

SCAT Machine Engineering Evaluation

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The SCAT Machine was developed to provide a sanitary means to clean buckets used for transporting and storing human waste on recreational multi-day river trips. With refinement the SCAT Machine use was expanded to disaster relief and undeveloped countries where honey-bucket systems are common, similar to rural Alaskan villages.

This technical memorandum summarizes a preliminary evaluation of the use of a SCAT machine in conjunction with the construction of a new sewage lagoon system and washeteria in Chefnak, AK.

SCAT Machine Background & Details

The SCAT Machine consists of a stainless steel box that houses the pumps, tanks, hoses, and controls for the operation of the machine. The SCAT Machine cleans buckets by a user manually loading the bucket and lid onto a platform and strapping it down. The platform is tilted so the bucket empties into the machine, and the cleaning process begins. The standard SCAT Machine has an option to select the degree of cleaning needed and will customize the wash cycle accordingly. Figure 1 shows a SCAT Machine installed at a recreational facility. Additional photos are included in Appendix A. After the cleaning cycle is complete, the clean bucket is returned to the user and the waste is discharged to the sanitary sewer, a vault, or other disposal area.



FIGURE 1
SCAT Machine Installation

Typical Utility Requirements

The SCAT Machine requires water, wastewater, and power connections. Details of each of these components are outlined in the sections below. The information provided here comes from the manufacturer for typical recreational use. Use in Chefnak may be similar, but some custom design details will be required. The typical installation does not use a sanitizing agent in the bucket wash. If this is desired, a sanitizing agent can be used in the wash process.

Approximately 40 buckets per day are expected to be washed in Chefnak. A typical wash cycle from loading the bucket into the machine to unloading the cleaned bucket takes approximately 5 minutes. All 40 buckets could be processed with about 3.5 hours of continuous use.

Water Use

The amount of water used by the SCAT Machine varies on the degree of soiling of the buckets that are washed. Typically about 25 gallons of water per bucket is required for a wash cycle. The water used for the wash cycle can come from a variety of sources, it does not have to be potable, but it needs to be free of most large particles.

Wastewater

The same amount of water consumed, plus the volume of waste emptied from each bucket is generated by the SCAT machine for each wash as wastewater. In a typical installation, wastewater is conveyed to a vault, lagoon, or septic system.

In Chefnak, locating the SCAT Machine with the new washeteria provides the advantage of being located near the new sewer system and lift station. The waste can be discharged to this sanitary sewer system and then pumped to the new lagoon using the new washeteria lift station.

Power

The power supply for a SCAT Machine is 220V. Typical power consumption for a SCAT machine is 3.5 kW per hour of use, assuming a mix of cleaning cycles. If a majority of the buckets are heavily soiled, the energy use would increase to 4.2 kW.

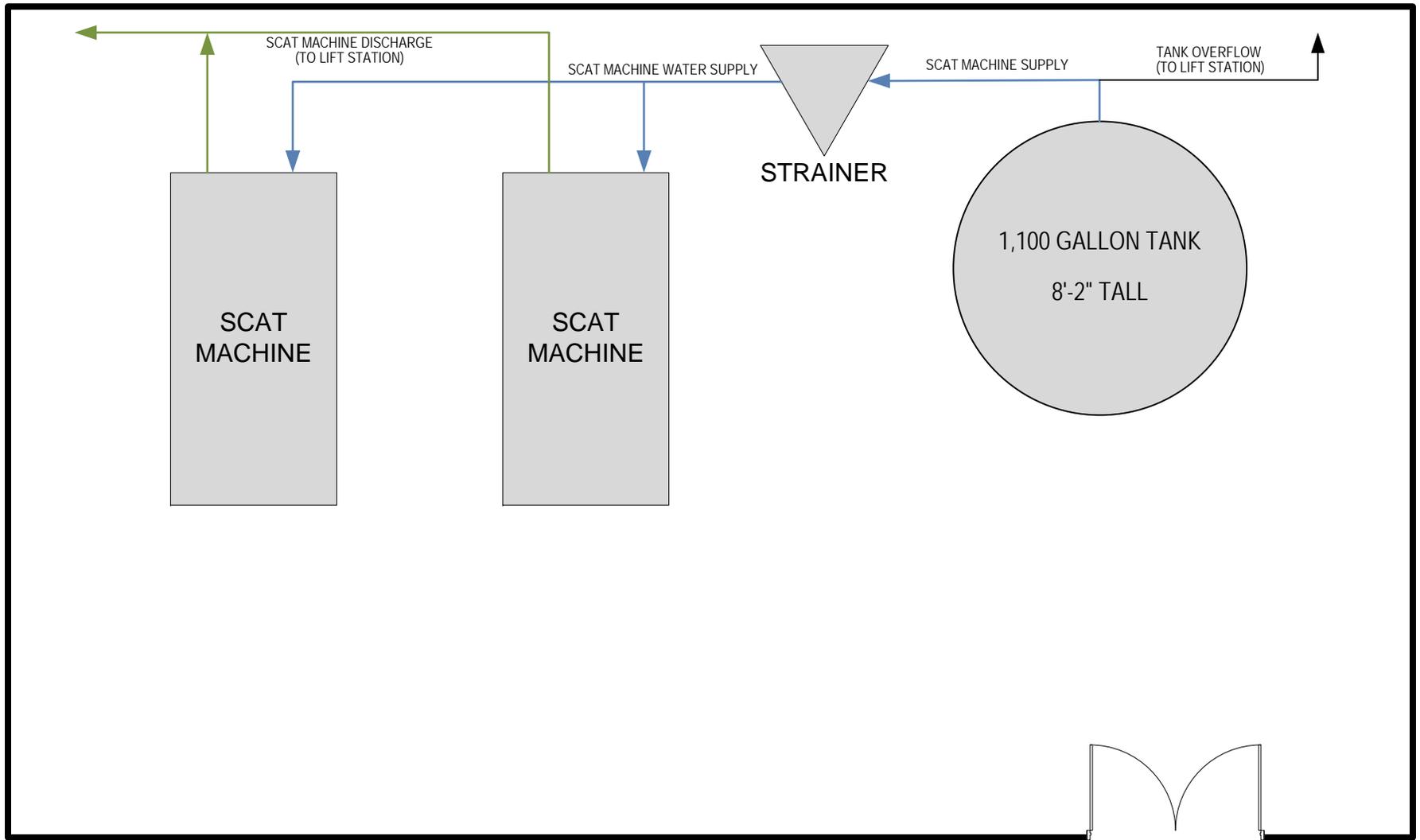
Utility	Requirements	
Water	25 gallons/bucket	1000 gallons/day
Wastewater	30 gallons/bucket	1200 gallons/day
Power	220 volt supply 3.5-4.2 kW/hour of operation	12.25-14.7 kW/day

SCAT Machine Detailed Considerations for Chefnak

Several customized design considerations are required for a successful installation of a SCAT Machine in Chefnak. With the remote nature of Chefnak, providing two machines would provide important standby capacity in case one machine is out of service for regular maintenance. Additionally, the machines, and any greywater storage and straining equipment should be installed in a heated enclosure to protect from freezing and vandalism. This would also provide space for frozen buckets to thaw before being emptied and cleaned. Figure 2 shows the space requirements to install a SCAT Machine in Chefnak.

Water Supply

Water conservation is a priority in Chefnak, and finding a water source other than potable water to supply the SCAT Machine is critical for feasibility of the installation. Non-potable water that is relatively free of solids can be used to supply the SCAT Machine, a source of non-potable water is available in the grey-water



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VILLAGE SAFE WATER
 CHEFORNAK SCAT MACHINE EVALUATION

PROCESS
BUILDING LAYOUT - FIGURE 2

SHEET	1
DWG NO.	1
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discharged from the washing machines in the new washeteria. The CE2 Engineers 95% design drawings for the washeteria indicate that washing machines will use approximately 1,900 gallons/day of water. This is an adequate quantity of water to meet the needs of the SCAT Machine. Since laundry discharge and bucket washing are likely to occur at different times, the washing machine discharge will need to be stored in a tank to supply the SCAT Machine. The tank would need to be outfitted with an overflow type drain to convey the excess water to the sanitary sewer. It should also be outfitted with a drain for periodic cleaning of the tank since solids from the washing machine discharge may accumulate in the tank. A potable water supply connection should be included in case the volume of water in the storage tank is inadequate to wash the buckets.

Water from washing machine discharge has more particulate than is allowable in the SCAT Machine. A strainer would need to be installed between the water storage tank and the SCAT Machine. There are several strainer types available, ranging from a manually changed particulate strainer to an automatic-backwashing strainer that would require little operator input. The exact strainer needed requires further evaluation.

Waste Quality

The SCAT Machine is designed for use with a fairly “clean” waste stream consisting of urine, feces, and toilet paper. Any additional items discharged into the machine, especially garbage (including diapers), food scraps, and other foreign materials can clog the machine. To mitigate this potential, the machine can be outfitted with an integrated grinder unit that would pulverize this material.

Bucket Thawing

The SCAT Machine will not work with frozen honey buckets, so buckets must be thawed prior to washing. If inadequate space for thawing is available, thawing can be expedited by using an electric resistance bucket or drum heater. The time and cost to thaw the buckets will vary, and depends on how frozen the buckets are and the nature of the contents.

Integration with Existing and Future Infrastructure

Successful implementation of the SCAT Machine in Chefornak depends on how the facility integrates with the existing infrastructure and the future washeteria. Supplying the SCAT machine with grey water from the washeteria is a cost effective method for providing a water supply, so no matter where the facility is located, redesign of the washeteria’s plumbing system to separate washing machine waste from other wastewater is required.

The facility housing the SCAT machine will require boardwalk access for residents and the existing honey bucket collection service to drive to the entrance and unload buckets. Several options for implementation exist:

Integrate SCAT machine and support facilities with future washeteria

Locating the SCAT machine and facilities at the same location as the water supply with ready access to a planned lift station to remove waste allows the facility to be well integrated with planned infrastructure. The required footprint can be minimal, and there would be only one building to heat and maintain. The planned lift station is already sized to handle the existing washeteria waste water, so adding the additional waste from the SCAT Machine (since the machines use the existing waste stream there is not a substantial increase in waste) does not impact the sizing of the lift station.

The primary disadvantage of this option is that it would require re-design of currently 95% complete washeteria plans to include space for the two SCAT Machines, grey water storage tank, and pump/strainer to supply the SCAT Machine. It also increases the size of the Washeteria building to allow space for the SCAT machine(s). The washeteria site is crowded, and so additions to the building footprint may be challenging.

Locate the SCAT Machine and support facilities separate from the future washeteria

If the SCAT machine facility is located at a remote location from the washeteria it reduces the degree of re-design of the washeteria facility. It would also allow for more customization and optimization of the SCAT machine facility layout since there would be fewer space constraints.

Locating the SCAT machine and facilities at a separate location from the washeteria complicates the plumbing since the grey water from the washeteria will need to be pumped to the SCAT machine facility. Additionally the wastewater from the SCAT machine will need to be pumped to a connection to the sanitary sewer system.

SCAT Machine References

Two references for the SCAT Machine have been contacted, and their comments are presented below.

Ryan Turner, Bureau of Land Management, Lower Salmon River, Idaho

The SCAT Machine program was started in the Lower Salmon River area in the mid 1990's. Ryan has been working with the SCAT Machine for many years. The primary problem Ryan has experienced with the SCAT Machine is people putting in things that should not, particularly trash. This problem would be alleviated if the machines in his management area were equipped with grinder pumps. He estimated that 75% of the problems experienced with the SCAT machine are user error.

One of the SCAT machines in Ryan's service area is the prototype for using a disinfectant. Pine oil is injected during the wash cycle for disinfection. The machine has had some challenges in getting the disinfectant injection timing perfected, but that with time this was resolved.

In terms of long term maintenance, some of the solenoid valves have been replaced over the years, which is to be expected with normal wear and use. Typical maintenance activities include cleaning the inside and outside of the machine.

Lynnette Ripley, Bureau of Reclamation (formerly Bureau of Land Management), Lower Deschutes River, Oregon

Lynnette was involved with getting the SCAT machine program set up. With the SCAT machines that she has used and been responsible for, the need for replacement parts was very infrequent. The machines are built from durable and robust components. Lynnette feels that over the years the inventor and manufacturer has perfected the machines and highly recommends them.

Rebecca Venot, CH2M HILL Engineer

In addition to references provided by the manufacturer, Rebecca Venot, PE CH2M HILL has used a SCAT Machine to clean out a waste container system at the end of a whitewater rafting trip. From an inexperienced operator's perspective, the machines are easy to use and provide a significant improvement from the bagged-waste requirements that were first required by agencies responsible for river permit regulations. When my family reaches the end of a trip, we are always pleased when we see a SCAT Machine rather than having to find our way to an RV dump station for disposal of waste.

Conclusion and Recommendations

SCAT Machines have been in use in public recreation areas for more than 20 years. They are a robust and hygienic way to empty and clean honey buckets and other portable waste containers. The SCAT Machine could be integrated into the new washeteria, utilizing grey water from the washing machines for the water supply.

To move forward with implementation of the SCAT Machine system in Chefornek, a decision needs to be reached for the location of the facility, either in the new washeteria or elsewhere. Once this decision has been made, the layout, building design, and water supply and wastewater discharge connections can be finalized.



PHOTO 1

SCAT Machine Interior – All Stainless Steel Components



PHOTO 2

Tanks for cleaning process inside machine



PHOTO 3

Strapping bucket into place on SCAT Machine Platform



PHOTO 4

Bucket loaded into SCAT Machine



PHOTO 5

Ready to close machine and start wash cycle



PHOTO 6

Closing Lid of SCAT Machine (With Bucket in Place)



PHOTO 7

Selecting Cleaning Regime Based on Bucket Contents