

Activity Overview for Crawford County GIS-Based Sinkhole Survey

VOLUNTEER GUIDE

› **OVERVIEW :**

This document is intended to serve as a reference for volunteers assisting the Crawford Stewardship Project with their assessment of karst in Crawford County. This volunteer effort will assess the local presence of sinkholes using a web-based interface and data prepared by Legion GIS, LLC. The sink points dataset was produced through hydrological analysis of a 5-foot resolution DEM (Digital Elevation Model).

The DEM was derived from data collected by remote sensing (LiDAR) in 2011. This elevation model was analyzed with computer software to mark closed depressions (basins, or *sinks*) deeper than 1 foot within the study area. These are the points which we will be working with.

The goal is for volunteers to assess sink points and attach a few pieces of relevant information to each point based on observations against reference data. Volunteers will not be adding or moving points; we will simply be vetting through a dataset of automatically-placed points and assigning a set of value attributes to each point.

› **ABOUT THE REFERENCE DATA — ELEVATION DERIVATIVES :**

For this task, we will be checking points against two main types of reference data. The first type of data is often referred to as an “elevation derivative”, as it is derived from the DEM using computer processing. Today we will have the chance to work with two types of elevation derivatives: **hillshade** and **slope map**.

A **hillshade** or **hillshade relief** is a rendering which simulates the illumination of a DEM by a light source. The hillshade provides a visually pleasing effect which also accentuates the hills and valleys of a landscape. Because of this, you may find that the hillshade layer is more easy to interpret/understand than the slope map.

The **slope map** shows the steepness of the terrain at a given spot. White represents level ground, while black represents very steep ground (over 75°). The slope map is perhaps the best data to reference against, as it accentuates fine topological details and lacks the directional bias of a hillshade. However, you may find that the slope map is hard to read because it does not provide a reliable way to distinguish hills from valleys. You are encouraged to check both; however, you can feel free to stick with one or the other if it is easier for you.

› **CAVEATS OF LIDAR DATA VS. AERIAL IMAGERY :**

There are obvious advantages to referencing against LiDAR-derived data — with the particular distinction that LiDAR DEMs provide an unimpeded look at the bare-earth surface, without the forest canopy, buildings or other objects getting in the way. In addition, elevation data can be rendered to display in various ways, including hillshade, slope, directional aspect, even elevation contours.

Nonetheless, there are some definite disadvantages as well. For one, despite the high resolution of LiDAR data, the resolution is not always enough to discern the finer details of topology; in addition, modern aerial imagery is collected at a resolution which is significantly more fine-grained, with many WI counties now moving to acquire 6-inch imagery (that is, 1 pixel is 6 inches square). By referencing against aerial imagery, we can take advantage of the higher information density such images can provide. Because of this, aerial imagery makes for an excellent reference dataset. The imagery we will be using is current Google imagery which was collected in September 2013 and March 2015.

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› ABOUT DATA COLLECTION :

For the purposes of data collection and interpretation, it is important that all data be assessed according to a clear and standardized set of criteria. We hope the following explanation will be easy enough to understand.

Despite the unavoidable interpretive element of this work, everyone should be sure to follow the same set of rules as everyone else. If we need to clarify something for you, please let us know.

This document details the criteria by which the data are intended to be assessed. We hope that the guidelines here will serve as a reliable and easy-to-use reference. However, there is always the possibility that you may encounter some situations we have not accounted for in our criteria. Remember to use the “comment” field to leave notes, and don’t hesitate to ask a CSP member or Legion partner to help you.

We will be collecting three primary pieces of information for each point — an assessment rating based on the elevation derivatives (hillshade & slope), an assessment rating based on the available Google imagery, and a letter code reflecting the specific criteria which was used to make the imagery assessment.

› THE WORKFLOW :

- a.* – Check slope map and/or hillshade to see if the point is a likely sinkhole
- b.* – Assign a number rating to “*dem_check*”. (See Part 1)
- c.* – Check imagery for indicators of a sinkhole.
- d.* – Assign a number rating to “*img_check*”. (See Part 2)
- e.* – Assign a letter to “*reason*” reflecting the criteria for the imagery (See Part 2 & Table)
- f.* – Leave a comment in the “*comment*” field (if you have one).

› THE WEB MAP INTERFACE :

Click-and-drag on the map canvas to move the map. You can zoom in & out by using the scroll function on your mouse or trackpad (some trackpads have a special scroll area, while many newer trackpads have a two-finger scroll function). You can also zoom in on an area by double-clicking on the map canvas. Alternatively, use the arrow buttons and zoom slider at the upper left to navigate around.

At the top of the page, you will see a menu bar with several buttons. To begin, click on the “**Edit**” button at right. When you are prompted to log in, use the username **guest** and password **guest**.



- At the left of the screen, notice the “**Layers**” panel. To choose a layer to edit, you must select it by clicking on it (you will see it become highlighted).
- To edit a point, click on it. A small pop-up window will display the attributes for that feature. (If this window shows a whole set of blank attributes, you are about to create a new feature – go back!).
- At the bottom of the pop-up window, you will find another “**Edit**” button. Click this button to allow editing of the point feature.
- You can edit a specific attribute via the pop-up window for each feature. Locate the appropriate row in the table, click in a cell, and type to enter a new value.
- When you are done, press “**Save**”. The point will change colors to reflect that it has been updated.

Assessment Criteria for Crawford County GIS-Based Sinkhole Survey

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› ASSESSING POINTS AGAINST ELEVATION DERIVATIVES (dem_check) :

The first step is a visual examination of either the slope map or hillshade (or both). You should base your judgements on what you can see of the local topography by looking at the hillshade or slope map. Do not check the aerial imagery to inform your choice of rating. Enter the rating into the “dem_check” field. You will choose one of the following ratings:

0 — This does not appear to be a sinkhole. Choose this if the point falls...

- ...in a cattle/livestock pond (look for evidence of a straight or smoothly-rounded earthen berm)
- ...in a ditch or low area along a roadside, or in a basin formed on the uphill side of a roadway.
- ...just above the spot where a road/logging trail crosses a low spot or a drainage channel.
- ...in a gully or ravine.
- ...in a creek or river; often on the upstream side of a bridge.
- ...in a marsh, swamp, wetland, or bottomland with uneven, hummocky ground.
- ...in tributaries and side-channels of rivers, creeks and wetlands.
- ...in low spots along dry riverbeds, flood channels and washes.
- ...in or immediately around a rock quarry.
- ...at the site of some other kind of excavation activity (e.g. excavating a house/building site).

1 — This appears to be a sinkhole. Some indicators are...

- ...a marked depression in an otherwise smooth or level area.
- ...the slope map shows steep sides (a ring of darker shading around the point, esp. continuous)
- ...evidence of large amounts of soil sloughing into a hole; evidence of inflow without outflow
- ...visible on both slope and hillshade renderings
- ...**if you find a sinkhole in a valley, please mark it as 2**

2 — This might be a sinkhole. Use this rating if you are unsure either way. Feel free to ask one of us about a specific point before rating it. A few particular cases when you should choose this when...

- ...a sink appears to be a sinkhole, but is located at or near the valley floor.
- Sink is large & rectangular, or has other indications that it is a constructed pond (e.g. for manure).

If you find a point which meets one of the above criteria as listed under (0), but which you suspect is a sinkhole anyway, please leave a comment in the comment field. Enter 0 in “dem_check”.

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› ASSESSING SINK POINTS AGAINST AERIAL IMAGERY (img_check) :

For each point, you will be asked to record the number code (from 0 to 3) which reflects your best assessment of the point. We will also ask you to record a letter code reflecting the criteria on which the judgement was based. The appropriate letter code is mentioned in {brackets} at the end of each line, and the full system of letter codes is summarized in the table below.

0 — I can tell that this is NOT a sinkhole. Choose this if the point falls...

- ...on top of or at the side of a house, barn, pole shed, silo, other structure, or old foundation. {S}
- ...in a manure lagoon (often a rectangular pool, usu. by a large CAFO-style farm) {M}
- ...in a livestock pond (pond behind a retaining berm, usu. on shoulders of ridgetops) {L}
- ...other (please enter a comment in the “comment” field) {O}

1 — I can tell that this IS a sinkhole. Choose this if the aerial imagery shows...

- ...a dark or discolored patch or spot strongly resembling a hole (on open ground only); {A}
- ...a dark spot in woodlands which is clearly distinct from the shadows of the trees; {B}
- ...tillage lines or irregular field margins indicating avoidance of a spot (in ag. land); {C}
- ...an access road or logging road swerving around a point; {C}
- ...a patch of trees in the middle of a field; {D}, or
- ...a visible heap of garbage. {G}

2 — I think this is a sinkhole, but I am not sure. Choose this if the aerial imagery shows...

- ...anything which may meet the above criteria, but is too dark, blurry or indistinct to be fully sure.
- ...a moderately-sized, roundish pond near the valley bottom which resembles a sinkhole* {W}

**In this region, karst is usually more exposed near the hilltops. however, there are some areas where the valley floors are underlain by karstic rock. Sinkholes in these areas, if they are near the water table, are likely to have standing water in them. These sinkholes would generally resemble ponds, but they often...*

- › show evidence of soil loss into the sink (exposed soil, steep banks);
- › have no channels of *regular inflow* (although they may have an outflow); and
- › are generally not situated immediately adjacent to streams or wetland systems.
- Enter a comment in the “comment” field if you have particular questions/doubts about a sinkhole.
- Do not hesitate to choose (3) — we are trying to collect data, not make it up!

3 — I cannot tell whether this is a sinkhole or not. Choose this if...

- ...the ground is not clearly visible;
- ...the imagery doesn’t show any distinct or discernible marks at or very near the point;
- ...you can find no substantial indication to support or discredit the possibility of a sinkhole; or
- ...you have to use your imagination to see evidence of a sinkhole here.

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Cheat Sheet for “reason” Values:	
YES / MAYBE	A - point marks a distinct spot strongly resembling a hole.
	B - point marks a dark or discolored patch in field/open ground; - point marks a distinct dark spot or anomaly among trees/woodland.
	C - tillage lines/field margins/access or logging roads suggest avoidance of a spot.
	D - point marks a patch of trees in the middle of a field.
	G - point marks a site of visible garbage dumping.
NOT SURE	B - imagery may show features such as in A, B or G above, but too indistinct to tell.
	V - potential sinkhole in valley.
	O - other (leave a comment if you are unsure).

