Underground Utility Detection
& Inspection Services

"It's A Jungle Out There!"

Limitations of Magnetic Detection Technology

As part of our continued commitment to transparency, safety, and technical excellence, this memo outlines the known limitations of magnetic detection technology. While magnetic locators provide a valuable means for detecting deeply buried ferrous objects, they have specific operational constraints that must be acknowledged, communicated, and documented on-site and in reporting.

Overview of Magnetic Detection

Magnetic detection is the process of identifying ferrous (iron-containing) materials using flux-gate magnetometers or magnetometers embedded in magnetic locators. CNI Locates uses magnetic detection to locate:

- PK nails and rebar
- Cast-iron pipes
- Valve and curb boxes
- Manhole and handhole covers
- Steel drums and tanks
- Well casings
- Septic tank handles
- Road culverts and fire hydrants

This method only works on ferrous metals, which are magnetic. Non-ferrous metals such as aluminum, copper, brass, and stainless steel (unless magnetized) will not produce a signal and cannot be detected using magnetic locating tools.

Key Limitations

1. Ferrous-Only Detection

- Magnetic locators cannot detect non-ferrous materials.
- Metals such as copper, brass, aluminum, and certain stainless steels are invisible to magnetic detection, regardless of size or depth.
- **No Signal from Plastic Objects:** Items such as PVC pipes, composite valve boxes, and plastic tanks will not produce any signal response.

2. Susceptibility to Nearby Interference

- Strong magnetic interference from nearby vehicles, fences, buildings, or other large metal objects can mask or distort signals.
- Some models feature an "erase" or interference suppression function, but this can reduce overall sensitivity.
- Technicians must reduce sensitivity or reposition to minimize interference.

3. False Positives from Carried or Worn Items

- Steel-toed boots, watches, knives, keychains, or other ferrous personal items can generate false signals.
- Operators should minimize such interference by removing metallic items and maintaining proper body position.

4. Limited Target Differentiation

- Cannot distinguish between different types of ferrous objects.
- A signal from a nail, pipe, or tank may produce similar audio/visual feedback based solely on mass, orientation, and proximity.

5. Signal Orientation Effects

- Stronger signals are produced at the ends of horizontally oriented targets and at the center of vertically oriented targets.
- In some cases, ghost signals may appear around strongly magnetized objects, complicating pinpointing.

- Experienced interpretation is required to differentiate between single objects and multiple closely spaced items.

6. Limited Depth Accuracy and Variable Range

Detection depths vary based on target size, orientation, soil conditions, and sensitivity settings:

Target Object	Typical Maximum Depth
PK Nail	1 ft
Septic Tank Handles	4 ft
Survey Markers	8 ft
Cast-Iron Pipe	8 ft
Valve/Curb Boxes	10 ft
Manhole Covers	10 ft
Steel Drums	5–12 ft
Oil Tanks	15 ft
Well Casings	17 ft

Note: These figures represent optimal conditions; actual field performance may vary.

Decreasing Accuracy with Depth: Although large objects (e.g., steel drums or well casings) may be detected at depths of 10–17 feet, smaller targets (e.g., PK nails, survey markers) quickly become undetectable beyond shallow depths.

7. No Depth Measurement or Size Estimation

- Magnetic locators do not estimate object depth.

- Visual/auditory signal strength can suggest proximity but not provide quantifiable depth readings.

8. Limited Functionality in Urban and Congested Environments

- Urban settings often contain overlapping ferrous objects, reinforcing steel, or metallic structures that can create signal confusion.
- Magnetic detection may be ineffective when near multiple conflicting sources.

9. Access and Maneuverability

- **Limited Accessibility in Tight Areas:** Precise locating may be challenging under or around obstructions, fences, or confined spaces without line-of-sight or maneuverability.
- **Water Submersion Limits:** Most magnetic locators can be submerged only up to the control unit housing—not fully waterproof for deep water applications.
- **Limited Access:** Access to specific areas is essential for conducting thorough inspections.

Best Practices

- Use magnetic detection in conjunction with other methods (e.g., GPR, EM locating, visual inspection).
- Always confirm suspected targets using multiple data points or technologies.
- Adjust gain and volume settings for optimal performance and make use of audio and visual cues simultaneously.
- Clearly document interference sources and environmental conditions in all reports.

Conclusion

Magnetic detection is a powerful but specialized tool. It should not be relied upon as a standalone method for comprehensive utility locating or subsurface investigations. Proper training, calibration, and field judgment are essential to interpret results correctly.

All personnel are reminded to document all limitations encountered in the field and clearly communicate any constraints to clients during pre-scan assessments or site walks.