DRAFT

WISCONSIN DEPARTMENT OF AGRICULTURE, TRADE, AND CONSUMER PROTECTION

TECHNICAL STANDARD

VERIFICATION OF DEPTH TO BEDROCK

01

BROAD REVIEW COMMENTS AND RESPONSES

Drafted technical note text (as sent for Initial Review) is in black font.

Comments are in blue, preceded by comment number (**C#**). To find a specific comment number, search for that number using "Ctrl + F" (Windows) or "Command + F" (Mac).

Responses to comments are in green italics.

Changes to standard text are in tracked changes.
Minor editorial suggestions from reviewers are also highlighted.

GENERAL COMMENTS

C1: Great job with this! // **C24:** I must say you and your team have come a long way and have done a great job.

RESPONSE: *Thank you!*

C2: Overall, the standard seems realistic and practical.

RESPONSE: *Thank you!*

C69: Over the past several years, numerous studies have demonstrated the vulnerability to contamination of groundwater resources in Wisconsin and the relationship of that vulnerability to land use practices and the underlying geological and soil profile. Some counties have taken the initiative to improve the maps available to their staff and landowners in their jurisdiction, but these efforts have often been piecemeal. Especially in light of new manure spreading rules for vulnerable areas of the state, we appreciate the SOC's attempt to establish more uniform standards for updating depth to bedrock maps and considering the technologies that allow for better maps than those produced up to now to be developed. Better data and maps to guide agricultural practices and other land uses will benefit farmers and landowners and citizens counting on groundwater resources to provide them with clean, safe drinking water.

RESPONSE: *Thank you!*

C73: Wisconsin's current depth to bedrock maps have remained largely unchanged for over 40 years. To our knowledge, the primary statewide data for depth to bedrock was published in the 1970's, and relied on rural wells to provide the necessary information. As such, the current map uses very few data points to identify minor but important changes in depth to bedrock, and those data points favor findings of deeper depth to bedrock. Given the nature of this underlying information, it is clear that there are large areas of Wisconsin that are insufficiently mapped. Creating a uniform verification process is an important initial step to accurately identifying areas of the state that are more susceptible to groundwater pollution due to shallow depth to bedrock. // **C76:** Wisconsin's current depth to bedrock maps have remained largely unchanged for over 40 years. To our knowledge, the primary statewide data for depth to bedrock was published in the 1970's, and relied on rural wells to provide the necessary information. As such, the current map uses very few data points to identify minor but important changes in depth to bedrock, and those data points favor findings of deeper depth to bedrock. Given the nature of this underlying

information, it is clear that there are large areas of Wisconsin that are insufficiently mapped. Creating a uniform verification process is an important initial step to accurately identifying areas of the state that are more susceptible to groundwater pollution due to shallow depth to bedrock.

RESPONSE: *The team fully agrees that there is a need for updated depth to bedrock maps in Wisconsin and DATCP is currently working with partners such as USGS, WGNHS, WI DNR and others to update the current depth to bedrock maps in priority areas.*

C65: The financial feasibility of the standard appears to lack actual dollars and cents to determine the practicality of the standard and the true economic impact. Assuming a 40 acre field for an example, listed below are some scenarios with actual numbers to complete the work:

- Two engineering firms requested quotes to complete the work for the scenario 40 acre field:
  - First quote was for $525 base for mob/demob and utility clearance then $15/LF.
  - Second quote was for $475 base for mob/demob and utility clearance then $16/LF for auger or percussive probe.
    - Work did not include any effort to locate probes or borings or map interpretation.
  - 1 per ¼ acre cost to just do the work:
    - First quote: $525 + (160 locations x $15/lf x 5' avg depth) = $12,525.00
    - Second quote: $475 + (160 locations x $16/lf x 5' avg depth) = $13,275.00
  - 1 per 1 acre cost to just do the work:
    - First quote: $525 + (40 locations x $15/lf x 5' avg depth) = $3,525.00
    - Second quote: $475 + (40 locations x $16/lf x 5' avg depth) = $3,675.00
- An agronomic consultant completed bedrock verification to 5' as approved by the DNR:
  - Procedure:
    - Used skid steer with 3 inch auger attached.
    - Did 1 boring for every 2.5 acres of the requested area.
    - Picture taken of each boring with tape measure
    - 2 people at $75/hour
    - Skid Steer at $60/hour
  - Project:
    - 104 Borings were taken that covered 250 acres took 16 hours to complete
    - Additional 4 hours pulling data together and processing data at $100/hour
    - Cost per acre complete: $15.04
    - Farm that has ~200 acres that will need verification
    - Total Cost: $3,080.00
  - Same project to meet new standard:
    - Procedure:
      - Due to close proximity, 15 to 20 probes or augers per hour: 4 to 5 acres per hour
      - 2 people at $75/hour
      - Skid Steer at $60/hour
      - Data Processing: $100/hour Assume 10 acres per hour this example
      - Cost per acre: $44 to $55 per acre
      - Farm that has ~200 acres that will need verification:
      - Total Cost: $8,800.00 to $11,000.00
  - EC and EM Mapping Cost:
    - Field Operations and Data Processing: $10 to $13 per acre
    - Field Verification: $15/acre
    - Total Cost: $25 to $28/acre
    - Farm that has ~200 ac needing verification:
    - $5,000.00 to $5,600.00

These costs noted are note complete services to compile, report, and submit or to complete verification if a geophysical method is selected. In our opinion, these are base numbers to complete the actual verification, but would be higher for the additional effort to submit to agencies or NRCS.

In our opinion, the new standard places financial hardship on farmers and the standard has unreasonable expectations for verifying depth to bedrock.

RESPONSE: *Thank you for this in-depth analysis on the economics of implementing the standard. This and similar information will be utilized when developing an economic analysis associated with rulemaking and potential cost-share related to this standard. The team recognizes these measurements will be an expense for the land owner or operator, but accuracy of verification is important. Note, a land owner or operator is not required to field verify depth to bedrock. A land owner or operator may choose to utilize this standard to verify depth to bedrock when the land owner or operator chooses to contest the current maps.*

C79: In terms of the draft technical standards themselves, we have concerns related to their cost and practicality. For example, the verification requirements proposed for intrusive and geophysical methods in Table 1 and Table 2 could be very expensive, and will vary based upon the method used and the size of the field investigated. The Department has made no effort to determine the cost to comply with these methods, or whether it is practical or feasible to implement them at the intervals proposed in the Technical Standard. These are important considerations that must be addressed before any policies are finalized.

RESPONSE: *A complete economic analysis will be conducted in a rulemaking process and may include potential cost-share related to this technical standard. The team recognizes these measurements will be an expense to the land owner or operator, but accuracy of verification is important. Note, a land owner or operator is not required to field verify depth to bedrock. A land owner or operator may choose to utilize this standard to verify depth to bedrock when the land owner or operator chooses to contest the current maps.*

DEFINITION

Investigative methods for infield depth to *bedrock*[1] verification for *fields* receiving mechanical applications of manure.

C51: I think this is better wording: "Infield depth to bedrock verification methods for fields receiving mechanically applied manure."

RESPONSE: *The wording is consistent with NR 151.075, therefore we will keep it the same.*

PURPOSE

The purpose of this standard is to provide appropriate methods for verification of depth to bedrock to support implementation of s. NR 151.075 in areas where the bedrock consists of Silurian dolomite with a depth to bedrock of 20 feet or less.

C52: How does this connect to [last sentence in Location section: "This standard may also be used to verify depth to bedrock (or other bedrock formations) in other locations, if applicable."]?

RESPONSE: *The team will remove this from the standard and evaluate in the future if this standard could apply to other bedrock formations.*

[1] Words in the standard that are shown in italics are described in the Glossary section. The words are italicized the first time they are used in the text.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to *crop producers* and *livestock producers* for all fields receiving mechanical applications of manure in areas where the mapped bedrock consists of Silurian dolomite with a depth to bedrock of 20 feet or less and where the existing *Silurian bedrock map information* is being refuted by crop and livestock producers.

C17: The proposed standard applies to areas "where the existing Silurian bedrock map information is being challenged." In our experience, the existing maps are a good indicator that there is/are area(s) with limited soil depth over bedrock in the area, but in most cases the footprint isn't accurate. We would propose requiring that bedrock depth investigation continue at least 100 feet past the mapped area of shallow soil depth, until bedrock is not encountered with investigation equipment, or to the edge of the field; whichever is encountered first. Requiring that verification extend beyond the mapped areas will ensure any inaccuracies in the current maps do not lead to incomplete verifications.

> ***RESPONSE:*** *This point is taken. Should a distance of verification need to be specified for implementation purposes, it may be included in future rulemaking. Qualified persons performing soil depth verification may increase sampling density and extend the mapped area, as necessary to complete the verification.*

C18: What about a challenge of an area where the mapping indicates that depth to bedrock is greater than 20 feet, but a landowner feels it is 20 feet or less?

> ***RESPONSE:*** *This standard only applies to mapped areas with depth to bedrock of 20 feet or less, directly tying it to the implementation of NR 151.075.*

C37: Include a map of Silurian dolomite bedrock locations?

> ***RESPONSE:*** *We provide a link to snapmaps.wisc.edu which provides the most up to date bedrock information at this time but NR 151.075 does not identify a specific Silurian dolomite map.*

This standard is not to be used for delineation of closed depressions.

C8: Why call this out as it begs a question? Is not a sinkhole a closed depression, could you not have high bedrock in a closed depression? Keep in mind that closed depressions in a glaciated area are common. I would clarify why you made this statement, I think it needs an explanation to be of value to user.

> ***RESPONSE:*** *"Closed depressions" is defined in NR 151.015 (2); however, the scope of this standard does not include verification of closed depressions. The team is including the clarifying statement so closed depressions are not overlooked in a site assessment or during verification.*

CRITERIA

General Criteria

This section establishes verification protocols, methods, and documentation for bedrock depths 20 feet or less from ground surface.

Laws and Regulations

Users of this standard are responsible for compliance with applicable Federal, State, Tribal, and local laws, rules, or regulations including, but not limited to, those governing safety, environmental protection, or nutrient management. This standard does not contain the text of Federal, State, or local laws. Implementation of this standard does not provide an exemption or defense of a violation of law.

Location

This standard applies to the area subject to s. NR 151.075 where depth to Silurian dolomite bedrock is 20 feet or less.

C67: The standard references NR 151.075 Silurian bedrock performance standards, but also under the Criteria section titled Location makes a statement, "The standard may also be used to verify depth to bedrock (or other bedrock formations) in other locations, if applicable". The standard implies is can be applied as an agency suits and contradicts itself when it clearly is intended to be used in the locations as previously determined to have Silurian dolomite present within 20' or less of the surface. These contradictions within the standard would allow personal opinions to be applied on a project by project basis to require conformance with this standard. It is our determination the standard and the contradictions within allow for lack of clarity and too much flexibility by the regulators.

RESPONSE: *From a regulatory standpoint, any updates to NR 151 would need to be done with additional rulemaking and public input. The team will remove this from the standard and evaluate in the future if this standard could apply to other bedrock formations.*

C68: A uniform verification process is a positive step…though it is concerning that in this standard it appears that those allowed to challenge the existing outdated maps are restricted to agricultural land owners. This restriction seems both inappropriate and unfounded, and the scope should be expanded to explicitly include directly-impacted neighbors, non-profit organizations, and local governments. We should all be working together to improve this critical data, not simply ensuring that certain operations are not overly restricted in their nutrient management. *//* **C72:** While we understand this draft rule to allow landowners to initiate a depth to bedrock review, the reality many residents dependent on groundwater for their drinking water confront is one where their neighbors' actions can directly and dramatically impact the quality of their water. Thus, other entities, like counties, state agencies, or residents with a stake in the resultant impact of land use practices on local water resources, should have the ability to reasonably question the accuracy of depth to bedrock information. We hope the SOC has considered the perspective of citizens dependent on groundwater resources for their drinking water and the benefits they accrue from informed land use practices based on reliable, accurate information like depth to bedrock maps. *//* **C74:** The stated purpose of the Technical Standard is to "define the criteria and procedures to verify and document the depth to bedrock when a landowner wishes to contest the current categorization of cropland specifically for the purposes of applying manure as a crop nutrient." The Standards Oversight Council's (SOC) explicit limitation to landowner disputes ignores affected members of the public who are often left to deal with the pollution that results from improper spreading or inadequate regulation. Moreover, this limitation sidesteps numerous regulations that extend rights to challenge or trigger other verification processes to members of the public. Admittedly, within subchapter II of NR 151 there is a notable absence of any discussion of a verification standard process or what triggers such a process. Given that general omission, it was improper to restrict which parties may dispute the current approved depth to bedrock. While not technically binding, language used in the Technical Standard's public notice or attached examples could dissuade affected members of the public from weighing in on discrepancies between old maps and their understanding of particular field geology. *//* **C77:** It is essential that these verification processes are triggered easily, regularly updated, and stored in an accessible way. Therefore, the Technical Guide and NR 151 should explicitly recognize the right of members of the public to trigger the verification process.

The stated purpose of the Technical Standard is to "define the criteria and procedures to verify and document the depth to bedrock when a landowner wishes to contest the current categorization of cropland specifically for the purposes of applying manure as a crop nutrient." The Standards Oversight Council's (SOC) explicit limitation to landowner disputes ignores affected members of the public who are often left to deal with the pollution that results from improper spreading or inadequate regulation. Moreover, this limitation sidesteps numerous regulations that extend rights to challenge or trigger other verification processes to members of the public. Admittedly, within subchapter II of NR 151 there is a notable absence of any discussion of a verification standard process or what triggers such a process. Given that general omission, it was improper to restrict which parties may dispute the current approved depth to bedrock. While not technically binding, language used in the Technical Standard's public notice or attached examples could dissuade affected members of the public from weighing in on discrepancies between old maps and their understanding of particular field geology.

RESPONSE: *NR 151 states that "All crop producers and livestock producers that mechanically apply manure directly or through contract or other agreement to cropland or pasture areas that*

meet the definition of Silurian bedrock under s. NR 151.015 (17) must comply with this section." This standard is also only to refute the existing maps where NR 151.075 applies.

Once verification data is submitted to the designated agency, the county, state agencies and members of the public may be able to update mapping information.

Criteria Applicable to Verification Process

Site Assessment

Prior to initiation of data collection, a site assessment must be performed to determine the depth to bedrock verification needs of the farm. The site assessment must include a review of regional and site-specific information necessary to determine verification priority areas and the data collection method(s) most suitable for the farm as outlined below and in Attachment 1. Findings of the site assessment must be used to identify the fields and/or field areas where bedrock depth verification will be performed, as well as the bedrock depths to be verified and the required sampling density. The following planning resources shall be reviewed, as applicable:

1. Discussions with land owner and/or operator to identify possible exposed bedrock, shallow soils over bedrock, or karst features;
2. Farm's *nutrient management plan*;

C53: Delete "manure management plan". How is manure management plan different from NMP?

RESPONSE: *Thank you; manure management plan text was removed as it is duplicative.*

3. Area bedrock and karst maps;
4. Any site-specific subsurface information (e.g., well construction reports, manure storage investigation, windmill drill logs, Wisconsin Department of Natural Resources (DNR) Bureau for Remediation and Redevelopment Tracking System (BRRTS) database information, Wisconsin Department of Transportation (WisDOT) boring logs, prior geophysical investigations, information from the county sanitarian, and county land conservation department resources);
5. Air photos, both recent and historic;
6. Maps of land surface elevations [e.g., topographic map, digital elevation model (DEM), Light Detection and Ranging (LiDAR)];
7. Natural Resources Conservation Service (NRCS) Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm);
8. Locations of utilities, tile lines, and cultural resources if intrusive investigation methods are to be used;

C54: Cultural resources?

RESPONSE: *Thank you, the text was updated to include cultural resources.*

9. Silurian bedrock map information, available from the University of Wisconsin's Department of Soil Science (https://snapplus.wisc.edu/maps/).

C38: Tough to find online. Many layers to turn off in order to see Silurian bedrock.

RESPONSE: *Currently, this is the best publicly available mapping effort for Silurian bedrock. DATCP, along with other project partners, are also working with USGS to improve bedrock mapping efforts in priority areas.*

Based on this information, the verification method(s) listed in **Tables 1 and 2** for field investigation can be evaluated.

Methodology

1. Qualified individuals, as identified in the Qualification section, must develop a plan for verification of depth to bedrock. For those who become qualified by taking a DATCP-approved training course, and who prior to that were not previously qualified, the verification plan must be submitted to and approved by the appropriate entity determined by the *Department* **before** any verification work is completed.

C9: Are you ready to roll out a DATCP-approved training course? Or do you have resource for this? I would be ready for this once you post this standard. Otherwise, remove this and add it at later date when you actually can do the training.

RESPONSE: *Training will be coordinated by DATCP to allow implementation by any interested parties who do not already have credentials from the list in the Qualifications section. It will be a DATCP-approved course, but not necessarily conducted by DATCP.*

C11: Concern over high cost of implementing a system to manage certifications. There will be additional manpower and time at DATCP to develop the trainings as well as maintain a database of certified bedrock verifiers.

RESPONSE: *It will take time and effort to maintain the certifications, but it is necessary. The team also decided to put a process in place for farmers to do the verification themselves.*

2. Choose verification method(s) based on depth suitability and site assessment. Verification method selection should also take into account site topography, variability in soil texture and moisture contents, and availability of equipment to choose the best verification method for the specific field conditions.
3. Before conducting verification sampling, the land surface must be smoothed in the immediate vicinity of the sampling point if needed, so depth measurements are collected from a level ground surface representative of the general area. A tillage pass is not required or needed to level out the ground surface.
4. Depth verifications must be performed in the field being refuted (i.e. not in adjacent ditch, road or treeline).

C56: Is “disputed” same as “challenged” above?

RESPONSE: *Thank you for the comment – the standard text was updated for consistency.*

C12: If bedrock depth verifications could be performed adjacent to the field during the cropping season it would open the timing window. The fall harvest season is already very busy with harvest, tillage, and manure application. If ALL bedrock verification must be performed in the fall or spring it will limit the amount of time available to apply manure. If some out of field sampling was allowed, with additional in field testing, it would help streamline the process.

Additionally, all of the "site specific subsurface info" (Line 301-314 [of Broad Review draft] and other areas) will likely not be in the field area. It will be in nearby areas and help pinpoint the need and success of identifying depth to bedrock inconsistencies.

RESPONSE: *The ground truth measurement could be done at the field edge. However, the geophysical measurements would also need to be done at the field edge to provide consistent comparison. Depending on which type of verification a qualified individual chooses, that choice may limit the window to conduct verification. However, not every field needing verification is a row crop and the verifier could plan accordingly. If a row crop is planted, the verifier could choose a method that could be performed in a row crop situation or just plan to coordinate before or after the growing season.*

C55: Proximity – is there a min distance? E.g. 100 feet in 313 for soil borings.

RESPONSE: *No, the standard relies on the qualified individuals identified in this standard to perform the verification that is a best representative of the depth to bedrock in that area.*

5. **Table 1** and **Table 2** provide the minimum sampling densities based upon verification method and depth to be verified;
   a. At minimum, follow the sampling density appropriate to the depth of bedrock being refuted and the verification method being used. Sampling density can be increased to exceed the minimum density requirement;
   b. When using geophysical methods, complete required verification/ground truthing using protocols outlined in **Table 2**;
   c. The minimum spacing in sample density may cross field boundaries and should match the overall sampling density specific to the verification method chosen for the depth being refuted in that area; and

C57: Is "disputed" same as "challenged" above?

RESPONSE: *Thank you for the comment – the language has been updated for consistency.*

   d. Use excavation as a verification method only if no other methods are available for use.

Table 1. Intrusive Methods

Method	Description	Minimum Sampling Density Required[1]	Allowable Boundary Depth Verifications
Hand probe	Rod less than 1" diameter is pushed into ground by hand.	At a minimum, one probe per 1/4 acre (~100 ft spacing) when disputing the 2 ft and/or 3 ft boundary.	2 ft 3 ft
C58: Does this include a soil science soil probe? I have seen two different sizes. A rod to be would be a tile probe. ***RESPONSE:*** *The probe or rod just needs to be less than 1".*			
Hand held or machine auger	Auger is advanced or turned into ground and rotated.	At a minimum, one probe per 1/4 acre (~100 ft spacing) when disputing the 2 ft and/or 3 ft boundary. At a minimum, one probe per 1 acre (~200 ft spacing) when disputing the 5 ft boundary.	2 ft 3 ft 5 ft
Direct push probe (e.g. Geoprobe, Giddings, loader/skid steer pushing rod, hammer probe)	Probe is advanced using hydraulic or percussive methods.	One probe per 1/4 acre (~100 ft spacing) when disputing the 2 ft and/or 3 ft boundary. One probe per 1 acre (~200 ft spacing) when disputing the 5 ft boundary. One probe per 10 acres (660 ft spacing) when disputing the 20 ft boundary.	Suitable for all depths
C59: Is Geoprobe a registered term? Promoting one manufacturer? E.g. giddings ***RESPONSE:*** *The team is giving examples of different types of direct push probes that are commonly used. Geoprobe is a brand –Giddings has been added so it isn't listing just one brand name. Note added below to address manufacturers.*			

Method	Description	Minimum Sampling Density Required[1]	Allowable Boundary Depth Verifications
Excavation[2]	A pit is excavated for evaluation.	One pit per 1/4 acre (~100 ft spacing) when disputing the 2 ft and/or 3 ft boundary. One pit per 1 acre (~200 ft spacing) when disputing the 5 ft boundary. One pit per 10 acres (660 ft spacing) when disputing the 20 ft boundary.	Excavation equipment suitable to the depth of reach.

C25: Table 1 discusses "spacing," which is inconsistent with Table 2 using the term "field spacing." I personally prefer the term "line spacing."

RESPONSE: *The term "field spacing" has been updated to "spacing" in both tables for consistency.*

C26: The line spacings used in Table 1 and Table 2 for 20 ft target depths should be consistent, either 660 ft or 200 ft.

RESPONSE: *Thank you. Spacing has been updated to 660 ft spacing in both tables for disputing 20 ft boundary.*

C13: With 4 or more cores required per acre the manpower commitment to sampling will be very high. Costs of verification should be established to be sure there isn't undue burden on farmers.

RESPONSE: *The team spent a lot of time discussing sampling density and what would be appropriate scaled to a full field. After much discussion and reviewing different in-field examples, the team decided on the above spacing to provide the most accurate depiction of the variation of the depth to bedrock in a field, while focusing on the boundary(ies) being refuted from existing maps. The cost of the verification may be addressed in a future rulemaking process, including any considerations for cost-share. This high-density probing is only for a small percentage of cropland, which is also the most vulnerable.*

C70: We also support the more numerous data points required when assessing shallower depths to bedrock, given the greater risk the thin soils above this shallow bedrock present for groundwater contamination.

RESPONSE: *Thank you; we agree!*

Notes:

1. This is only minimum criteria, additional probing to delineate boundaries may be necessary and will be left up to the qualified individual to make those determinations.
2. Excavation is only to be used if there are no alternative options for verification.

   C39: Is availability of equipment good enough to meet "no alternative?"

   RESPONSE: *Yes, that would fall under no alternative options.*
3. All product names and brands are property of their respective owners. All company, product and service names are for identification purposes only. Use of these names and brands does not imply endorsement.
4. See Attachment 2 for an example depicting the design of an intrusive sampling plan.

C19: We tested 50 ft (~1/20 acre), 100 ft (~1/4 acre), and 150 ft (~1/2 acre) probe spacings. The attached map [pasted below] shows areas of varying probe densities on the finished bedrock map. In this case the final map changed very little at three different sample densities. While additional probing may be necessary to delineate a definitive area of less than 24 inches of soil over bedrock, areas like we tested where a very large area is 20-36" to bedrock we found a probe density of 150 ft was adequate to make an accurate map of soil depths.

RESPONSE: *Thanks for the time spent on this example. The team spent a lot of time discussing the spacing, considering accuracy and cost. We created some test sampling plans using real data to see how verification and boundary lines would change with different densities and also compared actual intrusive and geophysical data to compare the accuracies of different methods and densities. After much team discussion and review of in-field examples, the team decided that the ¼ acre spacing would give us a reasonably accurate depiction of the variation of the depth to bedrock in a field while also remaining cost-effective.*

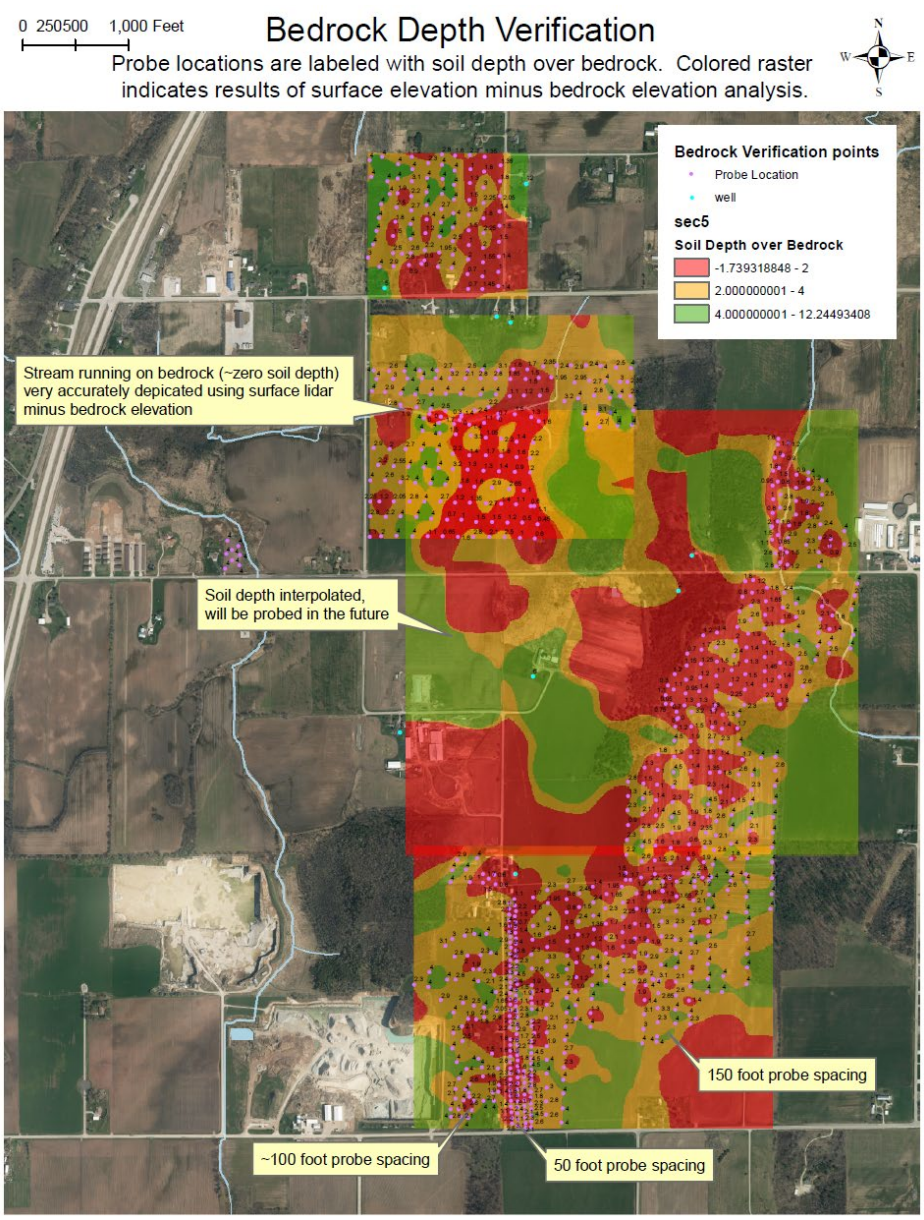

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Table 2. Geophysical Methods

Method	Description	Protocols	Output	Allowable Boundary Depth Verification
Contact Electrical Conductivity (e.g. Veris)	Electrodes in direct contact with the ground to measure the apparent electrical conductivity of the subsurface.	At least one survey line (covering the length of the field) per 100 ft spacing when disputing the 2 ft and/or 3 ft boundary.	Continuous profile of apparent bulk electrical conductivity along a survey line. Multiple profiles may be combined to produce a plan view map.	2 ft 3 ft
C60: Is Veris a registered term? Promoting one manufacturer? ***RESPONSE:*** *The team has addressed this with the addition of a Note: "All product names and brands are property of their respective owners. All company, product and service names are for identification purposes only. Use of these names and brands does not imply endorsement."*				
Electromagnetic (EM) surveys - Frequency domain conductivity (e.g., Dual EM, EM-31, EM-34, EM-38)	Using the induction principle, measures the apparent electrical conductivity of the subsurface.	At least one survey line (covering the length of the field) per 100 ft spacing when disputing the 2 ft and/or 3 ft boundary. At least one survey line per 200 ft spacing when disputing the 5 ft boundary. At least one survey line per 660 ft spacing when disputing the 20 ft boundary.	Continuous profile of electromagnetic apparent conductivity along a survey line. Multiple profiles may be combined to produce a plan view map.	2 ft 3 ft 5 ft 20 ft (depending on instrument model)
C14: EM methods do not have a spacing for disputing 20 ft boundary. // **C27:** The [EM] section does not offer a field/line spacing for the 20 ft target depth. A spacing of 660 ft for the 20 ft target depth would be consistent with the "Horizontal-to-Vertical Spectral Ration (HVSR) section in Table 2 and the spacing suggested in Table 1. If 660 ft is considered too large of a spacing for the 20 ft target depth, then Table 1 and the HVSR method in Table 2 should be consistent with all portions of the document. In other words, I believe the line spacings used in Table 1 and Table 2 for all target depths should be consistent for each target depth (100, 200, or 660 ft depending on the target depth). ***RESPONSE:*** *The EM method spacing has been added for disputing the 20 ft depth which is consistent with the HVSR method spacing for that depth.*				
Electrical Resistivity Imaging	Electrodes in direct contact with the ground at specified spacings to measure the electrical conductivity of the subsurface.	At least one survey line (covering the length of the field) per 200 ft spacing when disputing the 5 ft boundary. At least one survey line per 660 ft spacing when disputing the 20 ft boundary.	Continuous profile of electrical resistivity along a survey line. Multiple profiles may be combined to produce a plan view map.	5 ft 20 ft

Method	Description	Protocols	Output	Allowable Boundary Depth Verification
C28: While electrical resistivity imaging may be potentially excessive for very shallow depths, I am not aware of any depth limitations. In other words and based on personal experience, electrical resistivity imaging should also be acceptable for 2 ft and 3 ft depths, especially when "Contact Electrical Conductivity" is permitted. The theory behind the physics for mapping bedrock at these shallow depths is the same for "Contact Electrical Conductivity" and electrical resistivity imaging. ***RESPONSE:*** *The team did not recommend electrical resistivity imaging for the shallower depth boundaries because this would require very close electrode spacing, on the order of 0.5 to 1 meter to produce accurate results. Given the time and logistics involved, this seems impractical compared to direct push probe methods or the Veris method discussed above. Inherently, this is not a technical limitation of the method, but rather a practical choice because other methods would be more appropriate.* **C29:** I do not believe this geophysical method should be held to a higher standard or smaller line spacing than the 660 ft spacing for the 20 ft target depth suggested for the "Horizontal-to-Vertical Spectral Ratio (HVSR) section and spacings suggested in Table 1. ***RESPONSE:*** *The team chose 660 ft spacing for the direct measurements in determining the 20 ft boundary. This was changed to be comparable for the 20-foot boundary.* **C30:** This resistivity method does not require continuous profiles and is well suited for acquiring short resistivity images. If one opted not to acquire continuous profile lines, I believe one should be permitted to acquire short profile lines at the spacings suggested in Table 1 and the HVSR method in Table 2. ***RESPONSE:*** *A short profile using at least 24 electrodes would be allowable (basically collecting short profiles spaced 660 ft apart, rather than a continuous profile). A 1-D depth sounding using 4 electrodes (e.g. the expanding Wenner array) would not be allowable as that method does not provide the needed accuracy.*				
Horizontal-to-Vertical Spectral Ratio (HVSR)	A seismometer, records ambient seismic noise to estimate sediment thickness and depth to bedrock.	At a minimum, one measurement per 1 acre (200 ft spacing) when disputing the 5 ft boundary. One measurement per 10 acres (660 ft spacing) when disputing the 20 ft boundary.	Provides info about natural frequency at a point. Natural frequency can be converted to depth of sediments if the S-wave velocity is known.	5 ft 20 ft
Low Frequency Ground Penetrating Radar (GPR)	Radar waves are reflected at boundaries of geologic units.	At least one survey line (covering the length of the field) per 100 ft spacing when disputing the 2 ft and/or 3 ft boundary. At least one survey line per 200 ft spacing when disputing the 5 ft boundary. At least one survey line per 660 ft spacing when disputing the 20 ft boundary.	Continuous profiles of two-way travel times of radar waves along a survey line resulting in a cross section of the subsurface along a survey line.	2 ft 3 ft 5 ft 20 ft

Method	Description	Protocols	Output	Allowable Boundary Depth Verification
C31: As with the electrical resistivity imaging section, a field/line spacing for the 20 ft target depth was not provided for "Low Frequency Ground Penetrating Radar (GPR)." A spacing of 660 ft for the 20 ft target depth would be consistent with the "Horizontal-to-Vertical Spectral Ration (HVSR) section and spacings suggested in Table 1. Like electrical resistivity imaging, if one opted not to acquire continuous profile lines, one should be permitted to acquire short profile lines at the spacings suggested in Table 1. ***RESPONSE:*** *Similar to the above response concerning electrical resistivity imaging, the team agrees that the spacing for the 20-foot boundary can be changed to 660 feet. In addition, see above response to Comment C30 about collecting short profiles, which also applies to this comment. However, when running the GPR unit, it is logistically easiest to collect a single, continuous profile rather than collecting several, short, disjointed profiles. We are leaving the "continuous profile" wording in the description.*				
Multi-channel analysis of surface waves (MASW)	Seismograph and an array of geophones to record the surface wave energy created from a source.	At least one survey line (covering the length of the field) per 200 ft spacing when disputing the 5 ft boundary. At least one survey line per 660 ft spacing when disputing the 20 ft boundary.	Cross-sections of shear wave velocity as a function of depth.	5 ft 20 ft
C32: I do not believe that "Multi-channel analysis of surface waves (MASW)" should be held to a higher standard or smaller line spacing than the 660 ft spacing for the 20 ft target depth suggested for the "Horizontal-to-Vertical Spectral Ratio (HVSR) section and spacings suggested in Table 1. This method does not require continuous profiles and is well suited for acquiring shorter profile lines. If one opted not to acquire continuous profile lines, one should be permitted to acquire short profile lines at the spacings suggested in Table 1 and the HVSR method in Table 2. ***RESPONSE:*** *Similar to the above response concerning electrical resistivity imaging, the team agrees that the spacing for the 20-foot boundary can be changed to 660 feet. The team agrees that this method could be suitable for collecting short profiles, spaced 660 feet apart rather than a continuous profile.*				
Resistivity Mapping with a Towed Array (e.g. OhmMapper)	Capacitance coupled discharge with a towed array in direct contact with the ground, to measure the bulk electrical properties of the subsurface.	At least one survey line (covering the length of the field) per 200 ft spacing when disputing the 5 ft boundary. At least one survey line per 660 ft spacing when disputing the 20 ft boundary.	Continuous profile of electrical resistivity along a survey line.	5 ft 20 ft

Method	Description	Protocols	Output	Allowable Boundary Depth Verification
C33: Please see the comments about electrical resistivity imaging [C28, C29, C30]. I am not aware of any limitations that would not permit this technology to be used for 2 ft and 3 ft target depths. Once again, if "Contact Electrical Conductivity" is acceptable for 2 ft and 3 ft target depths so should this method. ***RESPONSE:*** *The team did not recommend OhmMapper for the shallower depth boundaries because in our experience we had seen significant "smear" within the resulting data compared to ERI which might make it very difficult to distinguish these shallow depths. However, The Handbook of Agricultural Geophysics by Allred, Daniels, and Ehsan provides an example of profiles showing conductivity variation at about 3 ft depth. They used several passes with different dipole separations, so this method would be acceptable for the 2 and 3 ft depths.* **C34:** Also, I believe this method should not be held to a higher standard or smaller line spacing than the 660 ft spacing for the 20 ft target depth suggested by the "Horizontal-to-Vertical Spectral Ration (HVSR) section and spacings suggested in Table 1. ***RESPONSE:*** *The Team agrees that spacing can be increased to 660 feet. Change made.*				
Seismic refraction	Seismograph and an array of geophones to record the seismic energy created from a source.	At least one survey line (covering the length of the field) per 200 ft spacing when disputing the 5 ft boundary. At least one survey line per 660 ft spacing when disputing the 20 ft boundary.	Layered profile of seismic velocities along survey lines.	5 ft 20 ft
C35: I believe the "Seismic refraction" method should not be held to a higher standard or smaller line spacing than the 660 ft spacing for the 20 ft target depth suggested for the "Horizontal-to-Vertical Spectral Ration (HVSR) section and spacings suggested in Table 1. Like other methods, this method does not require continuous profiles and is well suited for acquiring shorter profile lines. If one opted not to acquire continuous profile lines, one should be permitted to acquire short profile lines at the spacings suggested in Table 1 and the HVSR method in Table 2. ***RESPONSE:*** *Similar to the above response concerning electrical resistivity imaging, the team agrees that the spacing for the 20-foot boundary can be changed to 660 feet and agrees that this method could be suitable for collecting short profiles, spaced 660 feet apart rather than a continuous profile.*				

C36: If all geophysical methods are not permitted to take advantage of the 660 ft spacing for the 20 ft target depth then for consistency the "Horizontal-to-Vertical Spectral Ration (HVSR) method should be reduced to a 200 ft spacing for the 20 ft target depth. Furthermore, if the 660 ft is considered too large of a spacing for the 20 ft target depth in Table 2 Geophysical Methods, then I believe Table 1 should require methods for the 20 ft target depth to be held to the same standard as the geophysical methods (e.g. 200 ft spacing). In other words, I believe the line spacings used in Table 1 and Table 2 for each target depth should be consistent.

RESPONSE: *The team agreed that spacing for geophysical methods could be increased to 660 ft for the 20-foot boundary throughout this section. Change was made.*

C66: In reviewing the geophysical methods and equipment, members of the organization had a hard time finding a business or service to provide and quote many of the geophysical methods. Some members are aware of the technology because they had access to the instrumentation through college and universities or other research based organizations. As independent agricultural professionals we encourage economic development and adoption of service lines and technology, but with the industry

lack of the technology we estimate start-up costs are going to be significant and lack of competition is going to maintain a high fee for the geophysical methods. Not to mention the need for intrusive verification eludes to the lack of confidence in the technology will further increase costs.

It is our assessment the development and review of the standard did not take into account access to technology and if access to the technology is not shown the geophysical methods are not a viable option for determining depth to bedrock.

RESPONSE: *There are geophysical companies in the Upper Midwest that can do this work and a Wisconsin geophysical company provided input to this committee. We did not feel that listing companies was appropriate as these will change over time. To date, there has been little need for geophysical surveys to determine depth to rock. However, as the market grows, we expect that existing geophysical companies, will step up to fill the need.*

Notes:

1. New technologies not listed in this table are acceptable based on a qualified individual's experience with that equipment.
2. Anticipated depth and boundary refer to the depth to bedrock indicated on the map being refuted.
3. Geophysical instruments must be properly calibrated and operated using manufacturer recommendations for specific environment being evaluated.

C40: Who calibrates? Or keeps track of schedule?

RESPONSE: *Qualified persons are expected to perform calibration according the manufacturer's recommendations.*

4. GPS location must be recorded at 30-foot intervals along the geophysical survey line. Automated GPS and data collection recommended, where available. See GPS Requirements section.
5. Geophysical methods must be used in conjunction with intrusive methods to verify correlation of geophysical data with depth to bedrock (see Geophysical Method Ground Truthing section). When ground truthing geophysical measurements, intrusive sampling density is reduced to 10% of the densities in Table 1. This is only minimum criteria, additional survey or probing to delineate boundaries may be necessary and will be left up to the qualified individual to make those determinations.

C15: Geophysical methods should not require validation for each field. When methods are performed during the same sampling event intensive intrusive sampling is not necessary. Once a method has been verified, additional verification will cause undue burden on farmers.

RESPONSE: *There can be significant differences in soil type, moisture content etc. between fields. These parameters will affect the variability of the data collected by many of the methods listed above. To be confident of the depth determinations (as interpreted from geophysical data) in each field, we firmly believe that ground truth data must be collected from each field.*

C41: Does geophysical method clarify weathered bedrock as bedrock?

RESPONSE: *The definition of bedrock is as defined in the Glossary: "Bedrock – The solid or consolidated rock formation typically underlying loose surficial material such as soil, alluvium or glacial drift. Bedrock includes but is not limited to limestone, dolomite, sandstone, shale and igneous and metamorphic rock."*

C61: Density reduction - Area or spacing? 10% of ¼ acre or 10% of ~100 feet

RESPONSE: *10% of required sampling points.*

6. All product names and brands are property of their respective owners. All company, product and service names are for identification purposes only. Use of these names and brands does not imply endorsement.

C62: This is needed for Table 1 too.

RESPONSE: *Thank you. This has been added.*

7. See Attachment 2 for an example depicting the design of a geophysical survey and ground truthing plan.

Geophysical Method Ground Truthing

Prior knowledge of expected depth to bedrock and variation in soil types and/or textures in a *mapped area* is required in order to design an accurate geophysical survey.

When geophysical surveys are used to assess depth to bedrock, depth-to-bedrock data must also be collected by direct measurement using an intrusive method (see Table 1) in several locations so as to "ground truth" the interpretation of the geophysical data.

C6: For consistency, should this ["rock"] be "bedrock"?

RESPONSE: *Yes, update made for consistency.*

Note: Geophysical derived depths to bedrock are dependent on known conditions and are often interpreted after integrating intrusive result. Thus, geophysical data may require additional analysis after ground truthing or an intrusive sampling program.

Once the geophysical survey has been completed, the results must be presented in a map format that includes a legend showing the full range of measured geophysical values. The range of measured values must be divided into categories that can be related to the depths of interest and those categories presented on the map (and shown in the legend).

Ground truthing data must be collected such that mapped areas with both similar geophysical values and similar depths are sampled. First geophysical data are collected and areas of similar geophysical values are identified. For areas with similar geophysical values, the investigator needs to assess visible variation in soil moisture and/or texture. Measured geophysical values can vary based on depth to rock, soil type and moisture content. If the field appears to be uniform with respect to soil moisture and texture, then the investigator defines mapped areas in terms of similar geophysical values. Each mapped area must be ground-truthed in at least two locations and the sampling locations should be distributed throughout the field. If variations in soil moisture and/or texture are observed, the number of ground truth locations should be increased such that mapped areas covering the full range of geophysical values, moisture and texture are sampled.

The number of ground truth points must be at least 10% of the total required by intrusive methods (in Table 1) alone. Additional ground truth points must be collected if the number of points collected in the mapped areas does not meet the 10% number. Therefore, 10% of the total required by intrusive methods (in Table 1) with a minimum of 2 locations per mapped area is required.

C42: Is this "mapped area" as in definitions?

RESPONSE: *Correct.*

Global Positioning System (GPS) Requirements

Intrusive and geophysical survey locations shall be identified using a GNSS/GPS device (which could include a cellular phone equipped with a GPS application) that maintains a minimum horizontal accuracy of 16 feet.

Qualifications

Persons qualified to conduct the bedrock depth verification process must be knowledgeable and competent in designing, performing, and evaluating bedrock depth verification work. Knowledge and

competency can be acquired through field work, education, and training. Qualified persons are recognized as:

1. A certified professional crop consultant (CPCC) by the National Alliance of Independent Crop Consultants; or
2. A certified crop adviser (CCA) or certified professional agronomist (CPAg) by the American Society of Agronomy, Wisconsin certified crop advisers board; or
3. A Certified Professional Soil Scientist (CPSS) by the Soil Science Society of America; or
4. Licensed Professional Geologist, Professional Hydrologist, Professional Soil Scientist, or Professional Engineer by WI Department of Safety and Professional Services (DSPS); or
5. Persons with DATCP Conservation Engineering Practitioner Certification for DATCP Technical Standard 01 – Verification of Depth to Bedrock; or
6. Landowners, operators or others not meeting the above criteria may complete a DATCP-approved training course appropriate for the individual verification method to become qualified if they also have related field experience and/or education. The individual must work with the qualified entity identified by DATCP to get their verification plan approved **before** starting any work, and may only perform verification on their owned land.

C20: Change wording to: "… and may only perform verification on their owned land." Or "… and may only perform verification on *land they own*."

RESPONSE: *Text has been updated.*

C3: A "Qualified Person" can be any PE or Professional Hydrologist (among other types of certifications) with knowledge and experience in this type of verification work. I am a PE and I would not feel comfortable doing the analysis even though I have some experience with it.

RESPONSE: *The team agrees, which is why we are offering training and included this statement: "Persons qualified to conduct the bedrock depth verification process must be knowledgeable and competent in designing, performing, and evaluating bedrock depth verification work. Knowledge and competency can be acquired through field work, education, and training."*

Abandonment Procedures

1. If infield depth to bedrock verification uses *boreholes* or other subsurface investigations, they must be backfilled with soil within 72 hours of being created (NR 151.075 (5)) or before applications of nutrients, whichever is first. When abandoning, qualified persons must follow the *filling and sealing* requirements as defined.

C63: The term [borehole] not used in table 1. Can the terms in table 1 replace borehole?

RESPONSE: *In this specific section, the text is referencing code NR 141 and using the term "borehole" to be consistent with the code.*

a. Boreholes greater than 1" wide and less than 5 feet deep must be abandoned with either soil cuttings or bentonite granules or chips (3/8" in diameter or less) to grade.

C43: Where do we get this bentonite?

RESPONSE: *It can be purchased online or at local landscaping stores, home improvement stores or related business.*

b. All boreholes greater than 1" wide and between 5 feet and 10 feet deep must be abandoned with bentonite granules or chips (3/8" in diameter or less) to grade.

c. For boreholes, regardless of width, that are greater than 10 feet deep or where water table (as defined in NR 141) is encountered, follow abandonment procedures in NR 141.

C7: Is this [1.c.] for all boreholes regardless of how wide? I would suggest this be "yes", but then suggest the edit as "For all boreholes, regardless of width, greater than 10...."

RESPONSE: *Yes, this has been added for clarification.*

C64: Does [water table] need to be defined?

RESPONSE: *Water table is defined in NR 141 (the code being referenced) as this: ""Water table" means the surface of unconfined groundwater where the water pressure is equal to atmospheric pressure." We added this clarification in the text.*

2. If infield bedrock verification incorporates test pits:

   a. For test pits less than or equal to 10 feet depth, the excavation must be backfilled and lightly compacted in no more than 2-foot lifts to approximate the pre-excavated profile. The excavated materials should be replaced in layers and density similar to the surrounding undisturbed soils.

   b. For test pits greater than 10 feet depth, the excavation must be abandoned according to NR 812.26 which defines excavation as drillhole and requires different criteria.

C4: The term "borehole" may not be inclusive of holes remaining after the use of a probe. I suggest the term "borehole" within the document, especially within the Abandonment Procedures be changed to "hole left by probes and borehole".

RESPONSE: *Borehole is used to be consistent with NR rules and regulations. Borehole is defined by width of whole and depth regardless of the equipment being used.*

C5: Even with the above [Comment C4] suggestion, the Abandonment Procedures do NOT refer to any holes left by the smaller of various Probe methods allowed in Table 1 (anything 1 inch wide or less). These holes left by probes will create direct conduits to bedrock or groundwater. Though not to be "Abandoned" or filled, these holes should have the top 6 inches closed, as with a shovel.

RESPONSE: *A borehole is defined as, "A circular hole deeper than it is wide, constructed in earth material for the purpose of either installing a well or obtaining geologic or groundwater related data. Boreholes are also referred to as drillholes." This means that holes left by probes would still need to be backfilled according to the procedures in item 1 under Abandonment.*

CONSIDERATIONS

The following statements are optional considerations and not required practices:

- Accuracy of geophysical methods typically decreases as depth increases. Other factors such as soil type, subsurface moisture, field conditions and depth to bedrock impact geophysical readings and their accuracy.
- Due consideration must be given to local environmental concerns, economics, the farm's manure and nutrient management plan, and personal safety and health factors when choosing verification method(s).
- The quality of bedrock depth information generated is greatly influenced by the knowledge and expertise of the individuals collecting and interpreting the data.
- When locating intrusive sampling locations, consider spacing locations evenly across representative mapped areas within field to be verified.

C44: Use "mapped area" as in definitions for consistency.

RESPONSE: *Edit made to clarify language.*

- When using an intrusive method, if bedrock encountered is outside of expected range, consider additional probing to verify that what was encountered was not another hard surface (i.e. small boulder, gravel, etc.).
- When choosing verification equipment, consider the operators' expertise and physical ability, as well as weather and field conditions.

PLANS AND SPECIFICATIONS

Field investigation data shall be compiled, georeferenced, and interpreted to create a depth to bedrock *field map* for areas where verification activities were completed. Submittals shall be made to the appropriate regulatory agency identified by the Department prior to the application of manure when generated depth to bedrock field maps differ from current publicly available Silurian bedrock maps.

C16: Who are the appropriate regulatory agencies? Confusion will exist on who to report information to. These reporting requirements will vary from county to county and regulator to regulator. The same confusion abounds in the Farmland Preservation 590 NMP program and this will be a continuation of 590 confusion.

RESPONSE: *The appropriate agency/agencies will be determined by DATCP.*

C21: The proposed standard should include criteria for interpolation between probes when creating a map depicting depth to bedrock? Maybe include some simple mathematical methods as well as acceptable methods using ArcGIS. We've found that using the probes to map bedrock elevation, interpolating those elevations to create a bedrock elevation raster, then subtracting that from the surface elevation raster (generated by county LIDAR elevation data derived from several hundred points per acre) yields the most accurate depth to bedrock map. We found in many instances that bedrock elevation was consistent and the variation in soil surface elevation was the major driving factor in soil depth over bedrock. We recognize that this is not always the case, but in instances like this we were able to use very accurate surface elevation data to better account for a major variable influencing soil depth. Please see the attached map. [included with Comment C19]

RESPONSE: *The team has discussed this issue as a team extensively and decided that the qualified persons performing the verification will use their professional judgment when translating verification data since there are many variables that would go into guidance on this topic.*

C45: How and when is need for this generated?

RESPONSE: *This standard is for when existing Silurian bedrock map information is being refuted, which is stated in the Conditions Where Practice Applies.*

Results of depth to bedrock investigations shall include the following information:

- Field data reporting forms, to include the information listed in Attachment 3;
- Geophysical data map, if applicable, with legend, unit, and ground truthing locations;
- Borehole abandonment forms, if applicable;
- Name and qualifications of individual(s) analyzing the field data;
- A computer file with tabulated data in spreadsheet format (or use automatic download functions, if available) identifying latitude/longitude coordinates as recorded during the field effort; and
- Field maps depicting intrusive method data points and depth to bedrock, including information below.
    - Borings and/or geophysical survey locations by recording latitude/longitude coordinates of verification borings and geophysical survey locations using the WGS84 coordinate system; and

- Field location, field boundary, acres, field identification number, scale, all borings/and or geophysical survey locations using the above requirements, and a North directional arrow.

The verification information shall then be used to update the NRCS 590 Nutrient Management plan prior to manure application.

C22: Consider "Dominant Critical Soil Map Unit" and "Predominant Soil Map Unit" concept for generated depth to bedrock field maps. This appears in Technical Note 1 (NM-590) in Part 1 (c) (3). This concept is consistent with NR 151.075 (13)(c & d) and (16), as well as meeting the PURPOSE of this standard.

RESPONSE: *The standard considers predominant and dominant soils if they make up more than 1% of the area. SnapMaps shows all of the soils in the field that make up at least 1%. If any of them are restricted ("R") soils, SnapMaps flags the field as having an R soil.*

C71: Mapping technologies have advanced dramatically since many of the maps agencies, counties, and landowners rely on were developed, and current technology should allow maps to be regularly updated even if the new information coming in is not a wholesale review of a mapped area. If cost share is ultimately provided to landowners for verifying depth to bedrock, it is of paramount importance that the data it generates is available to state and local officials to update and maintain accurate maps and effectively implement regulations to protect our water resources. Once cost share dollars have been applied to a given area to verify depth to bedrock, additional resources should not be made available again if a future landowner or land user wishes to once again reevaluate available depth to bedrock information. In past instances, concerns have been raised about cost share dollars being used to bring land into compliance with conservation standards that was previously in compliance but lapsed. We hope the SOC has established a process that will effectively capture data that Wisconsin taxpayers are providing resources to collect and can ultimately benefit all of us by guiding land use decisions and protecting our water. *//* **C75:** This information should be collected and integrated into a public database, creating a more accurate and comprehensive statewide depth to bedrock map. Given the utility of the collected field data, MEA requests that the SOC or DATCP collect the data and store it in a state-wide database. Further, field verification depths should be integrated into official state maps. While this may lead to piecemeal updates, preserving this information will ensure accurate spreading restrictions in the future. WGNHS would be best suited to oversee this data as it already houses most of information related to geologic or hydrologic features in the state. Moreover, WGNHS has the requisite expertise to incorporate the field data into a current map. MEA recognizes that this comment likely falls outside the scope of the Technical Standard. Nonetheless, we request that the SOC and DATCP consider a means to collect and integrate this data to ensure appropriate manure spreading restrictions based on depth to bedrock are maintained as field ownership or rental agreements change. *//* **C78:** Additionally, this information should be collected and integrated into a public database, creating a more accurate and comprehensive statewide depth to bedrock map. Given the utility of the collected field data, River Alliance requests that the SOC or DATCP collect the data and store it in a state-wide database. Further, field verification depths should be integrated into official state maps. While this may lead to piecemeal updates, preserving this information will ensure accurate spreading restrictions in the future. WGNHS would be best suited to oversee this data as it already houses most of information related to geologic or hydrologic features in the state. Moreover, WGNHS has the requisite expertise to incorporate the field data into a current map. River Alliance recognizes that this comment likely falls outside the scope of the Technical Standard. Nonetheless, we request that the SOC and DATCP consider a means to collect and integrate this data to ensure appropriate manure spreading restrictions based on depth to bedrock are maintained as field ownership or rental agreements change.

RESPONSE: *The verification data will very likely be used to update existing maps resources. The responsibility of what entity will house and maintain the data will be identified in future rulemaking.*

REFERENCES

Chapter NR 141, Wis. Adm. Code, Groundwater Monitoring Well Requirements, https://docs.legis.wisconsin.gov/code/admin_code/nr/100/141/

Chapter NR 151.075, Wis. Adm. Code, Runoff Management, Silurian bedrock performance standards, https://docs.legis.wisconsin.gov/code/admin_code/nr/100/151/II/075

University of Wisconsin, SnapMaps, https://snapplus.wisc.edu/maps/.

USDA, NRCS WI, December 2015, Conservation Practice Standard, Nutrient Management, Code 590.

USDA, NRCS WI, October 2017R, Conservation Practice Standard, Waste Storage Facility, Code 313.

USDA NRCS, Web Soil Survey, https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.

Wisconsin Department of Natural Resources Bureau for Remediation and Redevelopment Tracking System (BRRTS) database, https://dnr.wi.gov/topic/Brownfields/botw.html.

GLOSSARY

Bedrock – The solid or consolidated rock formation typically underlying loose surficial material such as soil, alluvium or glacial drift. Bedrock includes but is not limited to limestone, dolomite, sandstone, shale and igneous and metamorphic rock.

Note: Although solid or consolidated bedrock can sometimes be removed with typical excavation equipment, these materials are included in the above definition.

Borehole – A circular hole deeper than it is wide, constructed in earth material for the purpose of either installing a well or obtaining geologic or groundwater related data. Boreholes are also referred to as drillholes.

Crop producer - An owner or operator of an operation engaged in crop related agricultural practices specified in s. 281.16 (1) (b), Stats.

Department – The Wisconsin Department of Agriculture, Trade and Consumer Protection.

Field – A group or single nutrient management unit with the following conditions: similar soil type, similar cropping history, same place in rotation (i.e., second year corn fields, established alfalfa), similar nutrient requirements, and directly adjacent. Examples include: alternate strips in a contour strip system, pasture, variable rate nutrient application management units, and other management units where grouping facilitates implementation of the nutrient management plan.

Field map – The map of a field that includes the completed verification depths and sampling locations required by this standard.

Filling and Sealing – “Filling and sealing” means to fill a well, drillhole, pit or reservoir with a material or materials so the well, drillhole, pit or reservoir will not act as a vertical conduit to contaminate another well, groundwater or an aquifer.

Livestock producer – An owner or operator of a livestock operation.

Mapped area – A continuous area or coverage with similar bedrock depths and soil properties such as electrical conductivity, used to develop a sampling/verification plan.

C46: Who decides how big?

RESPONSE: *The qualified persons performing the verification will use their professional judgment when developing the verification plan and translating verification data.*

Nutrient Management Plan (NMP) – A planning document that outlines the requirements for managing the amount, form, placement, and timing of applications of plant nutrients to cropland.

751 Silurian bedrock map information – Areas where Silurian dolomite bedrock occurs in Wisconsin can be
752 identified by the most current NRCS, Wisconsin Geological and Natural History Survey, DATCP, DNR, or
753 county maps. Silurian bedrock map information, available from the University of Wisconsin Department of
754 Soil Science, can be found at https://snapplus.wisc.edu/maps/.

755

Attachment 1

Management and Site Assessment

WI Department of Agriculture, Trade and Consumer Protection
Technical Standard 01 Verification of Depth to Bedrock

Farm: _____ Owner/Operator: _____

Assessment By: _____ Date: _____

Qualifications of assessor/verifier: _____

Location: _____ ¼ of _____ ¼, Sec. _____, T. _____, R. _____

Township: _____ County: _____ Field ID(s) _____

MANAGEMENT ASSESSMENT

Intent/Purpose:

- Items to consider before investigation
  - Mechanical application of solid (greater than 12%) or liquid manure?
  - What are the farm's nutrient management and manure management objectives?
  - Discuss with landowner and/or operator to identify possible shallow bedrock or karst features to determine verification priority areas.
  - What are the priority fields and current identified restrictions?
  - Contacting Digger's Hotline
  - What depth(s) to bedrock is desired to be verified (>2 ft, >3 ft, >5 ft, >20 ft)?

C47: What is purpose of each depth—different restrictions?

RESPONSE: *This standard is intended to provide protocols for depth to bedrock verification to meet the requirements of NR 151.075, which has manure spreading restrictions where bedrock is mapped at these depth intervals.*

SITE ASSESSMENT

Describe the site and attach information as available, information that may be included could consist of:

- Current nutrient management restriction maps
- Area bedrock and karst maps
  - SnapMaps or others as available
- Site specific subsurface information which may consist of:
  - Well construction reports
  - Manure storage soils investigation information

- Windmill drill logs
- DNR BRRTS database information
- WisDOT boring logs
- Wisconsin Geological and Natural History Survey data
- Prior geophysical investigations
- County Land & Water Conservation Department and Sanitarian resources

C48: Does this mean zoning office for septic system borings? CST pits?

RESPONSE: *Yes, and any other information they can provide regarding the site.*

- Recent and historic air photos
  - Is there evidence of exposed bedrock, fracture traces, sinkholes?
- Topographic maps – DEMs, Lidar information
- NRCS Web Soil Survey information
- Digger's Hotline and other utility/tile line locations, if intrusive methods are used
- Photos of the site

C10: I recommend that somewhere in the site assessment you make a reference to contacting diggers hotline when intrusive methods are used.

RESPONSE: *Thank you for this – it has been added.*

C23: Add a bullet for photos to document the site.

RESPONSE: *This has been added.*

Notes:

1. These items are only a recommended list and should not be interpreted as being required.
2. Based on information gathered in this Management and Site Assessment Form, the verification method(s) listed in Tables 1 and 2 of Technical Standard 01 Verification of Depth to Bedrock for field investigation can be evaluated.

Attachment 2

Examples of Verification Process

The following examples were created to help qualified professionals review how to conduct a credible verification of bedrock depth according the procedures outlined in this standard.

Example 1 – Intrusive example for disputing a 2 ft depth to bedrock boundary. In this example, an intrusive method will be used to sample locations along the 0-2 ft and 2-5 ft depth to bedrock boundaries, since this is the area of the field the landowner is disputing. Follow steps 1-3 below.

1) Identify the map and which depths will be refuted in the field (see Figure 1). This example is disputing the 2 ft depth to bedrock boundary in order to verify if bedrock is actually deeper than 2 feet. The soils map in SnapMaps was used as the starting point for developing the verification plan.

C49: Is this 1-8 on map below?

RESPONSE: *1-8 on the map below indicate the proposed sampling points also described in 2.ii. below. Clarification was added.*

2) Develop a verification plan by determining the appropriate verification method and sampling density as indicated in Table 1.

   a) This example is disputing the 2 ft boundary using a hand probe. Table 1 calls for the following density at a minimum for the area being refuted.

      i) "At a minimum, one probe per 1/4 acre (~100 ft spacing) when disputing the 2 ft and/or 3 ft boundary."

      ii) In this example, 8 hand probe locations would be performed, as shown as green points labeled 1 to 8 in Figure 1.

      iii) Remember, this is **minimum** spacing and more probing may be required depending on encountered depth – the qualified individual will make this determination.

3) Perform the verification using the approved plan from step 2.

Figure 1 – Example 1, Using an Intrusive Method

C50: Black and while copy doesn't show color.

RESPONSE: *The final technical standard will be posted in color on the DATCP webpage. Color hard copies would be available in DATCP training.*

Example 2 – Geophysical survey example for disputing a 2 ft depth to bedrock boundary This example is disputing the 2 ft depth to bedrock boundary in order to verify if bedrock is actually deeper than 2 feet. The soils map in SnapMaps was used as the starting point for developing the verification plan. Follow steps 1-3 below.

1) Identify the map and which depths will be refuted in the field.

2) Develop a verification plan by determining the appropriate verification method and sampling density as indicated in Table 2, with corresponding ground truthing. In this example, an EM geophysical method (e.g. EM-38, EM-31, or DualEM) and ground truthing with a hand probe will be used across the 0-2 ft depth to bedrock boundary since this is the area of the field the landowner is disputing.

   a) This example (see Figure 2) is disputing the 2 ft boundary using an EM geophysical method (e.g. EM-38, EM-31, or DualEM) and ground truthing with a hand probe.

      i) Table 2 calls for the following density at a minimum for the area being refuted: "At least one survey line (covering the length of the field) per 100 ft spacing when disputing the 2 ft and/or 3 ft boundary." The two survey lines shown in Figure 2 meet these criteria.

      ii) From the Geophysical Method Ground Truthing section, "10% of the total required by intrusive methods (in Table 1) with a minimum of 2 locations per map area is required." Therefore, two hand probes would be performed. 10% of 8 hand probes performed in Example 1 is less than 1 hand probe so the minimum of two hand probes is required. Preferred probe locations would be 1 and 5 to maximize distance and sample different bedrock depth areas. The ground truth hand probes are shown as green points in Figure 2.

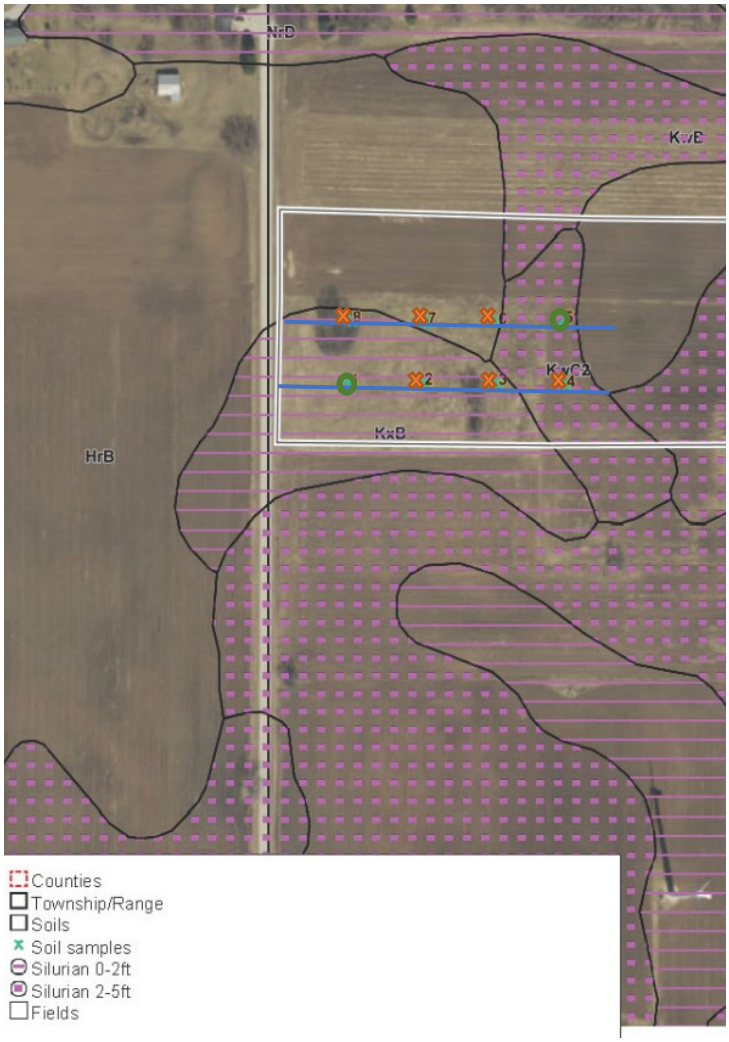

Figure 2 – Example 2, Using Geophysical Method

      iii) Remember, this is **minimum** spacing and more probing or survey lines may be required depending on encountered depth – the qualified individual will make this determination.

3) Perform the verification using the approved plan from step 2

Attachment 3

Field Data Collection Requirements

This attachment describes information to be collected for infield depth to bedrock verification.

1. Owner/Facility Name, Address, Phone Number
2. Property Location Information
    a. County
    b. Civil Town/City/Village
    c. Parcel ID#
3. Probe/Boring/Test Pit Information
    a. Equipment operator name and agency/firm
    b. Data recorder name and agency/firm
    c. Test hole ID #
    d. Field ID
    e. Tillage Conditions
    f. Date(s) of each test hole
    g. Equipment/Method used (e.g. tile probe, hand auger, hydraulic push, excavator). Include probe/auger diameter and/or equipment make and model, as appropriate.
    h. GPS latitude/longitude location
    i. Total depth of boring/pit, measured to the nearest 1 inch
    j. Depth to bedrock, if encountered, measured to the nearest 1 inch
    k. Borehole abandonment method
    l. Notes
4. Geophysical Survey Information
    a. Equipment operator name and agency/firm
    b. Data recorder name and agency/firm
    c. Date(s) of data collection
    d. Field moisture condition (e.g., saturated, unsaturated, droughty)
    e. Equipment/method used. Include equipment manufacturer and model
    f. Data collection sample spacing
    g. GPS latitude/longitude location
    h. Anticipated total depth measured by geophysical instrument and the instrument configuration used to achieve depth.
    i. Depth at which bedrock was encountered, measured from ground surface, and the accuracy of depth interpretation. If bedrock was not encountered, indicate that bedrock was not encountered.