

Questions, Comments and Responses

# Quantifying Nutrient Pollution Reductions Achieved by Erosion Remediation Projects on Vermont’s Roads. Work authorization number: 017. EA Number VTRC019-002

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## Q1. Is there a density measurement, obtainable from drones, that could inform you of deposition after erosion?

A1. We had hoped, at the start of this project, to use unmanned aerial systems (drones) to conduct the surveys of gully sites at road discharge outfalls, but we found that most of these outlets and associated gullies are not visible from overhead, due to dense forest cover or other obscuring vegetation along roadways.

## Q2. Is there a method to measure the density of compactness of the soil after rain events that would indicate it was a deposition event => less compact?

### A2. Our measurements, conducted as terrestrial lidar surveys at gully sites, provide a high-resolution estimate of the volume of evacuated soil at the site. When measured over time, these volume differences give an indication of erosion rate. During our presentation, we described one gully that decreased in volume, rather than increased, as we might expect as the gully grows. We are interpreting this change as related to collapse of the gully wall or deposition of sediment into the gully from an upslope source. Either mechanism of sediment transfer into the gully would result in a volume that would reduce the gully size following deposition. Subsequent surveys will show whether the gully size grows. We are not aware of any product that measures soil bulk density available for Vermont as an off-the-shelf option.

## Q3. When will the erosion mitigation treatments you described occur, and how will you monitor them?

### A3. Erosion mitigation at a gully on Milo White Road in Jericho was installed in summer 2020, approximately one year after the start of our study. Other sites are scheduled for erosion mitigation treatments in the coming month. We will monitor these sites, along with companion sites designated as research “controls” by continuing to conduct high-resolution topographic surveys to monitor change.

## Q4. Do you have any other means of assessing whether erosion mitigation projects on roads are effective in reducing erosion?

A4. Yes, in addition to the topographic surveys we describe on the poster, we are conducting visits to sites where erosion control measures have previously been put in place. These sites include Grants-in-Aid projects and Better Roads projects, funded by the Agency of Transportation. We have also visited sites documented by the Agency of Transportation through their Detailed Damage Inspection Reports, following extreme flood events. In these site visits, we review records of erosion mitigation measures installed and assess whether they are currently intact, compromised or have failed. This provides a qualitative measure of erosion control effectiveness, using the types of practices commonly employed.

## Q5. Your study only spans two years, and this has been a relatively dry summer. Is there any way to get a sense of how much these gullies at drainage outfalls erode over longer time scales?

### A5. To our knowledge, there is no other study in Vermont that has documented rates of gully erosion at road drainage outfalls. For this project, we are exploring whether gullies can be detected on the airborne lidar products that have been collected historically. If so, we hope to use comparisons across at least two time periods of airborne lidar products to create a coarse estimate of gully change.