



# Data-Driven Subsurface Management



*Precise groundwork intelligence*

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## Stronger Sites Start Below Ground

**How Soil-Moisture Data Reduces Construction Risk, Improves Landscape Establishment, and Protects Asset Value for Builders & Developers**

Successful developments rely on landscapes and subsurface conditions that perform predictably - from early grading work through post-construction establishment. While above-ground design often receives the most attention, the physical behavior of the soil - its moisture content, structure, load-bearing characteristics, and ability to support vegetation - ultimately influences everything from foundation stability to long-term curb appeal.

Historically, builders have relied on periodic inspections, assumptions, or historic climate patterns to judge how soil and vegetation will respond during the build. Today, continuous soil-moisture intelligence provides a direct, continuous view of subsurface performance. With quantitative data rather than assumptions, teams can identify issues early, reduce rework, and deliver more resilient, higher-value sites.

This brief outlines how soil-moisture monitoring supports construction workflows, enhances compliance, and strengthens both risk management and asset performance across the entire development cycle.

## Why Traditional Approaches Fall Short

Standard practices such as visual inspection, manual probing, or periodic moisture checks provide only snapshots. Soil conditions, however, change rapidly with precipitation events, irrigation cycles, equipment loads, and early landscape activities.

**Without continuous insight, teams face several vulnerabilities:**

- Hidden grading or drainage errors that only surface after damage occurs
- Over- or under-irrigation during establishment
- Undetected leaks or valve failures
- Compaction issues masked by temporary surface dryness
- Warranty claims driven by unclear or undocumented landscape care

Continuous soil-moisture data eliminates these blind spots, allowing teams to act before small issues escalate into delays or costly remediations.

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## How Soil-Moisture Data Supports Builders & Developers

### 1. Faster, more reliable Landscape Establishment

Healthy establishment is critical for site turnover, curb appeal, and long-term asset value. Soil-moisture sensors help teams:

- Identify zones where compaction is preventing infiltration
- Confirm that new plantings receive consistent, adequate water
- Optimize irrigation schedules to reduce stress during early growth
- Compare different soil treatments or amendments quantitatively

With early insight into plant-soil performance, builders avoid the cycle of replacements, callbacks, and rework.

### 2. Early Detection of Construction Issues - soil-moisture patterns can reveal

Moisture patterns often reveal problems invisible above ground. Continuous data helps teams identify:

- Grading mistakes or ponding zones
- Poorly draining soils that may require remediation
- Irrigation failures, leaks, or valve malfunctions
- Subsurface conditions that could affect settlement or stormwater performance

Identifying issues during construction rather than after turnover significantly reduces cost and schedule impacts.

### **3. Quality Assurance During Handovers**

Builders increasingly face expectations to *prove* that landscapes were installed and maintained correctly. Soil-moisture intelligence provides objective, auditable data:

- Documenting moisture levels during plant establishment
- Demonstrating compliance with soil preparation or amendment requirements
- Providing owners and managers with a data-backed baseline for long-term care

This transforms landscape handover from subjective evaluation to measurable quality assurance.

### **4. Support for Green Infrastructure & Sustainability Requirements**

Many municipalities and certifications require evidence of functional green-infrastructure systems.

Soil-moisture monitoring enables:

- Continuous tracking of stormwater infiltration performance
- Monitoring of green roofs and rooftop landscapes
- Early detection of tree-establishment challenges
- Documentation for LEED or other certification pathways

Continuous data helps developers meet sustainability goals while reducing compliance uncertainty.

### **5. Enhanced Long-Term Asset Value**

High-performing landscapes directly influence project valuation. Soil-moisture intelligence contributes to:

- Stronger curb appeal
- Reduced plant loss and maintenance costs
- Healthier, more resilient vegetation
- More predictable irrigation and stormwater system performance

Developments that deliver reliable, sustainable landscapes maintain higher value and lower operational risk over time.

## **Applications Across the Development Process**

Internet-of-things (IoT) sensors have shown to be a viable solution in understanding characteristics of the physical environment. By monitoring soil moisture and pore-water-pressure (pwp), builders and developers can visualize potential instabilities of the land, giving insights to potential stress paths through different levels of precipitation and saturation events (Peranić, Čeh, Arbanas, 2022). The data from sensors can also reveal how the land has evolved temporally, giving developers advance notice to make adjustments and modifications to their build plan to ensure the integrity of their structure. These tip of the iceberg insights ultimately improve risk assessment and engineering design for the stabilization of the land and remediation as necessary.

### **During Construction**

- Validate soil preparation and compaction
- Confirm functioning of irrigation systems
- Track performance during vegetation and soft-landscape install

### **During Establishment**

- Automated alerts when zones become too dry or saturated
- Maintain optimal moisture levels for plant health
- Documented proof of proper care to owners and inspectors

### **Post-construction**

- Reduce warranty claims related to plant loss or irrigation failure
- Enable predictable maintenance scheduling based on actual soil needs
- Continuously monitor green-infrastructure assets such as bioswales, detention areas, and green roofs

For builders and developers, this translates into better-informed decisions, earlier interventions, and improved risk management.

## References

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