the stream channel of Kidder Creek and the Barker Ditch is recommended for this leach field.

2) **Mobile Camping areas 1,2,3:** Mobile camping areas will have somewhat higher strength wastewater but moderate volumes that can be accommodated with conventional wastewater systems. **Alternative 1** is recommended for mobile camping areas 1, 2, 3. Additionally, it is recommended that the camp institute a policy and post rules for campers that disallow the use of odor reducing additives. These additives contain phenols and other chemicals that can affect the function of onsite wastewater systems.

3) **Welcome Center and Dining Facility:** The Welcome Center & Dining Facility has the highest wastewater volume and higher BOD, TSS and FOG in comparison to the other areas and facilities. The recommended alternative for successful wastewater treatment is **Alternative 2** (Orenco/Advantex type system) with an appropriately design solids pre-filter and grease trap.



GEOLOGIC MAP OF THE WEED QUADRANGLE, CALIFORNIA, 1:250,000

Compilation by
D.L. Wagner and G.J. Saucedo
Published 1987

ATTACHMENT A

ATTACHMENT C

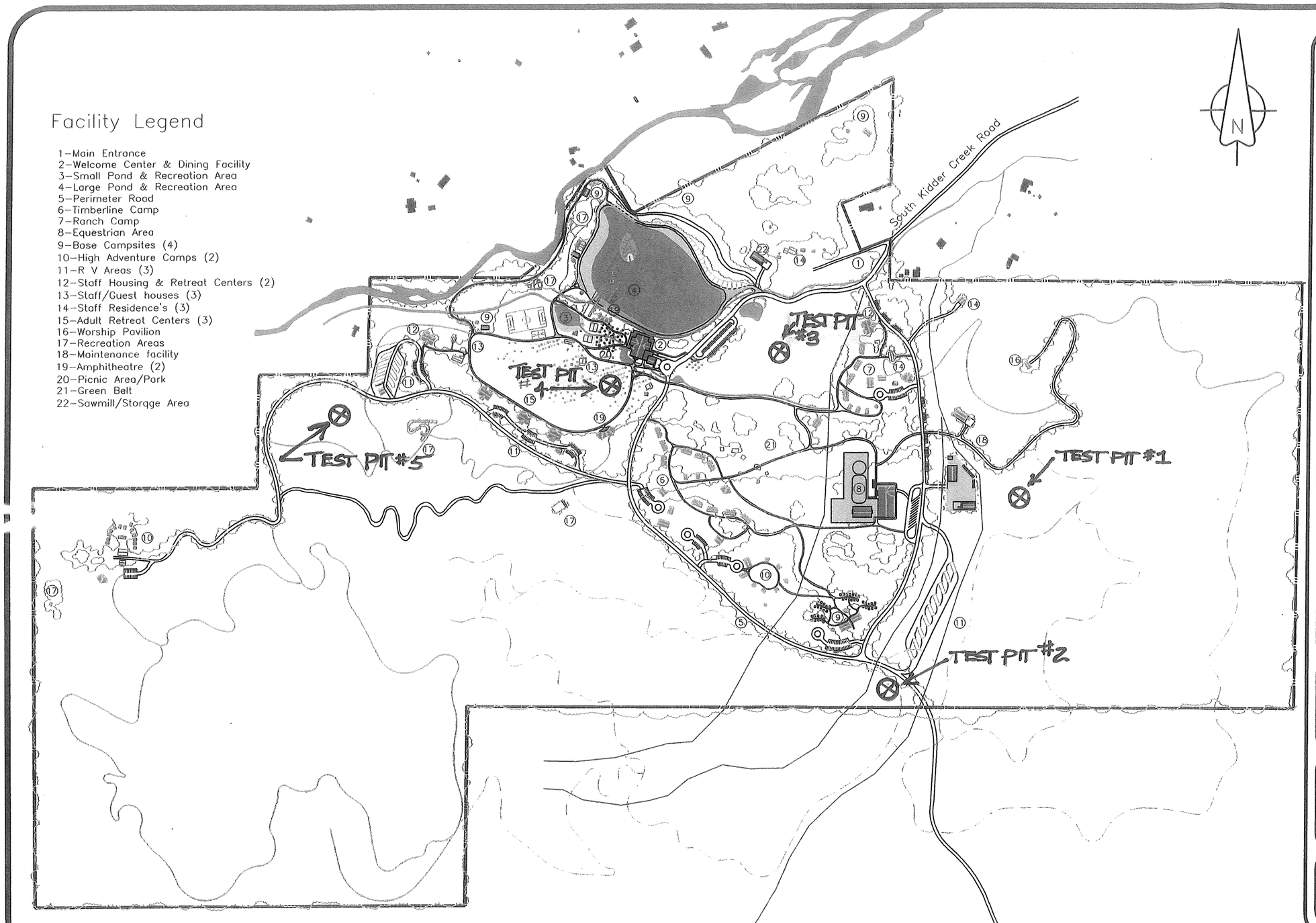
ATTACHMENT C - OCCUPANCY AND ESTIMATED FLOW RATES

Area	*Summer time Occupancy*	*Total*	*GPDPP Per Area*	*Max GPD*	Occupancy Reduction Factor: 73.7%*	Average Gallons Per Day Per Person
	Sessions		*avg*			
The Pines	10 cabins @ 16 3cabins @ 8	184	45	8280	136	6120
Ranch Camp	4 cabins @ 16 3 cabins @ 8	88	45	3960	65	2925
Base Campsite #1	50 people	50	15	750	37	555
Base Campsite #2	30 people	30	15	450	22	330
Base Campsite #3	20 people	20	15	300	15	225
Hi Adventure Camp	116 people	116	15	1740	85	1275
Hi Adventure Camp	40 people	40	15	600	29	435
Mobile Camping area 1	12 Spaces	24	50	1200	18	900
Mobile Camping area 2	12 Spaces	24	50	1200	18	900
Mobile Camping area 3	12 Spaces	24	50	1200	18	900
Staff housing/ Retreat Center 1	40 people	40	45	1800	29	1305
Staff housing/ Retreat Center 2	40 people	40	45	1800	29	1305
Adult Retreat Center 1	40 people	40	45	1800	29	1305
Adult Retreat Center 2	40 people	40	45	1800	29	1305
Adult Retreat Center 3	40 people	40	45	1800	29	1305
Staff Residence 1 (Hamilton)	6 people	6	45	270	5	225
Staff Residence 2 (Jones)	6 people	6	45	270	5	225
Staff Residence 3 (new)	6 people	6	45	270	5	225
Staff/Guest House 1 (Orchard House)	10 people	10	45	450	7	315
Staff /Guest House 2 (Cedar Lodge)	10 people	10	45	450	7	315
Staff/ Guest house 3 (Creekside)	6 people	6	45	270	5	225
	Total	**844**		**30660**	**622**	**22395**

*Occupancy reduction factor based on total 622 max summer time occupancy of camp.

Facility Legend

1–Main Entrance
2–Welcome Center & Dining Facility
3–Small Pond & Recreation Area
4–Large Pond & Recreation Area
5–Perimeter Road
6–Timberline Camp
7–Ranch Camp
8–Equestrian Area
9–Base Campsites (4)
10–High Adventure Camps (2)
11–R V Areas (3)
12–Staff Housing & Retreat Centers (2)
13–Staff/Guest houses (3)
14–Staff Residence's (3)
15–Adult Retreat Centers (3)
16–Worship Pavilion
17–Recreation Areas
18–Maintenance facility
19–Amphitheatre (2)
20–Picnic Area/Park
21–Green Belt
22–Sawmill/Storage Area



Master Site Plan
Proposed

No.	Revision/Issue	Date

Kidder Creek Camp
2700 S. Kidder Creek Rd.
PO Box 208
Greenview, CA 96027
530–467–3265

Project
Date 1/15/14
Scale 1"= 575'
Sheet 1

ATTACHMENT B