

PROTOTYPE STAGE — PILOT TOOLS LIVE

Terra Sentinel

Satellite, drone & ground-truth intelligence for mine-site water safety

RAISING \$5M PRE-SEED

Pre-seed pitch deck — prepared for prospective investors · September 2026

THE PROBLEM

A widening gap between water risk and who's watching it

Global freshwater demand is projected to outstrip supply by 40% by 2030, against a roughly \$7 trillion water-infrastructure financing gap. Mining is one of the sharpest, most immediate versions of this problem in Southern and Central Africa.

40%

PROJECTED SUPPLY GAP

Global freshwater demand vs. supply by 2030 (UN / World Economic Forum)

4B

PEOPLE AFFECTED

Already living in water-scarce areas (World Bank)

\$7T

FINANCING GAP

Global water-infrastructure financing gap through 2030 (World Bank, 2024) — scale of the wider problem, not TerraSentinel's own addressable market

MARCH 2025

A tailings dam failure at a copper mine in Zambia's Copperbelt released an estimated 50 million litres of acidic wastewater into the Kafue River basin. Not an isolated event — peer-reviewed research documents decades of copper and cobalt contamination in Kafue River sediments across the Zambia/DRC Copperbelt.

Today, no accessible system ties subsurface ground-truth data, tailings dam instrumentation, and downstream water signals together in one place.

THE CONCEPT

Four layers, correlated — ground truth first, remote sensing extends it

Not the other way around. Each layer below extends how far ground truth reaches; an alert only means something when the layers agree, or disagree in a way worth a physical look.

01

Ground truth

Borehole logs, piezometers, inclinometers, seismographs — the actual subsurface picture. Not something a satellite can infer alone.

02

InSAR radar

Tracks tailings dam surface deformation — can detect ground movement months before a structural failure. Cross-validated, never used alone.

03

Satellite optical / radar

Watches downstream turbidity and vegetation stress — early indicators, prioritising where a physical sample is needed most.

04

Drone ground-truth sampling

Confirms actual water and soil chemistry — pH, copper, cobalt, cyanide. Satellites flag; only a physical sample says what it is.

An AI layer correlates all four and raises alerts automatically — aligned with the Global Industry Standard on Tailings Management (GISTM): 15 principles, 77 requirements, an independent Engineer of Record, mandatory public disclosure.

A modest, defensible slice of a much larger problem

\$117M

TAM BY 2033

Global Mining Tailings Management Market — storage, dewatering, water recycling, dry-stacking, and monitoring systems combined; TerraSentinel maps to the monitoring slice (Grand View Research, 2025 — full scope on Market Sizing — Sources & Scope)

115+

TSFs ACROSS AFRICA

ICMM member companies only — a floor, not the full count (ICMM Tailings Progress Report, Nov 2025)

\$110K–521K

SOM BY YEAR 3

Bottom-up serviceable obtainable market — see calculation below

SOM CALCULATION

115+ target sites (Africa TSF floor) × \$96K–\$151K annual contract value per site (cost-plus, from the internal site-visit cost model — per-country pricing, DRC/Zambia/Botswana) × 1–3% achievable penetration by Year 3 — conservative, given zero customers today and a relationship-driven, long-cycle sale.

The closer analog to TerraSentinel's own product — geotechnical instrumentation and monitoring — is larger and growing faster: \$4–\$5B in 2025 to \$10–\$13B by 2036, an 8–10% CAGR, with mining named as a key application for ground-movement detection (MarketsAndMarkets, 2025). TAM/SAM figures here are separate from the \$7T global water-infrastructure financing gap (previous slide) — that describes the scale of the wider problem, not TerraSentinel's own addressable market.

From global category to Year-3 target: the full arithmetic

The previous slide's three headline numbers, shown as one traceable chain — every figure sourced, every step multiplied out.



The 115-facility floor counts only large, ICMM-member operators. TerraSentinel's actual target segment — smaller, less-resourced operators without full GISTM-grade instrumentation — is likely larger but not independently confirmed, so it is deliberately left out of SAM.

MARKET SIZING — WHY NOW

Regulation, incident cost, and regional growth are pulling the same way

Specific, dated signals that the underlying demand is real and moving now — not just a market that exists in theory.

67%

FULL GISTM CONFORMANCE

Of 836 ICMM member facilities; lower-consequence facilities sit at just 53–65% (ICMM Tailings Progress Report, Nov 5 2025)

\$29.9B

COST OF GETTING IT WRONG

BHP & Vale's settlement for the 2015 Fundão/Samarco dam disaster (Reuters / MINING.com, Oct 25 2024)

REGIONAL DEMAND — SEPARATE FROM GLOBAL CATEGORY GROWTH

DRC

+10% copper exports

3.1M → 3.4M tons in 2025, now the world's #2 copper producer after Chile. MINING.com, Feb 11 2026

Zambia

+8% copper output

825,513 → 890,346 tons in 2025; national push to 3M tons by 2031. CNBC Africa / Bloomberg, Jan 27 2026

Botswana

\$900M expansion

Khoemacau copper mine expansion approved, targeting 130K tonnes/yr. International Mining, Dec 30 2025

These are directional demand signals, not TerraSentinel-specific commitments or sales — no customer relationship exists yet in any of the three countries.

What these figures measure, and what the copper tailwind means concretely

TWO INDEPENDENT SIZING SOURCES

Grand View Research — Mining Tailings Management Market

\$73.7M (2024) → \$117M (2033) · 5.4% CAGR

Historical 2021-2023, forecast 2025-2033 · Published Nov 2025

Methodology: proprietary market databases, executive interviews & regulatory analysis, peer-reviewed

Covers: storage, dewatering, water recycling, dry-stacking, AND monitoring, globally

Geography: Middle East & Africa incl. South Africa — not broken out to DRC/Zambia/Botswana

Maps to TerraSentinel's instrumentation + water-signal slice, not the full storage/dewatering/dry-stacking scope.

MarketsAndMarkets — Geotechnical Instrumentation & Monitoring Market

\$4-5B (2025) → \$10-13B (2036) · 8-10% CAGR

Published Oct 2026 (Report Code SE 5238) · methodology per source's standard paid-research process

Mining named explicitly as a key end-user application

Geography: 4 global regions — Africa grouped under “Rest of World,” not broken out by country

Closer analog to TerraSentinel's full offering — ground-truth, instrumentation, water-signal sensing & the correlation engine — not the broader tailings-management category above.



HONEST SCOPE

Neither source breaks out DRC, Zambia, or Botswana individually — both group Africa at a regional or “Rest of World” level. The country-specific evidence below comes from named, dated projects and a government source instead, not a market-research estimate.

WHAT THE +8% ZAMBIA COPPER TAILWIND MEANS CONCRETELY

The +8% figure is Zambia's own reported national production data (825,513 → 890,346 tons, 2025) — CNBC Africa/Bloomberg, Jan 27 2026, not a market-research estimate. Two named, dated projects sit behind it, ~\$1.85B combined: Sinomine Kitumba (\$600M, production from 2026) and the Kansanshi S3 Expansion (\$1.25B, ~1,500 jobs, +20yr mine life). Each is a future target site, already inside the 115+ site floor and \$96K-151K per-site range used in the SOM calculation (Market Sizing slide) — this tailwind supports that serviceable estimate, not upside beyond it. The same source documents a SINO Metals Leach tailings incident and a new Minerals Regulation Commission — raising appetite for independent monitoring. Source: Presidential Delivery Unit Zambia, Feb 18 2026.

These are named projects and a real regulatory shift, not TerraSentinel contracts or commitments — no relationship exists with any of them yet.

A direct, relationship-led path to the first paying site

TerraSentinel's buyer is a specific, identifiable person, not a mass market — a direct technical sale sized to a \$96K–\$151K annual contract.

WHO WE'RE TARGETING

Initial segment: mine operators and TSF owners in the DRC, Zambia, and Botswana — the same geography used in the market sizing.

Primary contact: the technical/operations lead responsible for tailings and water-monitoring compliance, not procurement.

Starting point: ICMM-member operators already mid-way through GISTM conformance.

HOW THE PROCESS WORKS

Target-account ID → technical discovery → site assessment → pilot proposal → paid pilot or annual contract

Direct, not channel-led: at \$96K–\$151K per site and a multi-month technical sale, this is a relationship-driven enterprise sale.

Partner paths being explored, not yet active: geotechnical/environmental consulting firms, mining-compliance platforms, industry bodies operators already trust.



HONEST SCOPE

No mine operator has been contacted, interviewed, or signed as of this deck — the segment, process, and channels above are the intended plan, not results achieved. The concrete Phase 1 milestone is a single real pilot site, however small (see Roadmap). Real conversations already in motion toward that first site are on the Traction slide.

WHAT EXISTS TODAY

A working pilot, not a slide deck

A field data-entry tool and a live pilot dashboard already run today, backed by a real database.

- ✓ Field data-entry tool — borehole/lithology logs, instrument readings, drone water-chemistry samples
- ✓ Pilot dashboard — site map, threshold-based flags, time-series and depth-profile charts
- ✓ Correction-request workflow — original logger + independent second reviewer, third expert breaks ties; nothing silently edited or deleted
- ✓ terrasentinel.co.za — public-facing overview, prototype stage clearly stated
- ✓ Real Sentinel-1 satellite pipeline — end-to-end ground-deformation product (see Technical Milestone)
- ✓ Sentinel-2 downstream water-quality pipeline — cloud-masked NDTI, now split per monitoring cell (see Technical Milestone)

NOT YET BUILT: drone-triggered sampling automation, and the AI correlation engine that would flag anomalies across every layer automatically.

TECHNICAL MILESTONE

The satellite layer: concept to working pipeline

Sentinel-1 radar data now flows through a real, working pipeline — submitted, tracked, and completed end-to-end over a Copperbelt tailings site.

- ✓ Real Sentinel-1 SAR jobs — submitted, tracked, and completed through NASA/ASF's HyP3 service, not a simulated demo
- ✓ A secure, admin-only orchestration layer (Supabase Edge Functions) handles job submission, status polling, and result storage
- ✓ First successful run: a real interferometric ground-deformation product (≈861 MB) from two Sentinel-1 acquisitions
- ✓ Surfaced directly in the pilot dashboard — job status, acquisition dates, and a one-click download

FIRST REAL RUN

≈861 MB

ground-deformation product, 2 acquisitions

STATUS

✓ Complete

Pilot dashboard — Sentinel-1 InSAR jobs panel, validation run



HONEST SCOPE

The interferometric processing itself — phase unwrapping and baseline coregistration — runs on NASA/ASF's HyP3 service, not proprietary TerraSentinel code. What's TerraSentinel's own is the orchestration layer around it: submitting jobs, tracking status, and securing results.

The satellite layer, part two: Sentinel-2 downstream water quality

Sentinel-2 optical data flows through the same pipeline as Sentinel-1 — and this month, the monitoring itself got sharper and more honest about its own limits.

- ✓ Real Sentinel-2 L2A cloud-masked NDTI query via Copernicus's Statistical API — same orchestration layer as Sentinel-1, reused not rebuilt
- ✓ Root cause of earlier NO_CLEAR_SCENE failures found live in Copernicus's own Requests Builder — fixed with 10-day aggregation buckets
- ✓ NEW — split across two independently-monitored cells at the pilot dam (Cell 1 West / Cell 2 East) instead of one averaged reading
- ✓ NEW — a self-service “request a new reading” form ships in the dashboard, with real input validation on buffer radius, site name, and dates
- ✓ NEW — verified end-to-end: a typed buffer value provably reaches the satellite query, confirmed by independently recomputing the real monitoring-area size from stored geometry

CELL 1 — WEST

NDTI -0.1326

800 clear pixels

CELL 2 — EAST

NDTI 0.0690

800 clear pixels



HONEST SCOPE

NDTI is a relative turbidity/sediment index, not a calibrated absolute value — no safe/unsafe threshold is set yet. TerraSentinel's own: orchestration, admin-only security, dashboard UI, and input validation — the NDTI computation itself runs on Copernicus's Statistical API.

What mine operators use today, and why they still use it

Before any named technology competitor, most sites rely on some mix of these. None compete on capability; they persist on cost and familiarity.

ALTERNATIVE	WHAT IT IS	WHY IT'S STILL USED
Spreadsheets / manual workflows	Ad hoc tracking of readings and reports in Excel or Word	Zero upfront cost, no new tooling to learn
Environmental consultants	Periodic manual water/soil sampling and compliance reporting, per visit	Established relationships, regulatory familiarity
Third-party laboratories	Accredited chemical analysis of submitted samples	Required for certified results regardless of system used
Regulator-reporting systems	Government/industry portals for mandatory disclosure filings	A compliance requirement, not an early-warning tool

None of these are being replaced by TerraSentinel. The goal is feeding better, earlier ground-truth and remote-sensing data into the same reporting and expert-review processes these already require.

Where TerraSentinel sits today, honestly staged

Desk research on public provider materials, checked September 2026. TerraSentinel's own column reflects actual build status, not aspiration.

Provider	Ground Truth	InSAR/Sat.	Drone Sampling	Auto Correlation	Deployment
IDS GeoRadar	No	Yes	No	n/s	Satellite monitoring service
Viridien (CGG)	No	Yes	No	n/s	Satellite monitoring service
Canary Systems	No	Yes	No	n/s	Satellite + instrumentation
Sintela	Instr. only	n/s	No	n/s	Sensor + SaaS dashboard
GDMS	Instr. only	n/s	No	n/s	Sensor + SaaS, GISTM-oriented
Schauenburg Systems	Sensor/comms	No	No	No	Hardware & comms supply
TerraSentinel	Live	Live (S1+S2)	Manual / Pilot	Planned	SaaS + field tool

“n/s” = not publicly stated in materials reviewed. TerraSentinel status matches “What Exists Today”: field-data, dashboard, and satellite (S1 InSAR + S2 optical) are live; automated cross-layer correlation is not yet built.

TAKEAWAY — TerraSentinel's intended advantage is workflow integration across ground truth, remote sensing, physical verification, and auditability — in one product, not four vendors.

Subsurface complexity we're not glossing over

Aquifers are not uniform

A confined aquifer (sealed above by an impermeable layer) behaves completely differently under contamination than an unconfined one recharged directly from the surface.

Transport depends on the rock

Fractured rock lets contamination travel fast and unpredictably along joints; porous sedimentary layers move it slowly and more predictably. The same spill behaves differently at every site.

Seismic activity matters twice over

It affects tailings dam stability (liquefaction risk in saturated tailings) and how fractured ground transmits water and contamination — a factor GISTM-aligned facilities are expected to monitor.

Depth adds cost, time, and risk

At every stage of physical verification — which is exactly why deciding where to physically drill or instrument has to be informed, not guessed.

What TerraSentinel is not

- ✕ It does not replace core drilling, geotechnical instrumentation, or the judgment of a qualified Engineer of Record — GISTM requires that role for a reason, and this concept supports it, not bypasses it.
- ✕ It does not claim AI can interpret subsurface geology on its own.
- ✕ It does not yet have a signed paying pilot site or completed independent expert sign-off — this raise exists specifically to close that gap, not to claim proven revenue.

What it aims to do: make existing ground-truth data reach further — flagging where a new sample or instrument reading is needed sooner, particularly at smaller or less-resourced sites that don't yet have full GISTM-grade instrumentation in place.

WHY THIS FOUNDER

Built on years in the field, not a market spotted from outside it

Jean Venter

FOUNDER, TERRA SENTINEL (PTY) LTD

Jean Venter has spent 3 years core drilling across the DRC, Zambia, and Botswana — one year fully embedded on-site in each country — reading what comes back up the hole to understand ground formations, water tables, and rock behaviour below the surface. As drill-site supervisor, Jean led approximately 25–30 boreholes ranging from 50m to nearly 300m deep.

On one job at KICO SA in Kipushi, DRC — his most recent contract — he drilled straight through the middle of an existing tailings dam built in the 1950s: exploration to check ground structure and stability ahead of a much larger new dam. That judgment — where a monitoring borehole or piezometer actually gets placed — is exactly what no amount of satellite data replaces on its own.

Jean is also the founder behind two other live software products, Barter and Istokvel — this isn't a first attempt at taking an idea from concept to a working product.

BACKGROUND & SELF-STUDY

Wildlife Conservation

Hydrogeology-adjacent self-study

Soil Science

Physical Geology

Sustainable Development

TEAM & OPERATING ROLES

One founder covering build, sell, and lead — with a named gap this raise closes

Build

Jean Venter. Builds and maintains the TerraSentinel product — field-data capture tooling and the monitoring dashboard — using AI-assisted development to move at solo-founder speed.

Sell

Jean Venter. Leads all commercial development, mine-operator outreach, and pilot acquisition directly, drawing on 3 years of on-site relationships built during drilling operations.

Lead

Jean Venter. Sole founder and sole shareholder — 100% ownership, no other equity holders or options outstanding.

CONFIRMED TECHNICAL ADVISOR (PART-TIME)

Siyanda Nduduzo Hlatshwayo — GIS and Field Soils Officer, Sayari Earth; BSc(Hons) Hydrology & BSc Hydrology and Geography, University of Zululand (former GIS tutor there).

Direct relevance to TerraSentinel's satellite/InSAR correlation layer and water-signal interpretation. Confirmed by phone and written consent (WhatsApp), Sep 2026 — no relationship prior to that conversation.

REMAINING GAP & HIRING PLAN

Beyond one part-time advisor above, there is no full-time technical hire, salesperson, or co-founder yet. Phase 1 still calls for recruiting an independent geologist, hydrogeologist, and geotechnical engineer as technical reviewers — validation roles, not operating build or sell roles.

This raise funds the first full-time technical and commercial hires directly (see The Ask / Use of Funds) — no longer contingent on pilot traction alone.

Real conversations already in motion — none closed yet

Since 9 September 2026, via an Istokvel connection (Chris Mulhall and Ernest, business partners), after a live walkthrough of the dashboard and field data-entry tool:

A pilot site

Being arranged — at no cost to TerraSentinel.

Two academic supervisors

Introductions being arranged to professors at CPUT and a Pretoria-area university, who would supervise the pilot as student practical work at no cost — with formal university sign-off/accreditation possible if milestones are met.

Two investor introductions

Being arranged — one contact with a real-estate background (Seeff Properties), one with a direct mining-industry background (US-based).

Direct investor interest

Chris and Ernest are also personally interested in investing — no numbers discussed yet, deliberately deferred by Jean until after a supervised pilot runs.

All of the above are meetings being arranged, not signed commitments or term sheets — included because they're real and dated, not because they're closed.

ROADMAP

Phase 1 to Phase 4: one pilot site to a live, multi-site system

This raise is scoped to fund the full path below, as defined in TerraSentinel's own system architecture — not just the next six months.

1

Pilot

IN PROGRESS

One real site: real borehole/lithology logs, manually-entered instrument readings, real drone sample results. No live telemetry yet. Reviewed by a geotechnical engineer and hydrogeologist against real-world practice, not just internal testing.

2

Live ground instrumentation

FUNDED BY THIS RAISE

Connect to the pilot site's existing piezometer / inclinometer / seismograph telemetry system (e.g. Geokon, Encardio-rite-style vendor systems already on most active facilities), replacing manual entry with automatic feeds.

3

Automated satellite layer

FUNDED BY THIS RAISE

Sentinel-1 and Sentinel-2 already prove the integration end-to-end (see Technical Milestones) via manually-triggered requests. This phase automates and schedules that ingestion, and builds the cross-layer correlation engine that raises alerts automatically.

4

Multi-site production

FUNDED BY THIS RAISE

Additional sites onboarded across the DRC/Zambia/Botswana footprint; GISTM-aligned reporting and public-disclosure features built out; access controls so operators, regulators, and downstream communities each see what they need.

Pilot-site acquisition (Phase 1) is treated as the single greatest uncertainty in this plan and could extend past the initial horizon — Phase 2 and 3 engineering do not strictly depend on it and proceed in parallel.

What compounds as TerraSentinel adds sites

Each deployment leaves behind a verified site history that gets more valuable over time and costlier for a competitor to rebuild from zero.



THE ASK

Raising \$5M pre-seed to fund Phase 1 through Phase 4

Scoped to the full roadmap on the previous slide, not just the next six months.

\$5M PRE-SEED · 18–24 MONTH RUNWAY

Team — technical + commercial hires	28%	\$1.4M	First full-time technical hire + commercial/BD hire beyond Jean, plus continuing fractional geologist/hydrogeologist/engineer reviewers (Phase 1).
Phase 1 — pilot expansion	20%	\$1.0M	Expand from 1 to 4–6 pilot sites across DRC/Zambia/Botswana, scaled from Phase 1's own real per-site cost model (≈\$45–70K/site/6mo: experts, lab, GPS/tech, travel).
Phase 2 — live ground instrumentation	14%	\$0.7M	Software development to connect existing piezometer/inclinometer/seismograph vendor telemetry directly, replacing manual entry with automatic feeds.
Phase 3 — automated satellite + correlation engine	14%	\$0.7M	Software development to automate the Sentinel-1/2 ingestion already proven manually (see Technical Milestones), and build the AI cross-layer correlation and alerting engine.
Phase 4 — multi-site production groundwork	10%	\$0.5M	GISTM-aligned reporting/public-disclosure features and access controls for operators, regulators, and downstream communities, ahead of onboarding sites beyond the DRC/Zambia/Botswana pilots.
Hardware — site connectivity (Starlink)	4%	\$0.2M	Kits + Roam subscriptions so remote pilot sites stay live where terrestrial internet doesn't reach. ≈R6,800–R12,000/kit, Roam ≈R900–R1,260/month (Tech in Africa, Jan 2026; MyBroadband) — confirm licensing per target country first.
Sales & BD	6%	\$0.3M	The direct enterprise sales process named in Go-to-Market — site assessments, travel, relationship-led pilot acquisition.
Working capital / contingency	4%	\$0.2M	Standard buffer for a first institutional round.

Proposed allocation, built from Phase 1's own real per-site cost model and the architecture document's own Phase 1–4 definitions — refine with real hiring and vendor quotes before finalizing.

WHY NOW

Momentum already in motion — this raise puts fuel behind it

- ✓ Founder field credibility — 3 years core drilling across the DRC, Zambia, and Botswana, not a market spotted from outside it.
- ✓ Real regulatory pull — 67% full GISTM conformance industry-wide, and rising, with a \$29.9B example of the cost of getting it wrong.
- ✓ Regional growth signals — copper output and expansion rising across all three target countries right now, not on a future forecast.
- ✓ A working pipeline, not a slide deck — Sentinel-1 and Sentinel-2 both live and verified end-to-end, most recently this month.
- ✓ Real intros already in motion — a pilot site, two academic supervisors, and two investor conversations, all since 9 September 2026 (see Traction).

This raise converts momentum already in motion into a funded, multi-site pilot program — patient capital for a long-term effort, not fast-exit capital. TerraSentinel isn't chasing a fast exit; the right investors share the 2030 timeline for getting the science right.

Ground truth first. Remote sensing extends it.

Open to a conversation with anyone whose expertise or capital can help get the first funded, multi-site pilot program running — hydrogeology, geotechnical instrumentation, remote sensing, mine-site operations, or investment.

RAISING \$5M PRE-SEED

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