AQUIFER-RECHARGE SCREENING · COMPANION DOCUMENT

Spring Creek Analysis

Observability & Explainability Report

Companion to the Aquifer-Recharge Screening Summary. This document exists so the analysis can be **audited and reproduced***: it shows how every figure and number was produced, what data and external sources were used, and the complete record of the AI-assisted work behind it. Everything it links to lives inside this folder, so the package is self-contained.*

Prepared for: **(client)**

June 25, 2026

The explainability stance

Three things make this analysis auditable rather than a black box:

01 **Computed or cited.** Every quantitative claim in the report is either produced by re-runnable code (the figure/analysis scripts) or cited to a named, published source.

02 **Human-in-the-loop verification.** The AI handled orchestration, data fetching, and synthesis; a human directed the work and verified each result including an independent cross-check against the "Transect" report (see the report's appendix).

03 **The full record is retained.** The entire AI session (every prompt and reply) plus the exact data sources and computed artifacts are preserved here for inspection.

SCREENING-GRADE As stated throughout the report, this is a screening tool, not a substitute for calibrated modeling or field work. Observability does not change that — it makes the screening's basis transparent.

Tech stack

LAYER	COMPONENT	MODEL / PLATFORM	ROLE
Analytical operator	Claude Code	Claude Opus 4.8	Directed the workflow: fetched data, ran the GIS / terrain / water-balance computations, and drafted the synthesis under human direction.
Geospatial agent	bAI GeoAI agent	Claude Sonnet 4.6	Our in-house geospatial agent, invoked for the registered-tool steps and extended by the operator where its tools fell short.
Compute infrastructure	AWS	AWS (Bedrock AgentCore)	Cloud compute that hosted and ran the bAI GeoAI agent.

All work was directed and verified by our team; the models above performed orchestration, computation, and drafting, not unattended decision-making.

01 How the analysis was done

The work began as a staged plan for an automated GIS agent, but evolved as the client and a reviewing geologist asked follow-up questions. Many steps required operations the agent couldn't do (layer intersection, raster sampling, terrain flow-routing, reaching un-registered datasets), so they were run directly in Python against authoritative public services. Each stage below maps a real question to the data behind its answer:

STAGE	QUESTION ASKED	PRIMARY DATA SOURCE(S)	OUTPUT
Suitability	Where can impervious cover go without cutting recharge?	USDA SSURGO soils; PASDA geology/karst, streams, wetlands, FEMA	Tier 1/2/3 map (Figs 1, 3)
Recharge volume	How much recharge now & in 30 yr?	ArcGIS rasters (precip/recharge index); USGS SIR 2015-5073; PA DEP 2021	~4,020 ac-ft/yr; range to 2050 (Fig 4)
Cross-check	Does it agree with the geologist?	Transect report (PDF)	Independent corroboration (appendix)
Karst elevation	Where is recharge focused?	USGS 3DEP elevation + DEM; pysheds catchments	High-swallet catchment (Fig 5)
Max footprint	Most development within the recharge budget?	water-balance arithmetic over the above	~685 ac (recharge not the binding limit)
Demographics	Is the 30-yr rate static?	PA State Data Center projections; Centre Region / Nittany Valley plans	Growth steered off-site
Demand	Wells & withdrawals?	PA DCNR PaGWIS; SRBC dockets; SCBWA; Watershed Atlas	Demand ledger (Fig 6)
Basin erosion	Quantify urbanization effect	USGS WBD; Annual NLCD impervious 2001→2024	~3% rate erosion to 2050 (Fig 7)

The full prompt-by-prompt narrative (including the AI's exact replies) is in the conversation trace below.

02 Sources consulted

The analysis drew on **34 authoritative data-service endpoints, 7 fetched web pages, and 13 web searches** — the complete de-duped list is in `ai_trace/sources_consulted.md`. The authoritative data services include:

- **USDA** — Soil Data Access (SSURGO)
- **USGS** — 3DEP elevation, EPQS, Watershed Boundary Dataset (WBD)
- **PA DCNR** — Geological Survey / PaGWIS wells
- **PASDA** — geology, karst, wetlands, SRBC layers, FEMA flood hazard
- **MRLC / USGS** — Annual NLCD Fractional Impervious Surface
- **Published studies** — USGS SIR 2015-5073; PA DEP Climate Impacts Assessment 2021; SRBC dockets; State College Borough Water Authority; PA State Data Center population projections

(The auto-extracted list also includes a few exploratory probes that were dead ends — these are kept for honesty; the curated authoritative list is the one above.)

03 Data used

All **26 spatial/data artifacts** behind the analysis — raw fetched layers (`res_*`) and the computed outputs — are in the `data/` folder, each documented in `data/README.md` with its source, coordinate system, and which figure/section it feeds. These are the **frozen versions** used in the report (external sources update over time).

04 Full conversation trace

The complete AI session is preserved and readable:

- `ai_trace/trace_readable.md` — the full conversation (**user messages, AI replies**), with each AI turn annotated with the external sources it consulted. Tool calls and internal reasoning are omitted for readability; local machine paths and credentials are redacted.
- `ai_trace/README.md` — how to read the trace and reproduce the results step by step, plus the `extract_trace.py` helper (regenerate the conversation, list every command, or rebuild the sources index).

05 Figures & reproducibility

- `report_figures/` — the 7 figures and the scripts that generate them. Running `bash report_figures/run_all.sh` rebuilds every figure from `data/` with no network access.
- `report_figures/README.md` — what each figure shows and its inputs.

Index of linked resources

RESOURCE	PATH	WHAT IT GIVES YOU
Screening report	Rockview Report Main.pdf	The findings
Sources index	ai_trace/sources_consulted.md	Every external source consulted
Conversation trace	ai_trace/trace_readable.md	The full AI session (redacted)
Data catalog	data/README.md	Every data file + its source
Figures	report_figures/README.md	Figure inputs & scripts