WOODBURY COUNTY BOARD OF SUPERVISORS AGENDA ITEM(S) REQUEST FORM

Date: 11/9/2022 Weekly Agenda Date: 11/15/2022

ELECTED OFFICIAL / DEPARTMENT HEAD / CITIZEN: Dennis Butler - Finance/Budget Director

WORDING FOR AGENDA ITEM:

Approval of county contribution to ISAC for the Soil Compaction Project

ACTION REQUIRED:

Approve Ordinance ☐ Approve Resolution ☐ Approve Motion ☑

Public Hearing ☐ Other: Informational ☐ Attachments ☑

EXECUTIVE SUMMARY:

ISAC have agreed to contract with Iowa State regarding procedures & standards for minimizing soil compaction on agricultural lands during utility construction on wet soils .

BACKGROUND:

The analysis will investigate the methods to determine field soil wetness & establish a relationship between field soil water, precipitation from real-time data, & degree of soil bearing capacity for minimizing heavy-load induced rutting. The findings will be published in scientific journals and presented at extension meetings & professional conferences.

FINANCIAL IMPACT:

$600

IF THERE IS A CONTRACT INVOLVED IN THE AGENDA ITEM, HAS THE CONTRACT BEEN SUBMITTED AT LEAST ONE WEEK PRIOR AND ANSWERED WITH A REVIEW BY THE COUNTY ATTORNEY'S OFFICE?

Yes ☐ **No** ☐

RECOMMENDATION:

Approve county contribution of $600 from Gaming Funds for the Soil Compaction Program.

ACTION REQUIRED / PROPOSED MOTION:

Approve county contribution of $600 from Gaming Funds for the Soil Compaction Program.

Approved by Board of Supervisors April 5, 2016.

5500 Westown Parkway, Suite 190
West Des Moines, IA 50266
PHONE: 515.244.7181
FAX: 515.244.6397
www.iowacounties.org

ISAC
Iowa State Association of Counties

October 4, 2022

To: Iowa County Boards of Supervisors
From: William R. Peterson, Executive Director
Re: Procedures and Standards for Minimizing Soil Compaction on Agricultural Lands During Utility Construction on Wet Soils

The Iowa State Association of Counties (ISAC) and Iowa State Association of County Supervisors Association (ISACS) have been requested to contract for an analysis that will allow for the development of procedures and standards to assist in the mitigation of soil compaction on agricultural lands caused by utility construction occurring on wet soils. The Principal Investigator for this analysis will be Dr. Mehari Tekeste, Association Professor, Agricultural and Biosystems Engineering at Iowa State University in Ames, Iowa.

The analysis will investigate the methods to determine field soil wetness and establish a relationship between in-situ (field) soil water, precipitation from real-time data, and degree of soil bearing capacity for minimizing heavy-load induced rutting. Soil samples will be collected from the previous Dakota Access Pipeline impacted soils and four other locations with different drainage classes on sites where new construction activities will be carried out.

The specific objectives of the study are as follows:

1. Determine in-situ (field) soil moisture and wetness at various soil consistency from field sampled soils at top and subsoil layers. The soil cone penetrometer will be measured at the sampling sites to document the in-situ degree of soil compaction before construction activities.
2. Measure soil testing on mechanical and physical properties according to ASTM International and the American Society of Agricultural and Biological Engineers (ASABE) standards for establishing the degree of soil consistency (plastic limit, liquid limit) and proctor density levels.
3. Mathematically estimate the rainfall event that creates soil wetness and weak soil bearing capacity for excessive rutting and estimate the number of days allowing the soil to regain its load-bearing support with less soil rutting.

The findings from this research will be published in scientific journals and presented at organized extension meetings and professional conferences. The outcome of the results will assist in developing inspection standards for utility construction activities on wet soil conditions, and later after feedback from field technicians, the findings can be incorporated into state regulations for minimizing soil compaction and protection of agricultural lands (for example Iowa Utilities Board (IUB) Code on Chapter-9 6.8).

The ISAC and ISACS Executive Committees have agreed to contract with Iowa State for the analysis and request voluntary contributions from Iowa's 99 counties to pay for the project. The cost of the project is $51,098. There are currently three companies planning construction of carbon sequestration pipelines. These pipelines will cross a total of 70 counties in Iowa; however, the finding of this research will benefit agricultural landowners in all future utility construction activities. In anticipation that not all counties will agree to the voluntary participation, the Executive Committees have recommended that all counties contribute $600. Counties making a voluntary contribution should send their contributions by November 15, 2022 to:

Iowa State Association of Counties
Soil Compaction Project
5500 Westown Parkway, Suite 190
West Des Moines, Iowa 50266

All funds for this project will be accounted for separately.

I have attached a copy of the research proposal for your review. If you have questions, please do not hesitate to contact me at bpeterson@iowacounties.org or cell phone at 515.240.1562.

Richard Crouch
Richard Crouch
ISAC President
Mills County Supervisor

Tim Neil
Tim Neil
ISACS President
Bremer County Supervisor

William R. Peterson
William R. Peterson
ISAC Executive Director

Attachment B

Procedure for Determining Soil Wetness during Construction of Underground Utilities to Minimize Excessive Soil Compaction on Farm Soils

Principal Investigator (PI): Mehari Tekeste, Associate Professor, Agricultural and Biosystems Engineering, Iowa State University, 2331 Elings Hall, Ames, Iowa, 50011.; 515-686-7102; mtekeste@iastate.edu ; and **CO-PI: Mark Hanna,** Retired Professor, Agricultural and Biosystems Engineering, Iowa State University

I. Brief Project Justification and Rationale:

ISU investigated the impacts of pipeline construction activities on soil and corn-soybean yield from Dakota Access, LLC (DAPL) project, where a 30-inches diameter pipe was installed over 1,886 km (1172 miles) to transfer crude oil in the USA from North Dakota to Illinois. At the ISU experimental study site along the DAPL with a dominant soil series of Clarion loam, the pipe was buried at 1.2 m deep from the top soil surface after earth machinery work, consisting of topsoil (20-inches) removal and separation of the subsoil from topsoil. Heavy-axle load machinery operation in the Right-of-Way (ROW) on wet soil conditions (21.5% dry basis) resulted in a mean soil bulk density of 1.67 Mg/m3 (at 96% of Proctor compaction density) in year-one after pipeline installation. After subsoil tillage to remediate the excessive soil compaction induced from the machinery trafficking during construction, the magnitude of soil compaction exceeded root-limiting soil compaction (2.0 MPa (290 pounds per square inch (PSI)) at the subsoil layer, as shown in Figure 1. Soybean-corn yield measured at the study site showed percent losses of soybean by 18% (year-one; 2017) and 22% (year-three; 2019); and percent losses of corn by 11% (year two; 2018) and 19% (year four; 2020). Detailed results on soil and crop data from the pipeline study at ISU are available in our published articles (Tekeste et al., 2019 & 2020, Ebrahim et al., 2022). Based on our six-year study on soybean-corn rotation farms impacted by the DAPL pipeline construction activities and our previous study on soil compaction from agricultural machinery, measurement of the soil wetness in relationship to the equipment size and soil types and limiting heavy-machinery traffic intensity at low soil bearing capacity is very important. Working on wet soil conditions and soil mixing were identified as the major factors affecting the soil health properties during construction. From the DAPL project along the 347 miles pipeline installed in Iowa, approximately 57 tons per mile of topsoil was removed and backfilled to the ROW. With the new proposed total pipeline mileage of 1580 miles from Summit Carbon Solutions and Navigator CO2 in Iowa, approximately *ninety thousand tonnages* of topsoil could be removed.

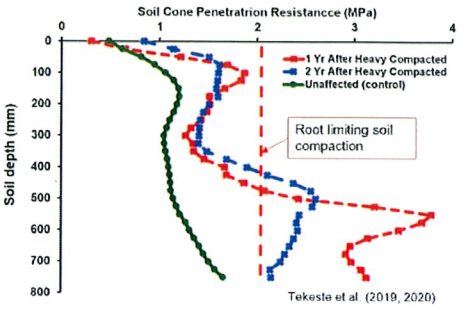

Figure-1 Soil penetration resistance after deep tillage (500-800 mm) applied in 2016

Future construction utility activities, including pipeline, solar and wind projects, on high-productive soils in the Corn-Soybean belt of the USA farms should have methods to quantitatively determine the degree of soil wetness that field technicians or inspectors could use for limiting or delaying heavy-machinery traffic. The IUB code chapter-9 6.8 does not address the wet soil working conditions, a crucial management strategy to minimize excessive soil compaction. Due to the limited scientific study on the relationship between soil wetness of agricultural soils impacted by construction utilities activities and its impacts on restoring the farmlands along the pipeline lanes to normal food production, further research is needed to determine the field methods for measuring wet soil conditions, and define its relationship to soil

bearing capacity. The study's outcome will benefit state regulator institutions and constructors working on agricultural farms with heavy machinery for construction utilities installation for generating decision support to reduce excessive soil compaction.

II. Brief Description of Proposed Research:

The proposed study will investigate the methods to determine field soil wetness and establish a relationship between in-situ soil water, precipitation from real-time data, and degree of soil bearing capacity for minimizing heavy-load induced rutting. Soil samples will be collected from the previous DAPL impacted soils and four other locations with different drainage classes on sites where new construction activities will be carried out.

Specifically, the objectives of the study are;

(1) Determine in-situ (field) soil moisture and wetness at various soil consistency from field sampled soils at top and subsoil layers. Measurement of soil cone penetrometer will be done at the sampling sites to document the in-situ degree of soil compaction before construction activities.

(2) Measure soil testing on mechanical and physical properties according to ASTM and ASABE standards for establishing the degree of soil consistency (plastic limit and liquid limit) and proctor density levels.

(3) Mathematically estimate the rainfall event that creates soil wetness and weak soil bearing capacity for excessive rutting, and estimate the number of days allowing the soil to regain its loading bearing support with less soil rutting.

Statement of Communication and Outreach Strategies

The findings from this research will be published in scientific reporting and presented at organized extension meetings and professional conferences. The outcome of the results will assist inspection of construction utilities activities on wet soil conditions, and later after feedback from field technicians, the findings can be incorporated to state regulations in minimizing soil compaction (for example IUB Code on Chapter-9 6.8).

III. Proposed budget:

The budget for professional & scientific (faculty, technician and students) (salary & fringe benefits) materials and supplies, soil analysis services and travel is estimated $51,098.

IV. Proposed Project Period:

a. Meeting for Reviewing Project Deliverables (Sept-9, 2022)
b. Field Soil Sampling (Oct-15, 2022)
c. Soil testing (Jan-30, 2022)
d. Data analysis (rainfall, soil properties, and mathematical modeling) (April-15, 2023)
e. Reporting (June 15, 2023)