Procurement Ledger: Lateral Root-Zone Scout (LRZ)

Role: Dumb Node (Mesh Mesh) | **Quantity:** 15,600 Units

The Lateral Root-Zone Scout (LRZ) is the high-density spatial component of the FarmSense grid. Designed as a "disposable yet durable" asset, it provides the granularity required to map lateral water variability across the varied soil textures of the San Luis Valley. This document details the granular procurement costs and the logistical framework required for the mass-deployment of 15,600 units across Subdistrict 1.

1. Granular Hardware & Component Costs

Category	Component Description	Supplier	Part # / Type	Cost (Unit)
Housing	2" SCH 40 UV-HDPE (3ft)	Ferguson	UV-White HDPE	$7.25
Housing	ABS Tapered Tip (Compaction)	Proprietary	Mold-V2-S	$4.25
Fasteners	Stainless Internal Snap Rings	McMaster	98410A130	$0.45
Seals	Viton (FKM) O-Rings (x2)	McMaster	9464K114	$3.50
Antenna	3ft SS-304 Whip + Spring Base	PulseLarsen	NMO-Spring	$14.00
Computing	nRF52840 "Dumb-Sled" PCB	Nordic	NRF52840-QIAA	$18.50
Sensing	Capacitive Moisture Traces	PCBWay	Custom FR4	$12.50
Power	19Ah LiSOCl2 D-Cell (Dual)	Saft	LSH20-LowTemp	$22.00
Thermal	10mm Neoprene Insulation	FoamOrder	Closed-Cell	$2.55
TOTAL	**Per Unit Hardware Cost**			**$85.00**

2. Engineering & Procurement Logic

- **The "Dumb-Sled" Architecture:** The LRZ utilizes the Nordic nRF52840 not for its processing power, but for its ultra-low-power radio efficiency and long-range (LR) coded PHY capabilities. By operating in a "transmit-only" mode, the sled bypasses the energy-heavy handshaking protocols of standard mesh networks, allowing the dual Saft D-Cells to achieve a theoretical 12-year lifespan.

- **Material Science (FKM vs. Nitrile):** While standard Nitrile O-rings would reduce the unit cost by $2.00, they are prone to "glassing" (losing elasticity) at the -20°F temperatures common in the Valley's winter soil. The inclusion of Viton (FKM) seals is a non-negotiable insurance policy against moisture ingress and internal corrosion during the spring thaw.
- **Capacitive Trace Geometry:** Sourced through PCBWay, the capacitive sensing traces are integrated directly into the internal FR4 sled. This geometry is optimized to measure the fringe-field dielectric constant of the soil through the HDPE wall, providing a moisture reading that is less sensitive to "air-pocket" interference than traditional probe designs.
- **Antenna Resilience:** The 3ft Stainless 304 Whip antenna is equipped with a heavy-duty spring base. This allows the LRZ to survive "over-passes" by low-clearance agricultural implements and the high-speed winds of the alpine floor without shearing the RF connector from the internal PCB.

3. Deployment Totals & Blitz Logistics (Subdistrict 1)

The deployment of 15,600 units is the largest logistical undertaking in the FarmSense rollout. It relies on a "Blitz" methodology to install the entire mesh during the 45-day window between the final spring frost and full canopy closure.

- **Hardware Subtotal:** $1,326,000
  - *Reflects bulk-tier pricing secured through direct manufacturer contracts (Nordic, Saft, and Ferguson).*
- **Logistics & Bulk Crating:** $31,200
  - *Covers the custom-molded foam inserts and reusable plastic crates used to transport 50-unit "bundles" via UTV to the field edge, preventing damage to the whip antennas during transit.*
- **Labor (Blitz Install):** $183,300
  - **Efficiency Metrics:** Installation is calculated at 10 minutes per unit using a three-crew rotation. Crew A pilots the hydraulic auger, Crew B seats the LRZ and verifies the RF "heartbeat" using a handheld diagnostic tool, and Crew C performs the final soil compaction and GPS tagging.
  - **Wage Loading:** Includes $35/hr base pay plus "Blitz Incentives" for the seasonal field technicians required to meet the 45-day deadline.

LRZ TOTAL PROJECT COST: $1,540,500

Note: The LRZ is designed to be a "sunk asset." While the VFA nodes are serviced annually, the LRZ is intended to remain buried and untouched until battery depletion, at which point the internal sled is swapped while leaving the HDPE housing in situ.