Parkhill

A WHITE PAPER TO DOCUMENT THE FINDINGS AND CONCLUSIONS RESULTING FROM RAID GRANT PRJECT NO. 16NT-09 WHICH INVESTIGATED THE FUNCTION OF AN ORGANIC EVAPOTRANSPIRATION COVER FOR EROSION CONTOL IN AN ARID CLIMATE

SANDOVAL COUNTY, NEW MEXICO

Organic Evapotranspiration Cover

January | 2021

Parkhill Project # 01802320

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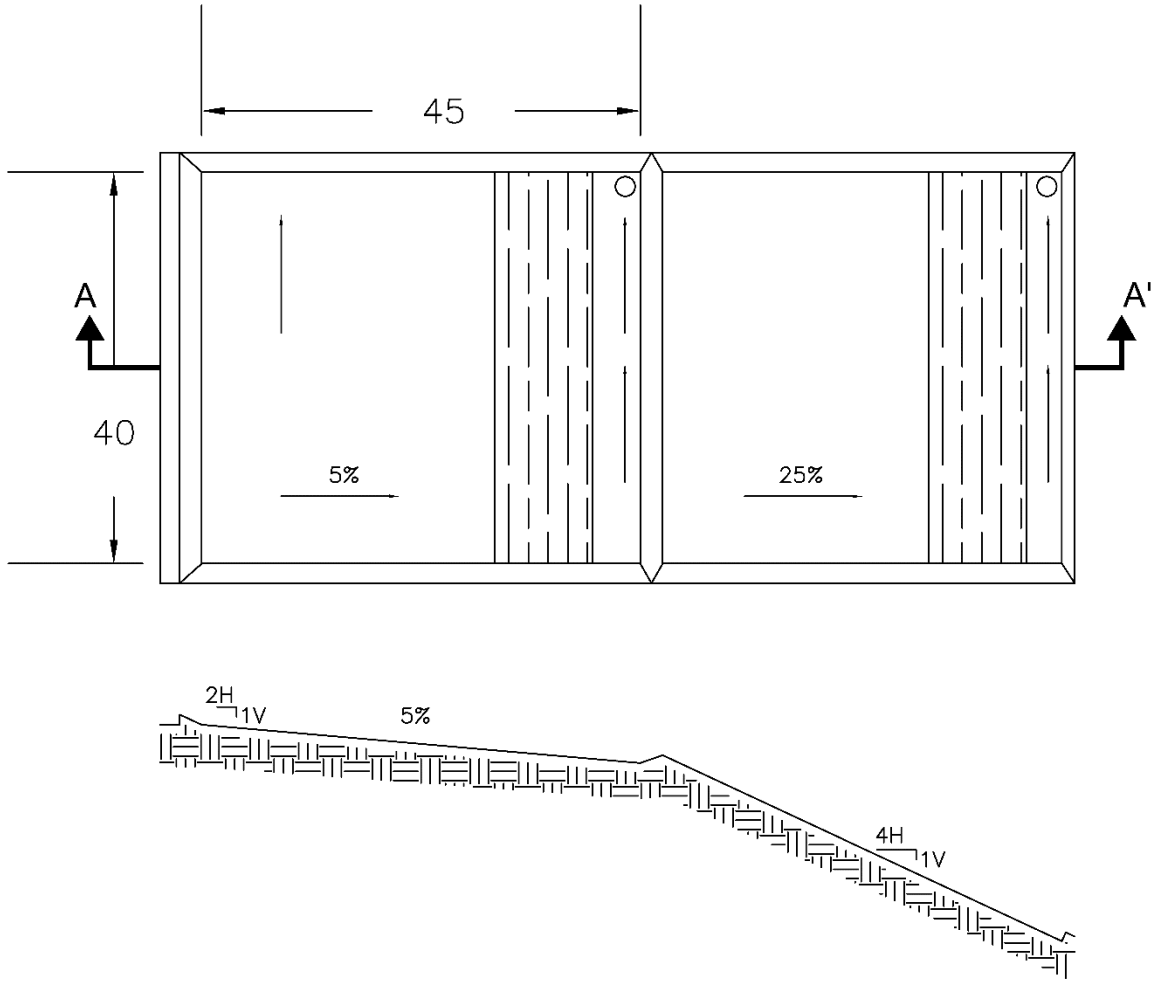
INTRODUCTION

Sandoval County, New Mexico was seeking innovative solutions and partnerships for the diversion of organic materials in their effort to develop a market for the use of organic products for erosion control and landscape projects. This project was conceived as a creative solution to beneficially utilize hard-to-manage materials by evaluating and documenting the function of an alternative organic cover system that relies on organic armoring and evapotranspiration (an organic ET erosion control and cover system) to stabilize slopes and other soil surfaces in an arid environment. The project goal was to provide an ongoing demand for organic materials utilized in an ET erosion control and cover system designed with equivalent or greater performance than the conventional erosion control and cover systems currently required and employed in New Mexico. The tasks undertaken to accomplish the goal required the County, with support from their Consultant, Parkhill, to design an organic ET erosion control and cover system that relies on the use of compost and/or wood chips for armoring and erosion control, in conjunction with an infiltration/evaporation layer that precludes liquids from passing through the cover and into the subgrade. This effort was intended to verify the organic ET erosion control and cover system design and performance through site specific, field scale testing.

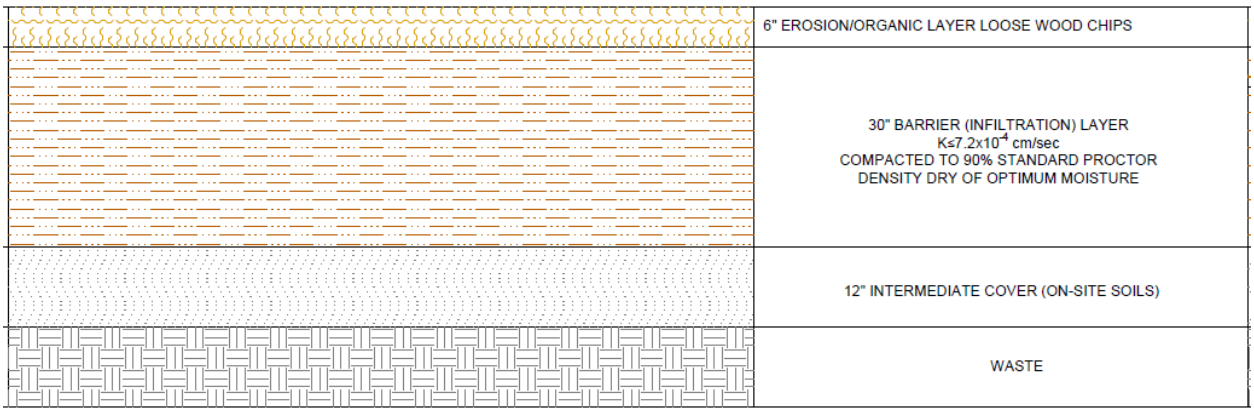
PRODUCT/SERVICE/METHODOLOGY

The project was constructed on a portion of the Sandoval County Landfill and consisted of two field scale lysimeters (with approximate dimensions of 30 x 30-feet), coupled with in-situ soil instrumentation to document the system performance. The County provide the necessary manpower and heavy equipment to complete the earthwork associated with the lysimeter construction. The RAID Grant provided funding for Parkhill to design the lysimeters and to develop the construction plans necessary to build them. The Grant also provided funding to purchase the containment liner and monitoring equipment outlined in the design. The monitoring equipment was designed to provide the documentation necessary to demonstrate the viability of this design. Considering that the development of the lysimeters is taking place on top of landfill intermediate cover, precautions were taken to ensure the underlying waste was not disturbed.

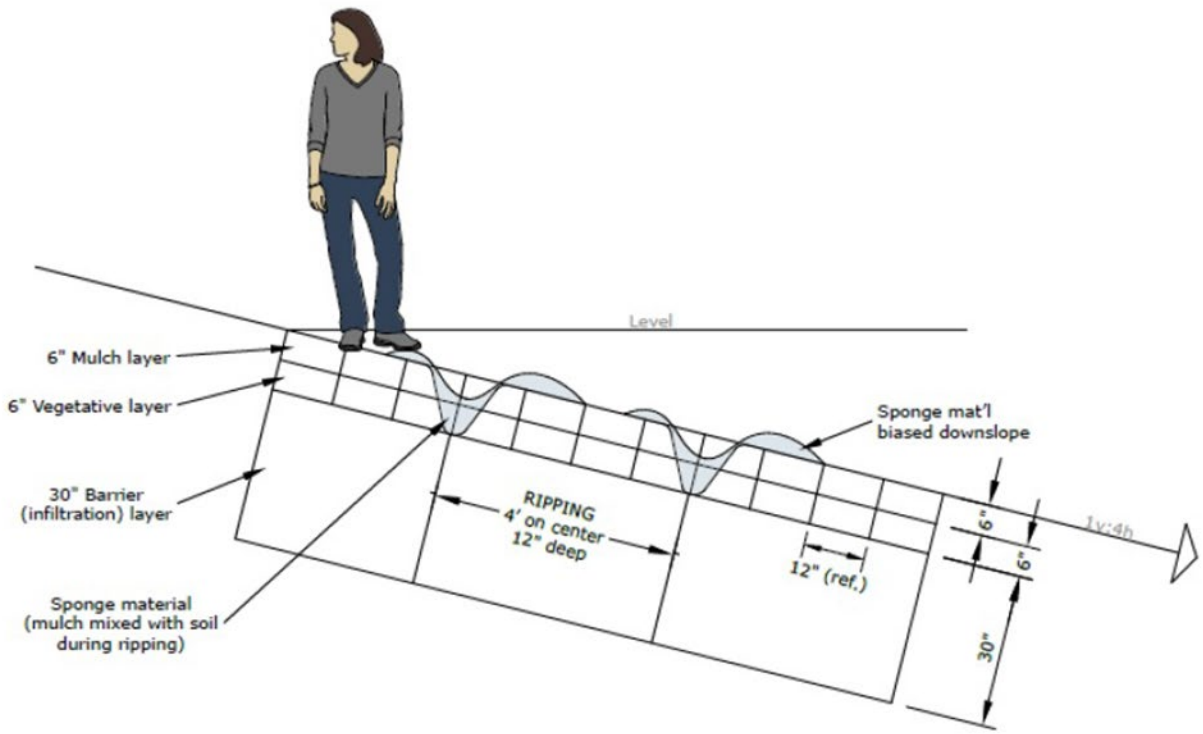
This project, conceived by Parkhill and Soilutions, was presented to the County in an effort to identify a viable beneficial use for large quantities of organic materials. The partnership of these entities evolved from participation in New Mexico Organics Recycling Organization (NMORO), which had challenged its members to develop an organic based (wood chip and compost) erosion control cover system that might resolve the challenges stabilizing soil slopes. This is a challenge faced by landfills and other entities in NM, to provide a long-term, stable system that precludes infiltration and minimizes erosion.



The construction plans depicted two lysimeter pads, one at a five (5) percent grade and the second at a twenty-five percent (25%) grade (depicted above). To allow for monitoring a 60-mil Flexible Membrane Liner (FML was installed on top of the Intermediate cover in the Organic Evapotranspiration Cover System (depicted below). A 200-mil Geocomposite drainage layer, consisting of a geotextile bonded to a drainage net bonded to geotextile) was installed above the FML. This was included to allow any liquids that pass through the Infiltration Layer to collect in a sump situated in a downgradient corner of each lysimeter pad. Instrumentation was installed on the FML Liner to detect moisture prior to the placement of the Infiltration Layer. This instrumentation provided monitoring for measurable moisture percolation through the cover system.

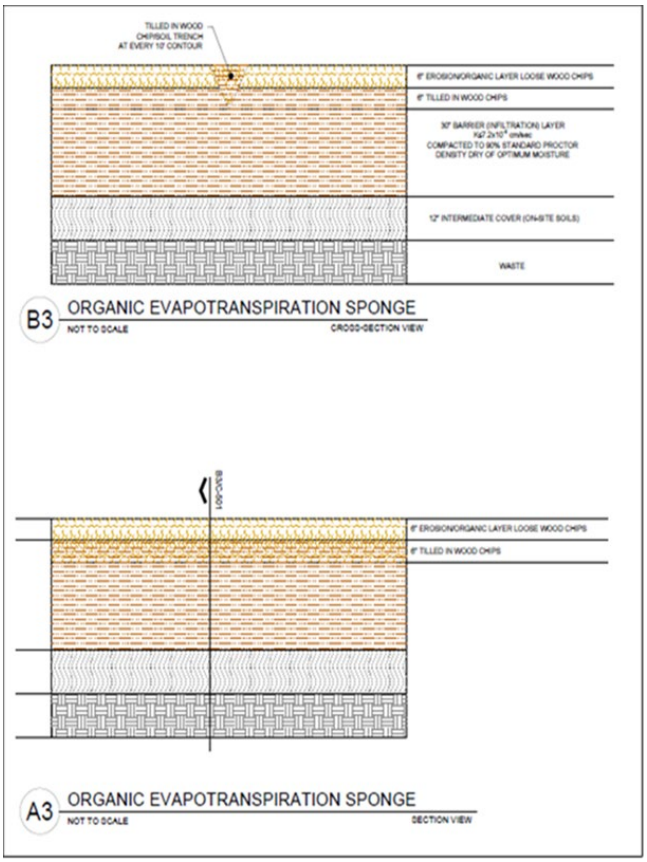


Installation of the FML and Geocomposite at the bottom of the infiltration layer allow the lysimeter to confirm the integrity of the Erosion/Organic Layer and the Barrier/Infiltration Layer that was approved in the last Permit Modification. The detection system consisted of fifteen moisture sensors distributes across each of the lysimeter pads. In addition, each lysimeter pad is contoured to drain to a sump in which a transducer has been installed to detect the presence of liquids and measure the depth of the liquid in the sump. A data collector takes these measurements every minute and stores the information for download and analysis. In addition to the moisture information collected from the lysimeter pads, a weather station collects rainfall, temperature, humidity, wind speed and direction, as well as solar radiation on the same measurement interval.



In an effort to improve the function of the cover system, Soilutions suggested the installation of what can best be described as an “Organic Sponge”. As depicted in the Figure above and the cross-sections adjacent, a bulldozer with two “ripping” tines was drug across the surface of the Lysimeter Pads folding and mixing wood chips and soil in a one-foot deep trench. This trench is designed as a break in the flow of liquids across the surface, allowing them to be absorbed into the cover. Hydraulically, this trench disrupts the surface flow reducing the velocity to zero and mitigating the potential for erosion.

Placed at ten-foot contour intervals, the Organic Sponge will be ideally situated to mitigate erosion rills every forty feet slope intervals (on a 4H:1V grade) where typical rill propagation was observed on similar soil slopes at the landfill. This allows moisture that would have otherwise created significant erosion as it moved along the slope to be captured in the infiltration layer to promote vegetative growth on the cover system.



The Lysimeter Pads have been in operation since the spring of 2016 seeing the first measurable rainfall in June of 2016. Since that time there have been numerous measurable rainfall events but no evidence of percolation penetrating the Infiltration Layer as confirmed by the moisture sensors and the liquid level transducers in the sumps.

KEY FINDINGS

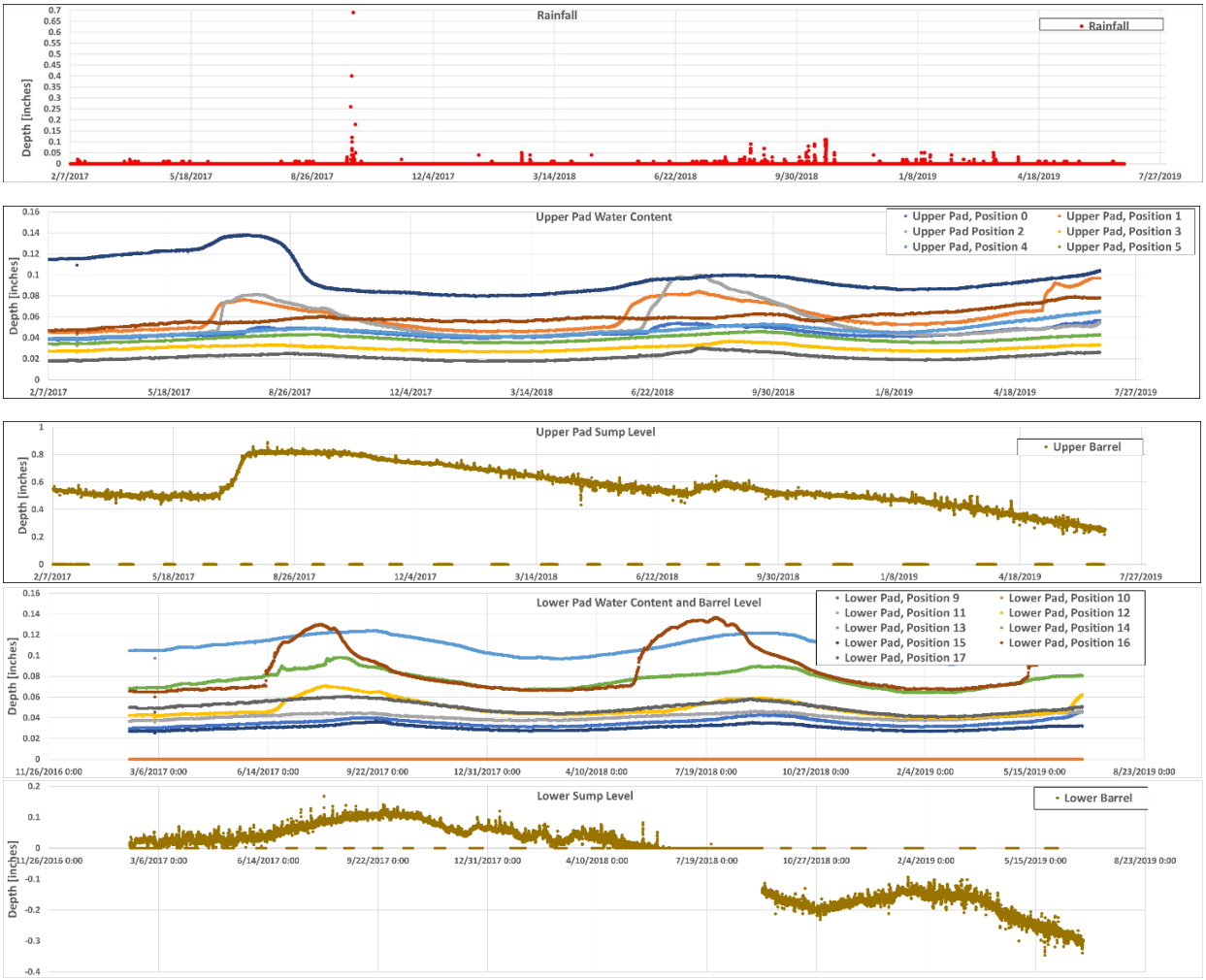
Key Findings #1

Mitigation of Erosion

The mitigation of erosion is the most significant finding observed during the intervening four-plus years that the lysimeters have been in place (Since Spring 2016). As observed in the photos (Left-September 2016 and Right September 2018) the soil cover surrounding has experiences significant erosion rills while the lysimeter pads themselves show no signs of erosion. This is a critical observation considering that erosion rills represent the single major failure of cover

systems in New Mexico. The armoring provided by the wood chip vegetation layer and the organic sponges installed to dissipate flow on the slopes have prevented the development of rills.

Key Findings #2



Mitigation of Infiltration

Based on the lysimeter data collected, there has been no infiltration observed through the Organic Evapotranspiration Cover. This is evidenced by the presence of significant rainfall events (for New Mexico) with no detection of moisture at the 32 moisture sensors distributed across the two lysimeter pads.

In addition, there was no discernable accumulation of liquid in the two lysimeter sumps confirming the absence of infiltration demonstrated by the moisture sensors.

Key Findings #3

Vegetative Base

Current observation of the lysimeter surface confirms that the anticipated development of a soil zone resulting from the degradation of the organic material placed as a component of the cover system is occurring. The presence of “volunteer” vegetation is evidence that the vegetation layer of the lysimeter pads is capable of supporting plan growth. Seeding this layer, which is typically a requirement of final cover closure plans, would encourage the development of this vegetative cover. The ultimate goal of developing a soil zone capable of supporting vegetation appears to be possible in as little as two years fulfilling the ultimate goal of this evaluation.

CONCLUSION

The development of an organic evapotranspiration cover system is a practical, viable and cost effective alternative to other cover systems providing similar levels of armoring and infiltration protection. The installation of organic sponges to dissipate surface flow velocities and retain moisture in the vegetative layer is a valuable component of this design. The management of liquids has the beneficial effect of enhancing the degradation of the organics resulting in the development of soil. Given the lack of soil in New Mexico, this cover system has the potential to ensure a stable, ling term solution to address this critical need.

Key Takeaways

- Organic Evapotranspiration Cover systems mitigate erosion
- Organic Evapotranspiration Cover systems eliminate infiltration
- Organic Evapotranspiration Cover systems promote vegetation growth