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COMPETITIVE DIVISION – Practitioner

Arithmetic Analysis of Remotely Sensed Elevation Surfaces with Novel Applications for Disaster Sedimentation Cost Recovery

Efforts began in summer of 2018, to identify & quantify sediment deposited in select channel systems affected by the floodwaters of Hurricane Harvey (FEMA-4332-DR-TX, August 2017). The removal of the sedimentation under the FEMA Public Assistance Program required isolating preexisting sediment deposits from other flooding or natural occurrences was necessary to ensure program eligibility. The following methodology provided a comprehensive, safe & economical approach over the entire channel system (1,777 sq. mi) than numerous in-person inspections. Suspected sites were visually identified in post-storm aerial photography and clustered to provide extents for further inquiry. A geospatial surveying contractor, Survey And Mapping LLC (SAM), developed contours from pre-storm NADIR aerial photography flown in early 2017, which were verified in stereo analysis using ground control points of known elevation. This base elevation data for the channel segments, including sedimentation that was already present, was compared to a digital elevation model derived from LIDAR data flown in 2018 by Houston-Galveston Area Council (HGAC) & purchased by Harris County Flood Control District (HCFCD). The resulting arithmetic surface models showed changes in elevation after Harvey, including granular delineation of deposits & major erosion. A Surface Volume Analysis software tool then processed sites that increased in elevation greater than 6 cm (the method's upper margin of error). Analysis was repeated for quality control assessment of the arithmetic analyses,

integrity of the input data & overall best practices. The methodology was successful in identifying sediment attributable to Hurricane Harvey in a defensible manner as well as surveying areas that are difficult to reach on foot or that present unsafe conditions for inspectors. I am updating this methodology for 360 degree video, drones & oblique imagery for future expanded application in cost recovery

Presentation Theme: Progress in disaster cost recovery efficacy relies heavily on an increasing burden of documentation and defensible data for jurisdictions to seek reimbursement for large disaster repair projects. Benefit cost analyses and pinpoint delineation of scope are a growing expectation from funding partners as data collection and analysis technologies become more widespread and democratized. However, the burden of proof remains on the applicant despite insufficient increases in recoverable funds for administrative costs. I have provided a methodology in the case of incident specific sediment quantification that is more expedient, efficient, safer for staff, and scientifically defensible. Similar methodologies can be adapted for rapid estimates of other large scale projects such as drought intensity, remediation of mass-wasting, and earthquake related changes in morphology prior to commitment of resources for design engineering and geotechnical survey.

Collaborators, Advisor(s) and Department(s) that assisted with this research:

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Alan Black, Director of Operations, Harris County Flood Control District (HCFCD);

Robert Hertwig, Program Manager, Survey and Mapping, LLC. (SAM);

Houston-Galveston Area Council (HGAC)

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