

# SUBSURFACE 3-D DIAGNOSTIC IMAGERY: VISUAL EVALUATION OF SPORTS FIELDS, PARK GROUNDS, AND ICE RINKS FOR PRUDENT MANAGEMENT

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New developments in subsurface imaging technology allow the detection of smaller objects and more significant details than ever before. Geophysical investigations can create

maps of underground features, including various pipes, drains, sinkholes, and even soil changes and permafrost. Using breakthroughs in computer modeling, it is now possible to integrate data from ground-penetrating radar and electromagnetic conductivity meters into a 3-D environment. With proper analysis, these tools can highlight

minute changes in the subsurface where pipes have been compromised or leaks and heaving have occurred.

Two case studies are shown here that were able to detect damages that compromised two recreational structures: an athletic field at Westminster School in Atlanta and the Taos Recreation Center,

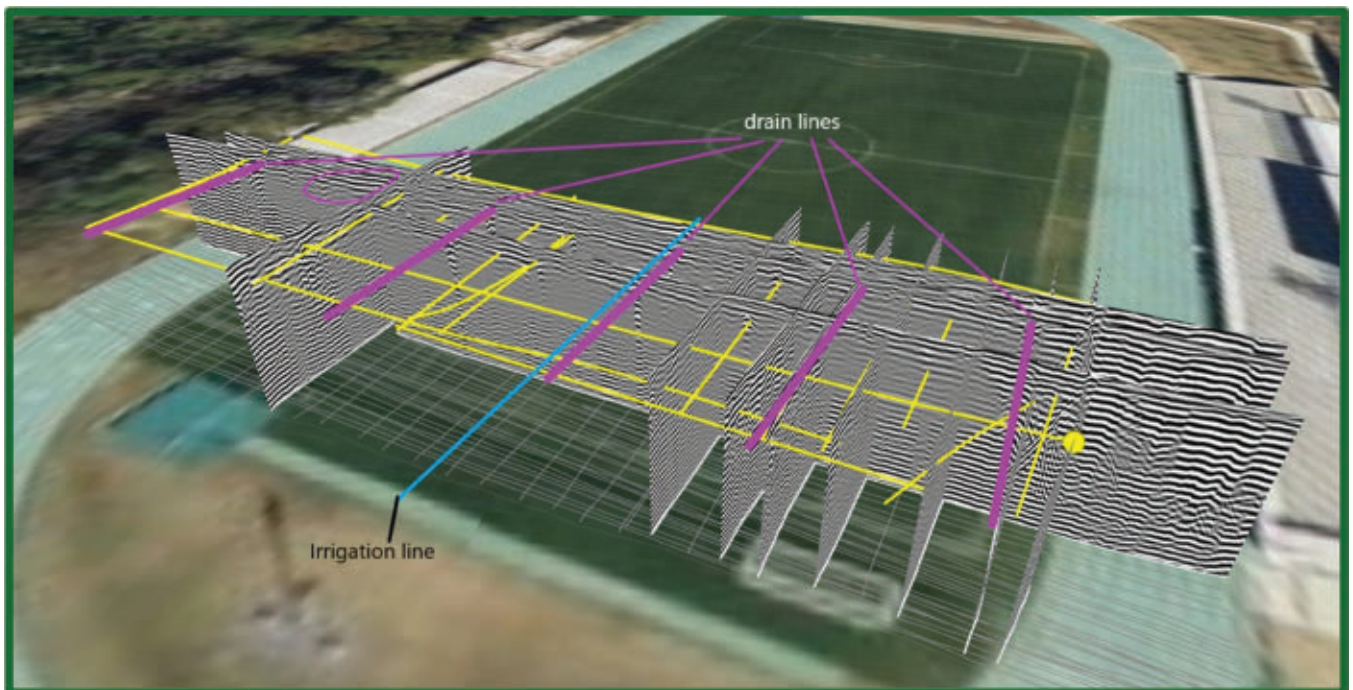


Figure 1: A model projecting radar data three-dimensionally above the field. Features show the irrigation line (blue), drain lines (purple), and various abandoned features (yellow). An area with detected leaking and heaving is highlighted in a purple circle (left side).

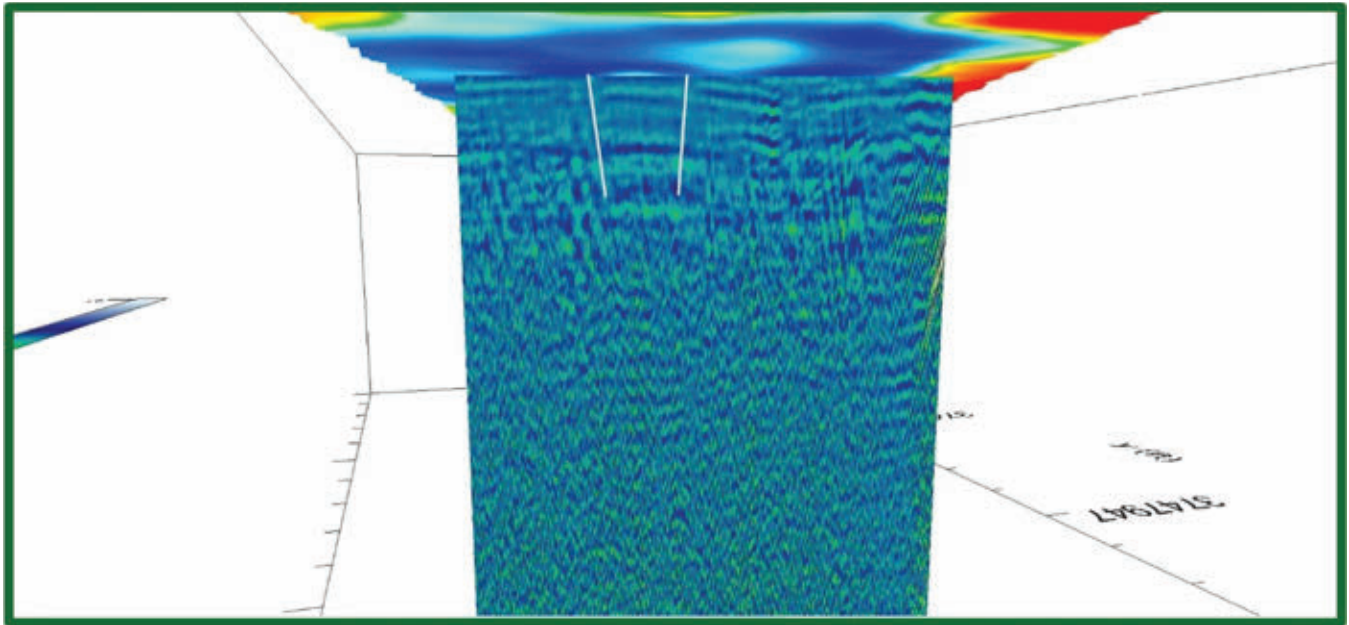


Figure 2: A close-up view showing the detected feature of concern, with evident heaving bordered in white lines.

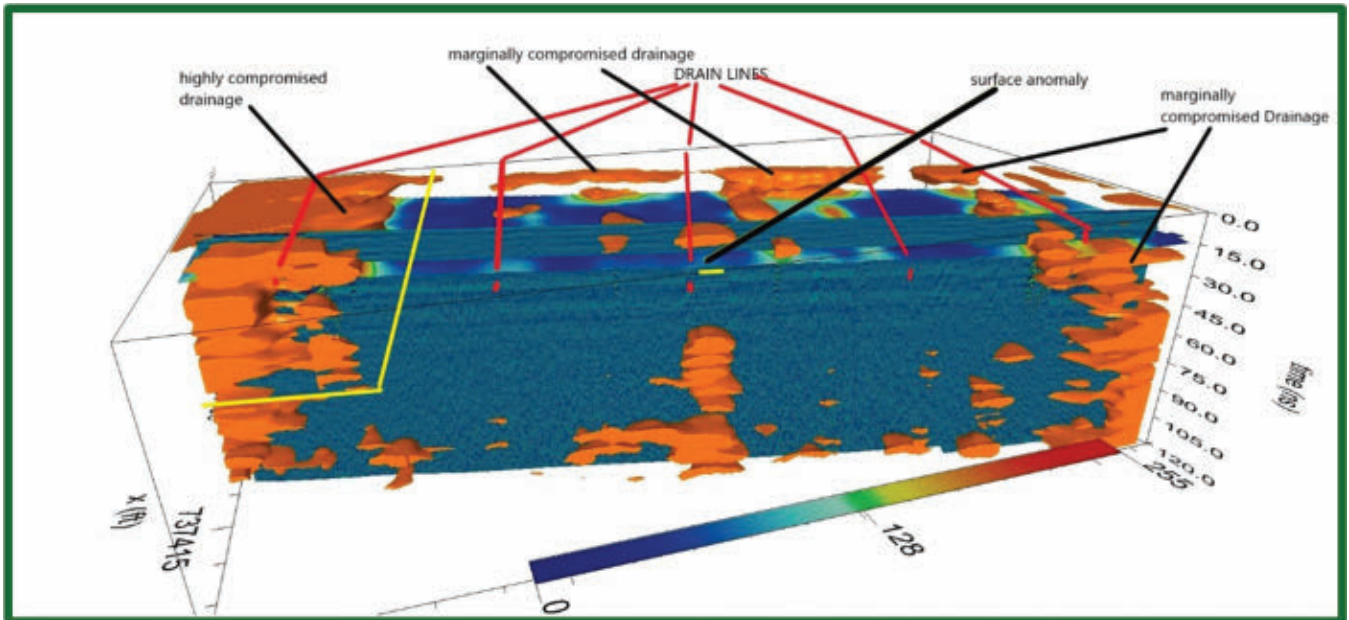


Figure 3: The master 3-D evaluation shown from the evaluation presented to the asset owners.

Family and Youth Ice Rink, Taos, New Mexico. Each example was found to be of tremendous value to asset owners with minimal financial impact while providing decisive, actionable insights. In both cases, the diagnostic imagery proved to be a most understandable platform for managerial discussions and ensuing decisions.

### The Athletic Field at Westminster School

Pegasus Environmental performed a geophysical survey of a problematic area of an athletic field. The field itself was

a maze of abandoned pipes and other buried anomalies due to several historical attempts to resolve problematic turf issues on a field that had been in use for close to a century. Cutting-edge technology was able to provide an image-based evaluation, depicting the root causes and extent of drainage issues. Many of the detected features were small plastic objects, considered undetectable to previous ground-penetrating radar versions.

A detected feature was flagged as a “target of concern.” It was located

next to an existing drain line yet did not appear similar to the normal moisture distribution throughout the field. In Figure 2, an image captures the “heaving” of the pushed-up soil stratum, as evidenced by a very uneven portion at the surface. The full model, including isometric shapes, is shown in Figure 3, which highlights the concentrations of moisture across the site, and demonstrates the problem area.

The model clearly presented the problematic features but also served as a general “health inspection” for the

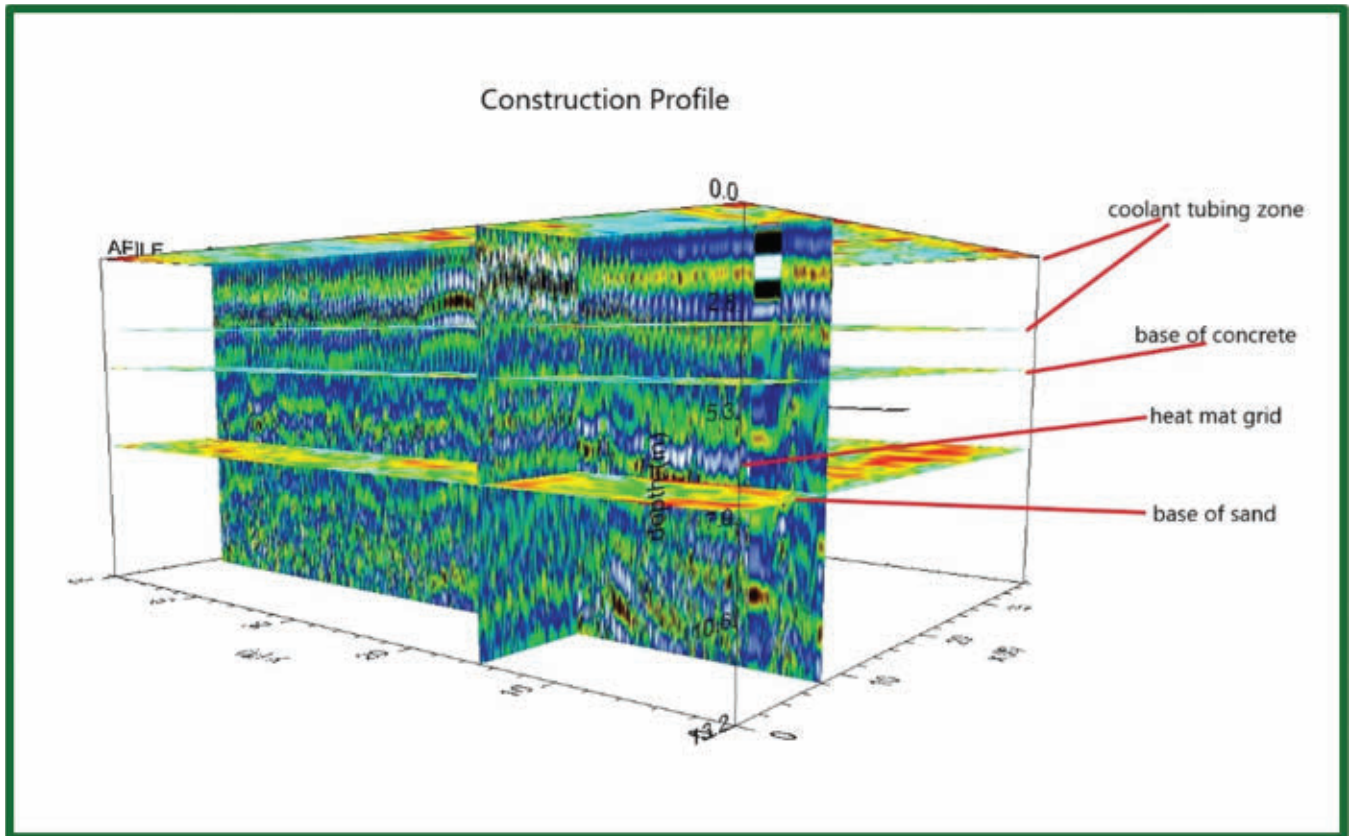


Figure 4: An image from the 3-D evaluation of the Taos Ice Rink. Annotations describe the various layers of material and physical features that the structure was comprised of.

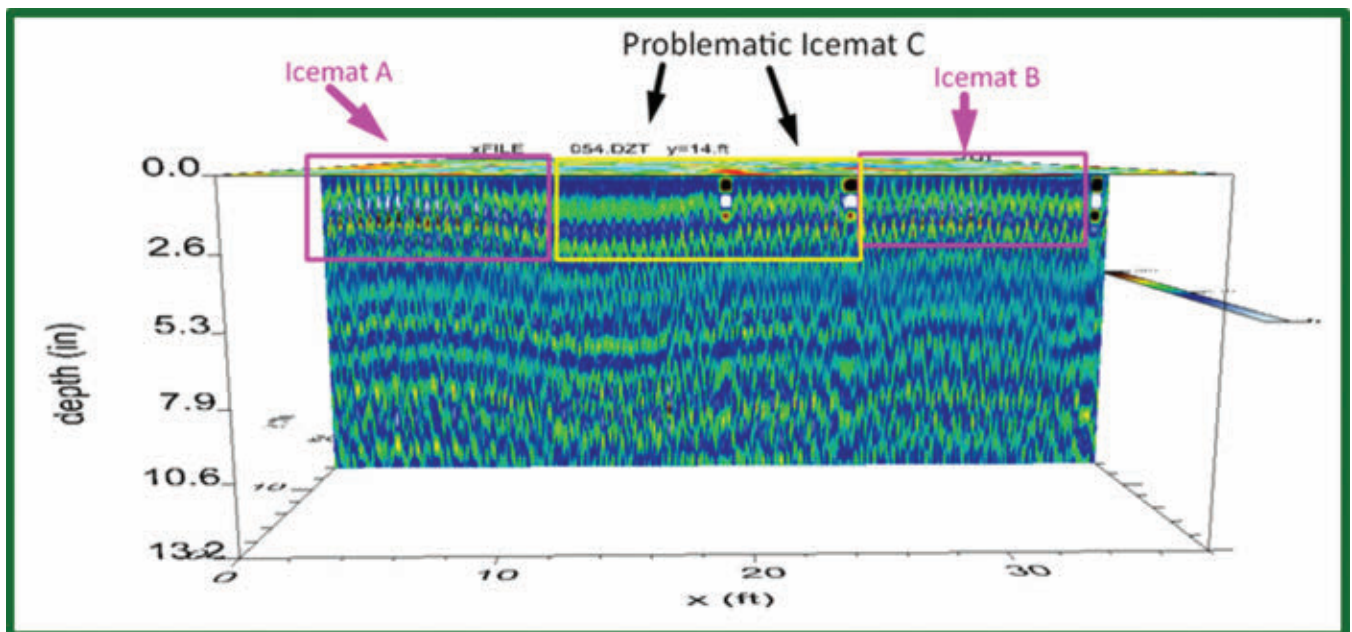


Figure 5: This image highlights the compromised tubing within a mat section. The problem area was deemed too extensive for meaningful repair, and areas outside the compromised mat were likely to fail soon as well, for similar reasons.

rest of the surveyed area. This kind of presentation is useful for designing future maintenance and repair work, and judging the health of buried assets in general.

### Taos Recreational Center: Youth and Family Ice Rink

This troubled rink was known to be in a serious decline situation despite being only relatively young at the time of the survey.

The conditions were so severe that asset managers were uncertain if the structure should see extensive repairs or simply be demolished and rebuilt. By performing a multi-component ground-penetrating

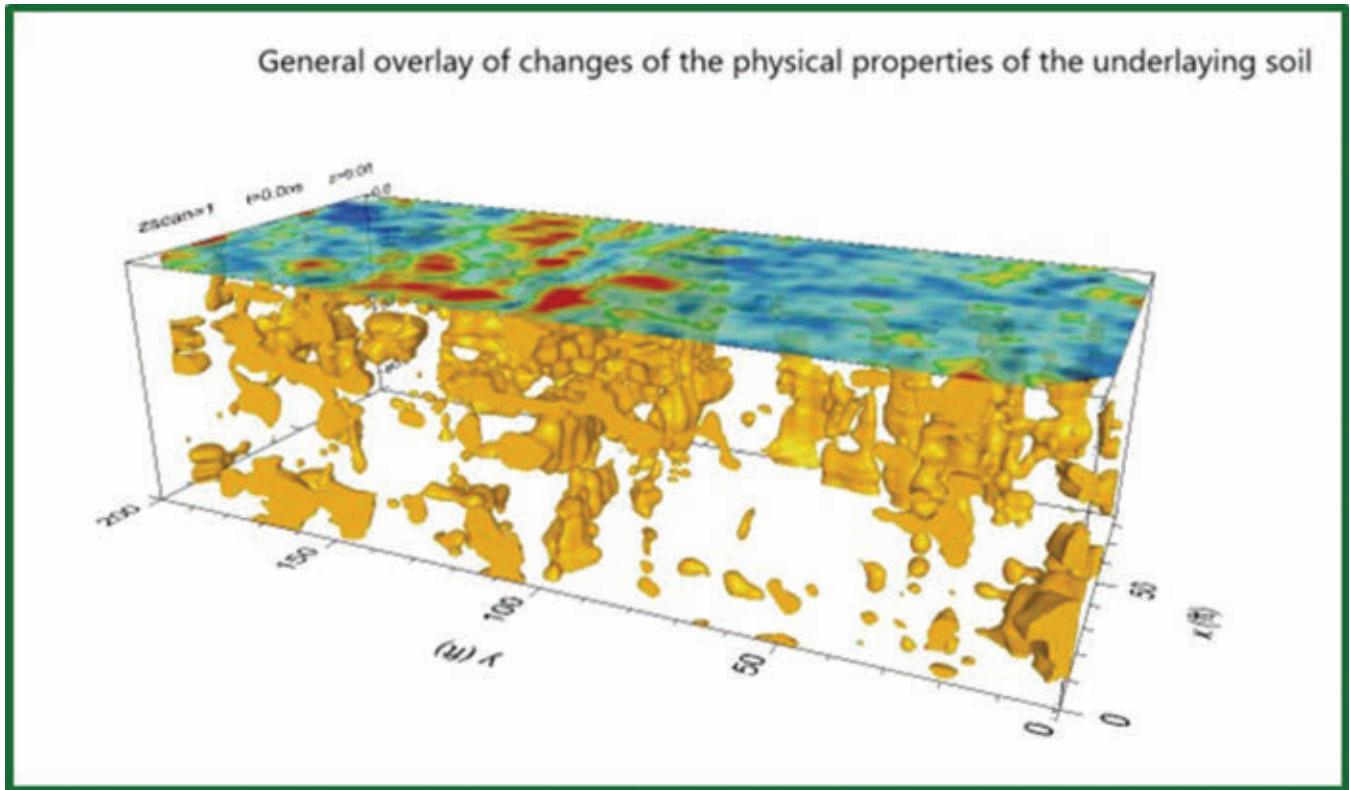


Figure 6: An image showing the drainage failures drawn as isometric shapes. These features should have shown clear indications of drainage lines, but the dispersal was so random that there is little to suggest an effective drainage system was ever installed.

radar survey, Pegasus Environmental was able to map and project in a three-dimensional computer model the full array of coolant lines, drainage lines, and heating systems, as well as concentrations of moisture and heaving that could result from failures.

The investigation found that the rink had not been built to industry standards, and no evidence of an effective drainage system was found in the survey. Similarly, the coolant system was a series of flexible mats designed for temporary, seasonal structures that the questionable builder had encased in concrete as a permanent fixture. The heating elements used similar mats and were likewise woefully under-designed for permanent use.

The 3D diagnostic scanning presented a very clear model that allowed confident, decisive decision making on the part of the owners and managers and likely saved years of disappointment and repairs nursing an improperly built structure. Figures 4 to 6 show imagery created as part of the diagnostic imaging.

The city council was provided with a highly detailed model that showed the physical structure of their buried assets.

It gave strong indications of the health of various elements and where compromises had occurred. In this case, the stakeholders discovered that the prudent approach was to avoid long-term costs and delays associated with managing an improperly built structure. They found that the cost of the non-invasive evaluation was negligible compared to the tremendous losses they avoided and that, using geophysical surveys, they were able to conduct future planning with total confidence in the status of their property.

Pegasus Environmental has found that modern geophysical tools can be used to create powerful, highly detailed visuals that are of tremendous value for understanding the health of athletic fields and structures. Computer modeling allows these sophisticated systems to create understandable images and confident understandings of the nature of various compromises. 3-D imaging and evaluation are much more powerful tools now than ever before and can allow informed decision-making on projects that are many orders of magnitude more expensive than the cost of analysis. A picture is worth 1,000 words. ■

