



Intelligence Beneath the City

Healthy landscapes, healthier communities

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Healthy Cities Start Underground

How Soil, Water, and Data Strengthen Urban Landscapes, Reduce Costs, and Improve Public Stewardship

Across parks, sports fields, streetscapes, and civic grounds, the long-term health of public infrastructure depends on a simple relationship, **the balance between soil and water**.

When moisture levels remain at the right range, turf stays playable, trees stay resilient, and public spaces remain attractive and safe.

When it doesn't, maintenance workloads rise, water use increases, and public expectations go unmet.

Historically, municipalities have relied on fixed irrigation schedules, visual inspections, and seasonal procedures to determine watering needs. However, rising water costs, climate-driven weather variability, and stricter conservation requirements make "watering by feel" increasingly unsustainable.

Modern soil-based irrigation sensors give cities a practical advantage: the ability to **respond to real conditions** beneath each field, tree, and planter swiftly, rather than guessing what's happening underground.

This paper summarizes insights from university research, municipal deployments, and operations teams to show how data-driven irrigation improves asset longevity, reduces water waste, protects soil quality, and strengthens municipal operations.

Watering Challenges Become Operational Challenges

Hidden Costs of Overwatering

Overwatering public landscapes is more than wasted water, it directly impacts budgets, field availability, and asset performance.

- **Field closures and Turf Damage:** saturate soils weaken turf structure, increasing compaction and reduce playability
- **Nutrient and soil health loss:** excess water flushes nutrients and beneficial microbes, forcing more inputs
- **Tree decline in urban forests:** chronic saturation increases risk of fungal diseases and root rot
- **Stormwater Impacts:** overwatered parkland contributes to runoff into storm drains. This is exacerbated during precipitation events
- **Public perceptions:** puddled fields, soggy medians, visibly stressed plants reduce confidence in city maintenance

Hidden Costs of Underwatering

Water applied too late, or not at all, creates cascading problems.

- **Drought stress in young and heritage trees:** amplified by the Urban Heat Island Effect
 - **Increased replacement costs:** More dead turf, failed shrubs, and street-tree losses disrupt long-term urban design goals.
 - **Hot, unusable public spaces:** Dry medians, playgrounds, and fields become uncomfortable and underutilized
 - **More complaint-driven maintenance:** Crews are pulled into reactive work instead of scheduled, strategic operations.
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What the Research Shows

Peer-reviewed studies consistently validate the operational value of sensor-driven irrigation:

- Smart irrigation systems reduce water use by 48–59% compared to manual or timer-based watering (Nassar et al., 2023; Evans et al., 2022)

- Conventional irrigation almost always leads to nutrient leaching; data-driven irrigation adjusts for soil variability to apply only what's needed (Li et al., 2018)
- Sensor-guided irrigation can reduce fertilizer requirements by up to 50% (Van Iersel & Chappell, 2018)
- Plants irrigated with soil-moisture feedback show healthier growth and reduced reliance on growth regulators (Van Iersel & Chappell, 2018)

For governments, these findings translate directly into **lower operating costs, healthier landscapes, and improved compliance with water-use mandates.**

A Smarter Approach: Precision Irrigation for Public Assets

Technologies like **SoiLiNQ** enable municipalities to monitor soil conditions across diverse assets - athletic fields, street trees, medians, bioswales, parks, and civic grounds—and apply water **only when and where it's needed.**

Key benefits to Municipal Operators

- **Healthier public landscapes**

More resilient turf, stronger tree root systems, and predictable plant performance.

- **Improved water stewardship**

Lower potable water use and better alignment with conservation ordinances.

- **Reduced runoff events**

Sensors highlight saturation early, preventing overwatering during rain cycles.

- **Optimized crew labor**

Fewer emergency site visits, less time troubleshooting controllers, and more proactive care.

- **Continuous dashboards & reporting**

Visibility for sustainability targets, heat-mitigation programs, and departmental KPIs.

- **Operational consistency**

Reliable, repeatable outcomes even with limited or rotating staff.

Instead of relying on fixed schedules, public agencies gain a up-to-date, zone-by-zone understanding of what's happening underground.

References

Evans, S. R., Kopp, K., Johnson, P. G., Hopkins, B. G., Dai, X., & Schaible, C. (2022). Comparing smart irrigation controllers for turfgrass landscapes. *HortTechnology*, 32(5), 415–424.

<https://doi.org/10.21273/HORTTECH04985-21>

Li, Y., Li, J., Gao, L., & Tian, Y. (2018). *Irrigation has more influence than fertilization on leaching water quality and the potential environmental risk in excessively fertilized vegetable soils.*

PLOS ONE, 13(9), e0204570. <https://doi.org/10.1371/journal.pone.0204570>

Nassar, A. A., Shokr, M. A., Abdelmonem, Y. K., & Mokhtar, M. (2023). *Smart Irrigation for Green Areas in Urban Zones: Case Study – Madinaty Smart Irrigation System.* In *Proceedings of the International Conference on Smart Cities (ICSC 2023)*. Cairo, Egypt.

https://www.researchgate.net/publication/369261653_Smart_Irrigation_for_Green_Areas_in_Urban_Zones_Case_Study_Madinaty_Smart_Irrigation_System

van Iersel, M. W., Chappell, M. R., & Thomas, P. A. (2016). *Optimizing growth, quality, and profits through precision irrigation in ornamental plant production.* In III International Conference on Quality Management in Supply Chains of Ornamentals (Acta Horticulturae, 1131:8).

<https://doi.org/10.17660/ActaHortic.2016.1131.8>