NELLIE CREEK TOILET RETROFIT PROJECT
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FINAL REPORT

Submitted by

Lake Fork Valley Conservancy
PO Box 123
Lake City, CO 81235

Submitted to:

Colorado Water Conservation Board

And

Upper Gunnison River Water Conservancy District

Introduction

The Nellie Creek trailhead to Uncompahgre Peak is located west of Lake City, Colorado, on the Gunnison National Forest (Figure 1). This is one of the most popular peaks in North America and attracts an enormous amount of hikers. In 1996 a composting toilet was installed at the trailhead (Figure 2). Due to the overgrowth of vegetation (shading the toilet) and the elevation, the waste inside the vault stopped decomposing as designed. Waste has been building up and eventually it was closed to further use in 2014 (Figure 3). Since that time the waste collection vault cracked, leaking human waste onto the ground about near Nellie Creek, which flows into the creek during high rain events and snow melt (Figure 4). Currently there is so much human waste in the woods near the trailhead it's been advised on online forums not to camp at the trailhead. All this human waste is inevitably flowing into Nellie Creek, which is a valuable recreational creek and fisheries. Consequently, this area has become a public health hazard. There needs to be a functioning toilet if we want to preserve water quality of Nellie Creek and to protect health of trail and downstream users.

Objectives

There are two main objectives to the project.

Objective 1 - Removal of existing waste: The first step to rectifying the public health issue is to remove the waste from the leaking vault and remove the vault. The road leading up to Nellie Creek Trailhead is difficult to drive and only maintained for small 4 wheel drive vehicles with high clearance. Due to the rough condition of the road (4 miles), a regular vault pump truck is not able to drive to the site. This project will require a small truck and many loads. It will also require someone with hazmat training to handle human waste. The waste material is mixed with wood chips and cannot go to the county water treatment center. Therefore the waste will have to be dried and taken to the dump. Due to these factors the cost to remove the waste and to haul away the vault will be higher than if near a highly maintained road.

Objective 2 – Retrofit the existing building with an effective composting toilet: The restroom building is in decent condition, besides the leaking vault and the lack of composting, and therefore the most cost effective option is a retrofit of the current building. We have researched an alternative composting system made by Toilet Tech Solutions (TTS). This system has been used to retrofit a toilet on the Ouray Ranger District at a similar elevation and situation. The District has reported the toilet is composted well. An excellent YouTube showing how the TTS system works can be found at www.toilettech.com. Toilet Tech offers a low-cost and low-hazard solution for waterless human waste management at high use sites. Toilet Tech's urine diverting toilets are superior to expensive barrel fly out toilets, hazardous and ineffective conventional composting toilets, and water polluting pit toilets. The system works by diverting 100% of urine to a drain field. When fecal matter and toilet paper are separated from urine, the solid matter composts better by being consumed by microbes leaving little residue and low odor.

Tasks and Deliverables

Task 1: Remove Vault Tank and Human Waste and Install Urine Drain Field

Description of Task

The road leading up to Nellie Creek Trailhead is difficult to drive and only maintained for small 4-wheel drive vehicles with high clearance. Due to the rough condition of the road (4 miles), a regular vault pump truck is not able to drive to the site. This project will require a small truck and many loads. It will also require someone with hazmat training to handle human waste. The waste material is mixed with wood chips and cannot go to the county water treatment center. Therefore the waste will have to be dried and taken to the dump. Due to these factors the cost to remove the waste and to haul away the vault will be higher than if near a highly maintained road. This part of the job will also require the installation of a urine drain field.

Deliverables

LFVC selected Coal Creek Construction during an open bidding process. Only two bids were received and Coal Creek had the better experience and lower cost.

In mid June, Coal Creek and USFS staff travelled to the site. The team removed the human waste from the vault (Figure 5). The vault was then rinsed and bleached and cut into transportable pieces. The upper toilet was then removed leaving a hole in the existing concrete floor (Figure 6). They also sawed off the vertical 12" pipe (that directed waste from the toilet into the composting vault) so that 1-2' remained below the floor level. They then rinsed and used a 5% bleach solution to completely disinfect the inside of both the upper and lower portions of the building. All materials were safely transported to Hinsdale County Transfer Station in a lined truck bed to ensure no leakage during transport. They also checked the existing drain field and determined it to be in good working order, eliminating the need to install a new one.

Task 2 - Retrofit existing building for a composting toilet

Description of Task

To build a new building would be very costly, so we proposed to retrofit the existing building. USFS contacted a company, Toilet Tech (toilettech.com) out of Seattle that specializes in composting toilets for high elevation, cold, shaded and hard-to-get-to places. There toilets have proven to compost at difficult sites all over North and South America. The US Forest Service installed a similar retrofit composting toilet at a very high elevation location on the Ouray District, Ouray Colorado. The District has reported they are very pleased with the retrofit. TTS has the exclusive rights to the Ecodomeo conveyor in North America (and some South American countries). TTS has branded the Ecodomeo seat the Behind the Wall (BTW) urine diverting conveyor. This system won a Janu Design Award in Europe in 2013. One of its greatest attributes, after 99% source separation of urine, is that is conveys solid waste through the rear wall of the toilet for further processing. This lateral movement of the waste gives the toilet enormous flexibility and toilet users are spared the view of 10,000 previous deposits; instead they see a

black conveyor belt, which is automatically cleaned by a dual set of scrapers on the underside of the belt. Urine diversion is the critical component in creating low-cost, low-hazard, low-odor waterless toilets. When urine mixes with fecal matter, excess ammonia create odor and toxic conditions in the waste. When urine is diverted prior to mixing with fecal matter, it can be safely treated by onsite soil. Fecal matter that hasn't been soaked with urine can be consumed by a wide range of invertebrates (worms, nematodes, and mites) without any bulking agent. TTS's rugged urine diversion systems re-establish the natural diversion of urine away from fecal matter so that urine can fertilizer local plants and soil invertebrates can consume fecal matter, naturally.

Deliverables

On June 20 and 21, staff from USFS, LFVC and Toilet Tech Solutions were onsite to retrofit the structure (Figures 7-15). This involved the following tasks:

- Constructed the waste bin in the lower level
- Installed TTS conveyor system
- Trained FS staff on operation and maintenance of the TTS conveyor system
- Leak-tested urine drain line

Post construction tasks that followed later in summer by USFS staff and contractor were the following:

- Installed urine drain line solids settling chamber.
- Redid urine drain line leak test
- Painted vent pipe black for enhanced ventilation
- Monitored proper functionality of the "poop chute". This was an odd facility to retrofit due to the location of structural joists, necessitating a waste deflector. If waste ends up piling up on the deflector, leading to inhibition of proper conveyor functionality and cleaning, it will need to be removed and a new solution will need to be devised.
- Urine drain line operation – leaks, and checking to see if solids settling chamber plug has popped out
- Other maintenance items, outlined in the TTS Decompose Maintenance Manual

Long Term Maintenance Plan

The restroom will require cleaning and continued maintenance. LFVC has partnered with the Forest Service to maintain the restroom, about $1000/year. USFS has hired a contractor to clean the restroom weekly and maintain functioning as necessary. The USFS put up an informational poster in the toilet to educate users about how the toilet works and to care for the facility. They also put up a sponsorship poster. Copies of these posters can be found attached to this document.

The Forest Service will enter into a Collections Agreement with its partners to guarantee funding for continued maintenance of the restroom. In return, restroom sponsors/partners can put their name on the restroom or receive donations. Last summer Coal Creek Watershed Coalition placed a PVC donation tube next to the Musicians' porta-toilets up the Slate River and received $330 in donations. We will continue with the donation tube to help pay for the restroom.

In addition to the restroom, there will be an educational component. For example, this year the US Forest Service hired 2 crews of 8 people through the YCC (Youth Conservation Corps). Part of the duty of the YCC members was to educate the public about stewardship of the land and leave no trace ethic.

The project has received positive feedback from users, as well as good local press. An article recently published in the local Silver World is attached.

Expenditures

Total project expenditure was $25,930.68. Upper Gunnison River Water Conservancy District (UGRWCD) contributed $12,445.68 toward the project, and Hinsdale County $500. CWCB contribution was $10,985.

Description	WSRF Funds	UGRWCD	USFS	Hinsdale County	Total
Task 1: Remove vault tank and human waste and install urine drain field					
Coal Creek Construction	$0.00	$8,900.00	$0.00	$0.00	$8,900.00
Bid advertising	$0.00	$65.42	$0.00	$0.00	$65.42
LFVC staff - project assistance	$585.00	$675.00	$0.00	$0.00	$1,260.00
Task 2: Retrofit existing building and install new composting toilet					
Engineered Compost Systems	$10,000.00	$1,250.00	$0.00	$0.00	$11,250.00
LFVC staff assistance - construction and recon	$360.00	$900.00	$0.00	$0.00	$1,260.00
Plumbing supplies	$0.00	$16.76	$0.00	$11.97	$28.73
Construction Waste disposal	$40.00	$0.00	$0.00	$0.00	$40.00
mileage to/from site	$0.00	$53.50	$0.00	$0.00	$53.50
site followup and maintenance	$0.00	$0.00	$2,000.00	$0.00	$2,000.00
Project Management	$0.00	$585.00	$0.00	$488.03	$1,073.03
TOTAL	**$10,985.00**	**$12,445.68**	**$2,000.00**	**$500.00**	**$25,930.68**

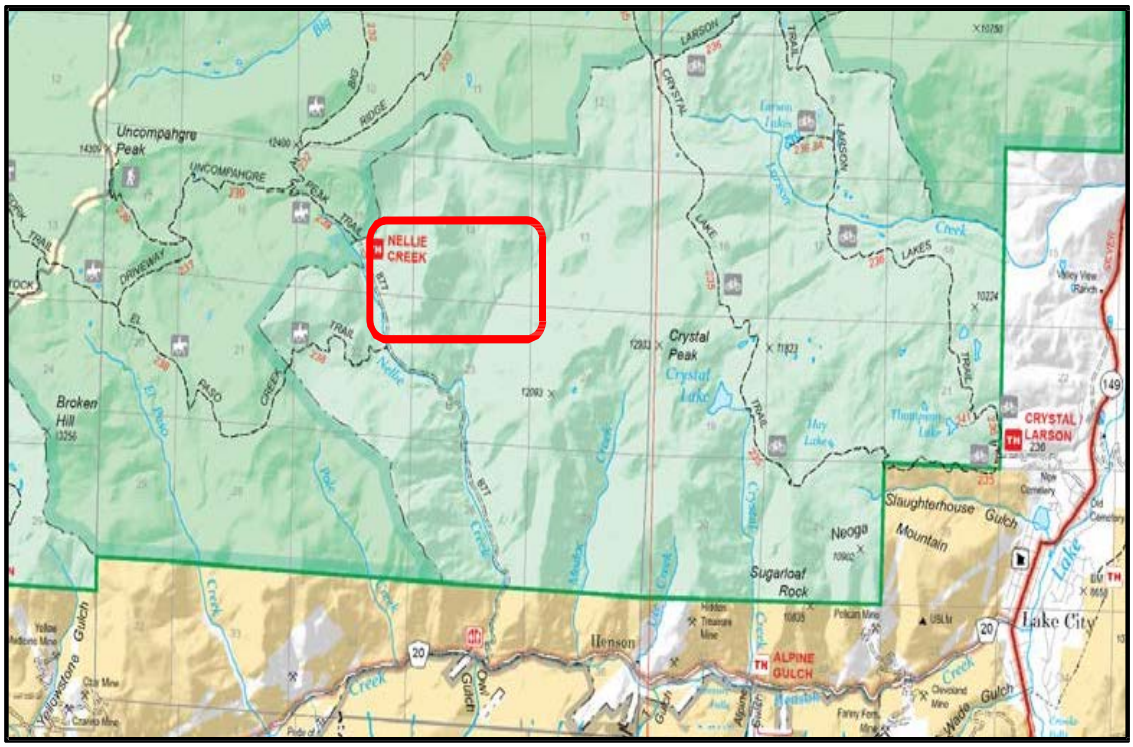


Figure 1. The red square outlines the location of Nellie Creek Trailhead and toilet location.

Figure 2. Installation of Nellie Creek toilet in September 1996.

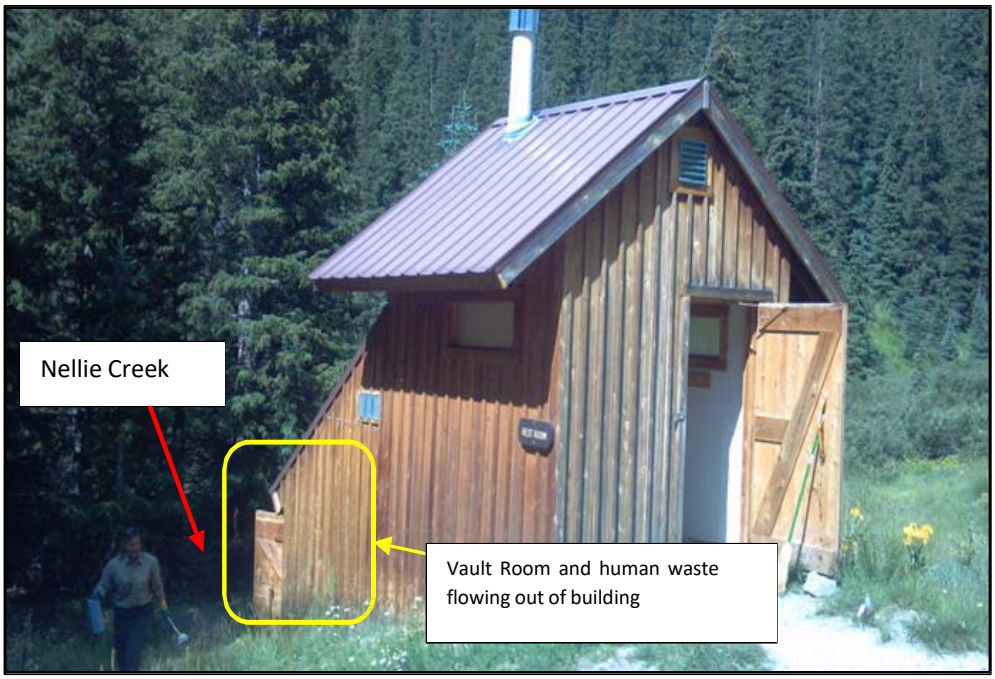


Figure 3. In 2013 when the toilet was still being maintained and the vault was not yet full. Since then, the vault has filled and the restroom is closed.

Figure 4. Photo of the full vault. Even the black vent pipe in photo right was full of human waste that did not decompose.

Figure 5. Removal of waste from the vault. The vault was also removed leaving an empty chamber below the toilet.

Figure 6. Removal of the old toilet.

Figure 7. Lining up materials for the waste crib wall (Camille Richard – Left, Ashley Hom – Right)

Figure 8. Eric from USFS sealing up the plywood in preparation to plug the hole in the floor.

Figure 9. The completed Basement (visible area the waste crib, the urine drain line, and the fly trap.

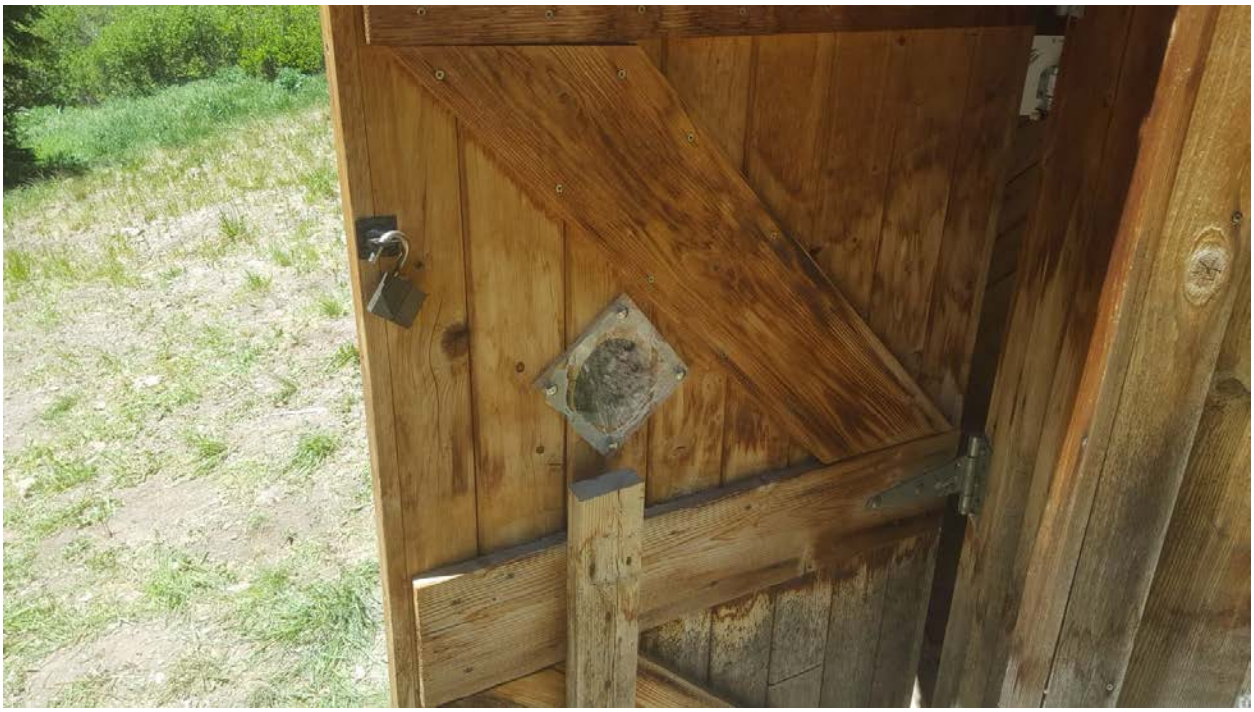


Figure 10. Completed Fly Trap (fly trap light window visible).

Figure 11. Urine drain line where it ties into the existing leach field.

Figure 12. Vinyl sheeting to keep the wood surfaces clean/from rotting.

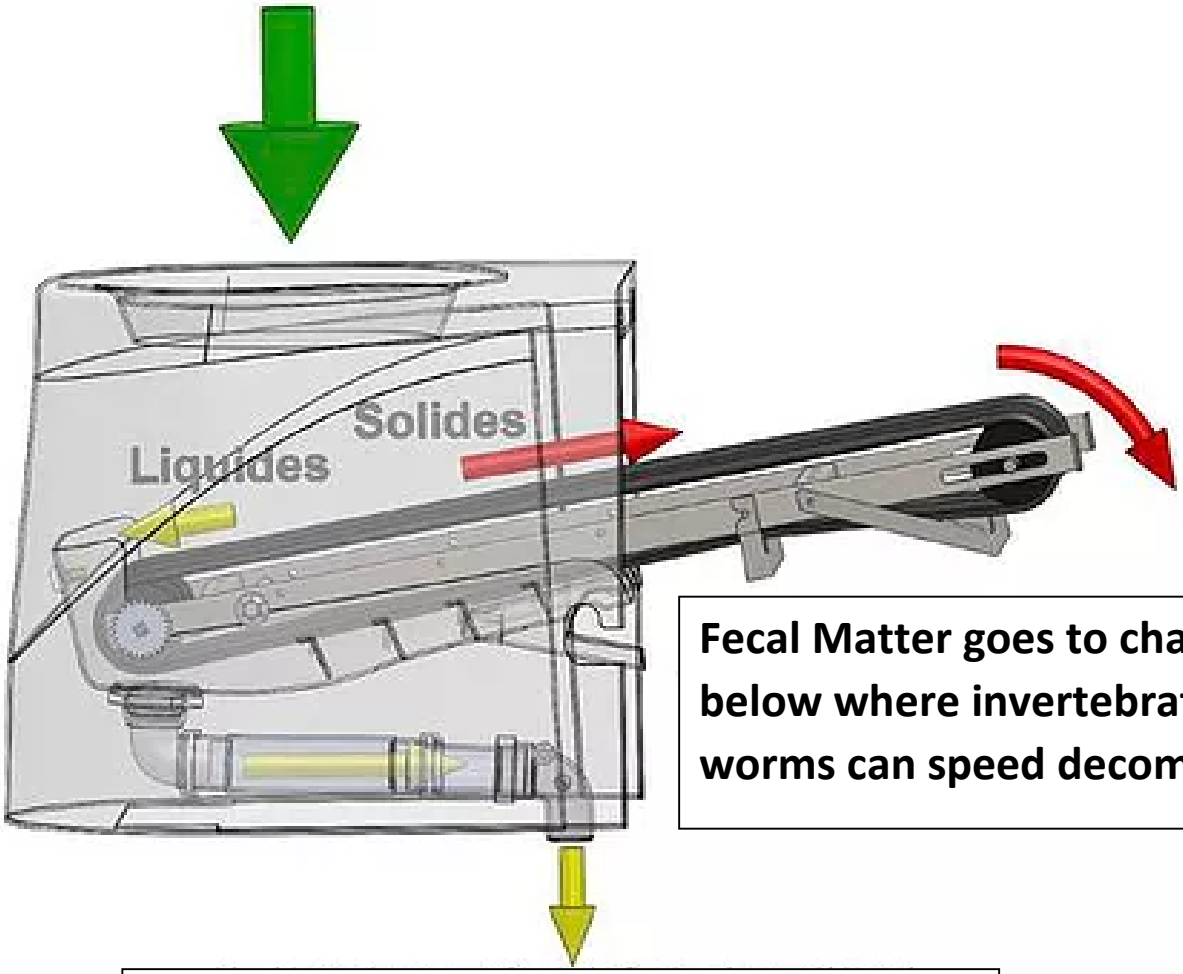
Figure 13. View of completed retrofit from inside the basement.

Figure 14. The toilet riser secured in place with wood trim.

Figure 15. Spare parts kit hangs on the wall in the basement.

How this toilet works which was installed in June 2018 by Toilet Tech Solutions

Urine Diversion Toilet Seats



Fecal Matter goes to chamber below where invertebrates such as worms can speed decomposition.

Liquids go to gravity fed drain field.

Urine diversion is the critical component in creating low-cost, low-hazard, low-odor waterless toilets. When urine mixes with fecal matter, excess ammonia creates odor and toxic conditions in the waste. When urine is diverted prior to mixing with fecal matter, it can be safely treated by onsite soil. Fecal matter that hasn't been soaked with urine can be consumed by a wide range of invertebrates (worms, nematodes, and mites) without any bulking

agent. Humans are the only mammal on the planet to pee on their poo. Toilet Tec Solution's rugged urine diversion systems re-establish the natural diversion of urine away from fecal matter so that urine can fertilize local plants and soil invertebrates can consume fecal matter, naturally.

Toilet Tech Solutions (TTS) has the exclusive rights to the Ecodomeo conveyor in North America (and some South American countries). The Ecodomeo conveyor is patent protected in Canada (2,826,499) and the USA (14/025,668). TTS has branded the Ecodomeo seat the Behind the Wall (BTW) urine diverting conveyor. This system won a Janu Design Award in Europe in 2013. **One of its greatest attributes, after 99% source separation of urine, is that is conveys solid waste through the rear wall of the toilet for further processing.** This lateral movement of the waste gives the toilet enormous flexibility and toilet users are spared the view of 10,000 previous deposits; instead they see a black conveyor belt, which is automatically cleaned by a dual set of scrapers on the underside of the belt.

Please no Trash or Plastics in toilet

We care a lot about this toilet,

Care with us!

Restroom Sponsored By

Lake Fork Valley Conservancy
LAKE CITY COLORADO

HINSDALE COUNTY

UPPER GUNNISON RIVER WATER CONSERVANCY DISTRICT 1959

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

DNR CO
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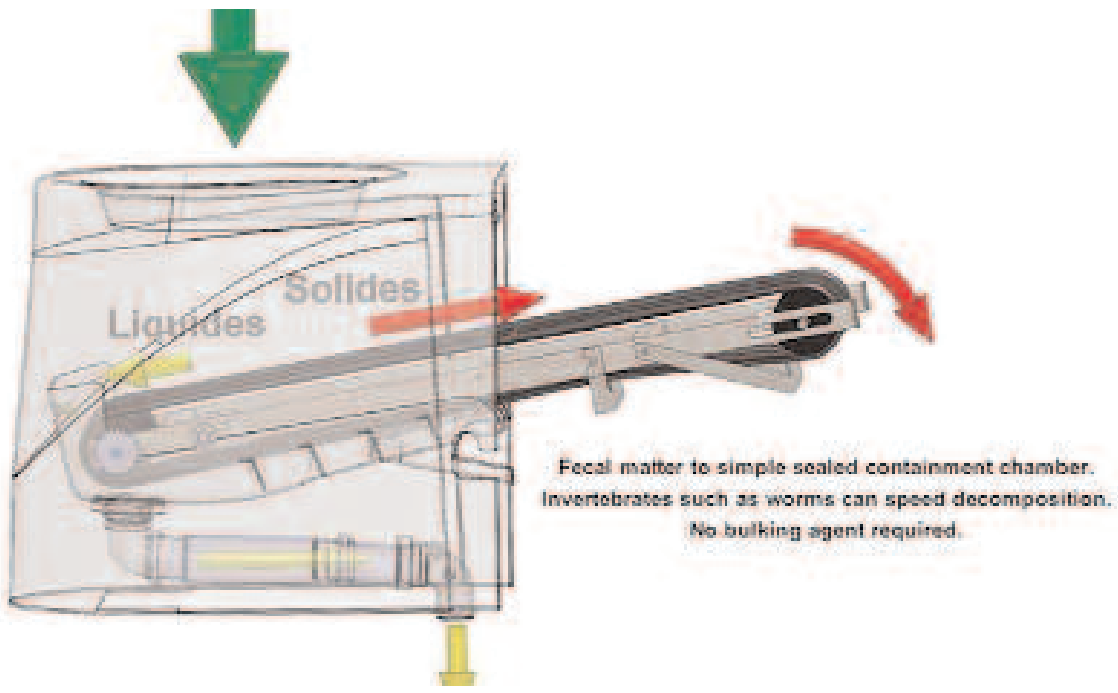
Water Conservation Board
Department of Natural Resources



Innovative non-flush toilet technology has been integrated into facilities at the 12,212'-elevation trailhead to Uncompahgre Peak. Seattle-based Toilet Technology Services has created a pedal-powered conveyor belt toilet in which liquids and solids are separated, as shown in the above diagram.

Innovative Toilet Technology Aids Hikers at Uncompahgre Trailhead

SILVER WORLD typically avoids potty-mouthed conversations, although it somewhat reluctantly delved into just such a topic with Lake Fork Valley Conservancy's Camille Richard.

Lake City and environs have a rich history in terms of outdoor toilets, every home in the vicinity sporting single and double-hole privies which were erected over an in-ground excavation.

Some facilities, such as the old Lake City Public School, boasted sizeable frame outhouses segregated into separate rooms for girls and boys. Celebrated outhouses in regional history include the multi-hole outhouse at Ute-Ulay Mine, which survives and is part on the ongoing Hinsdale County stabilization project; also famous, and sadly no longer extant, was a multi-seat brick outhouse with plastered walls which was located behind the Lee Mansion at Capitol City.

The succession of outhouse technology is illustrated at Hinsdale County Museum with the solidly-built two-room log Civilian Conservation Corps outhouse which was erected at 30-Mile Resort on the Upper Rio Grande in the late 1930s.

Now preserved at the Lake City museum, the 30-Mile Resort outhouse was one of the earliest adaptations which included a sub-ground concrete vault.

Unlike the older style outhouses which were simply moved several feet to the right or left and positioned over a new excavation when the old hole filled, concrete vaults retained their contents and required periodic pumping. In the intervals between maintenance, campground outhouses such as the museum's CCC privy retained a foul odor. The smell factor prompted improved air ventilation and, in worst case scenarios, a surface-floating oil was poured into the vault to effectively create a barrier between the effluent and the air above.

Lake City 6th Grade student Silas Fox, upper right, briefly rests on the Uncompahgre Peak trailhead's new toilet while persuing local reading. Note foot pedal to side of toilery which operates conveyor belt located within the toilet.

Above, Toilet Tech Services' Ross Mazur, center, is flanked by F.S. summer techs Erik Oswald and Melissa Peterson in front of the remote and high elevation facility.

Hinsdale County continues to rank in the forefront of outdoor toilet technology with a state-of-the-art outhouse which is located at the high elevation trailhead to Uncompahgre Peak, located at 12'212'-elevation.

Composting toilets work effectively in a majority of lower-elevation public campgrounds, although the model proved a dismal failure at higher elevation; adding to the complication, vault toilets are inappropriate in remote locations as a result of pumper trucks having to traverse rough, 4-wheel drive roads..

Despite its immense popularity with hikers to Uncompahgre Peak, the composting toilet at the trailhead had been decommissioned and not available for use since the early 2000s as its vault filled to capacity and, worse yet, there were indications of effluent spilling out onto the ground.

U.S. Forest Service Hydrologist Leslie Hom researched state-of-the-art toilet technology options which might be sustainable at such a remote and high elevation location.

The result of Hom's research was refreshingly simple, a non-flush, pedal-powered toilet in which solids are separated from liquids.

Manufactured by Seattle-based Toilet Tech Solutions especially for remote locations in cold-temperature areas, solids collect on a small conveyor belt and are conveyed to the storage vault

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GCEA Receives Charge Ahead Colorado Grant to Fund Additional Electric Vehicle Charging Stations

Gunnison County Electric Association (GCEA) will be adding three new level II (240-volt) electric vehicle (EV) charging stations to the area and upgrading a fourth station with help from the Charge Ahead Colorado grant.

The $36,000 grant will cover 80 percent of the costs including hardware, labor and materials to install stations with a $9,000 maximum per station.

Charge Ahead Colorado grants were awarded to GCEA in previous years for the Crested Butte and Lake City charging stations. These stations have proven to be useful for local EV owners and visitors.

GCEA is seeing strong growth in station utilization, particularly at its Crested Butte station.

The stations will be strategically located to enable greater use of existing EVs and to encourage EV adoption by other drivers.

Approximately 80-85 percent of EV charging occurs at home and in addition to the environmental benefits of EVs, more EVs can help GCEA to keep its rates down for all member-consumers.

The National Park Service is providing a site at the Elk Creek Marina, which will reduce the gap between Montrose and Gunnison. Almont Resort has offered space in its back parking lot.

The town of Crested Butte is providing two more parking stalls to accommodate growing demand, this time in the parking lot at First Street and Elk Avenue. Lastly, GCEA will be upgrading its public headquarters station.

Under the terms of the grant, GCEA has committed to a set fee structure for five years. Fees charged to drivers at the four charging stations will vary. The first three years will be free at Elk Creek Marina.

At GCEA headquarters, drivers will be charged during on-peak hours (5:00 pm to 10:00 pm). Charging will be free at GCEA's headquarters during business hours.

The first year will be free at the Almont Resort and the new Crested Butte location. At these two stations, drivers will be charged only during on-peak hours in the second and third year.

GCEA will soon start charging drivers at its initial Crested Butte and Lake City stations. The free charge commitment required by earlier grants will be met November 30, 2018 in Crested Butte and October 25, 2019 in Lake City. The grant funding received for these stations will exceed the cost of free power delivered several times over.

Charging time limits will vary by station and be enforced to achieve a balance between facilitating participation in nearby activities and maintaining charging station availability.

The project will start in September with completion by year-end.

GCEA is excited to offer more resources to allow electric vehicle owners to travel with confidence between the communities in our area, promote clean energy technologies and encourage the use of more electric vehicles in the area.

For more information regarding the existing and new charging stations, please visit www.gcea.coop or call 970-641-3520.

Behind the scenes view at newly revamped Uncompahgre Trailhead toilet, left, shows lowest level of building with vented swinging doors accessing waste crib and piping for urine drain.

Bottom photo also illustrates end of conveyor belt, below left, and chute into the containment area.

Toilet Tech,

continued from page 5

by foot pedal. Conversely, liquids are routed via piping out to an underground leach field.

In her research, Richard found that Toilet Tech models are installed throughout the world and are particularly popular in high elevation, colder areas of Canada and the northern United States.

Solids are allowed to accumulate in a separate vault beneath the toilet, the volume of which is vastly deceased -- reduced by upwards of 75 percent of its original size -- through the introduction of decomposing microorganisms. From the conveyor belt and through a chute, solids are collected in an accessible bin in the lowest level of the outhouse.

According to Lake Fork Valley Conservancy's Camille Richard, the bin collects refuse from up to 10,000 separate uses, after which it is shoveled into another area adjacent to the bin within the base of the building where it is composited with microorganisms and allowed to dry.

Maintenance of the facility is minimal, requiring only introduction of the microorganisms and the dried effluent periodically being shoveled out and hauled away.

The process for replacing the Uncompahgre Peak Trailhead outhouse began in early summer when Mike Schell's Coal Creek Construction contracted to laboriously dig out and remove all the material which had collected in the vault beneath the old, decommissioned toilet.

Other interior reconfigurations included taking out the old toilet and replacing it with the pedal-powered, conveyor belt toilet manufactured by Toilet Tech Solutions.

Assisting in the reconfiguration and reinstallation were Toilet Tech representative Russ Mazur, aided by Lake Fork Conservancy's Camille Richard, and, from the U.S. Forest Service, Ashley Horn and two Forest Service summer technicians, Melissa Peterson and Erik Oswald.

Work was completed in late June and the Uncompahgre Peak toilet has been in successful operation since July.

Total cost for excavation of the old toilet and installation of the new non-flush, conveyor belt toilet is approximately $24,000. Contributing to the installation was Upper Gunnison River Water Conservation District with a $12,500 donation, together with $11,000 which was received from Colorado Water Conservation Board. Also aiding in the installation process was a $500 contribution from Hinsdale County, and $2,000 from the U.S. Forest Service.

The new trailhead toilet installation will be closely monitored and, if it proves successful in the long term, will likely be replicated in other high altitude, remote locations. One potential candidate for a toilet facility is on the extreme upper Lake Fork Valley at American Basin. Installation of a public toilet at or near American Basin has repeatedly been suggested by the county commissioners to the BLM, although the challenges of maintaining such a facility with the requirement of frequent pumping has to date stymied actual installation.

Innovate toilet technology such as is now installed at the Uncompahgre Peak trailhead may, in fact, be the solution for wildflower-lovers at American Basin and other relatively inaccessible locations which are popular with recreationists.