Parcel-Scale Terrain & Relative Elevation Assessment

Zonal Statistics Screening Analysis

Prepared by: Touch of Green Environmental GIS, 2026
Location: Client Parcel – Sterling, Colorado
Scale: Parcel-level, screening analysis

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1. Purpose of Analysis

This analysis evaluates relative elevation characteristics of a subject parcel and its immediate surrounding context using raster-based terrain statistics. The objective is to determine whether the parcel's elevation profile differs meaningfully from surrounding land within a defined buffer distance.

The analysis is screening-level and intended to support:

- Floodplain and drainage context justification
- Preliminary site evaluation and risk communication
- Comparative terrain assessment (parcel vs. surroundings)
- Documentation support for planning or regulatory review

This analysis does not replace a survey, engineered grading plan, or hydrologic modeling.

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2. Study Area & Data Overview

2.1 Study Extent

Two spatial extents were evaluated:

1. Subject Parcel – parcel boundary provided by the client
2. 300-foot Buffer – surrounding terrain context used for comparison

The buffer distance was selected to represent immediate local terrain influence, while remaining small enough to avoid unrelated regional topography.

2.2 Floodplain Context and Regulatory Setting

The subject parcel is located within a mapped Federal Emergency Management Agency (FEMA) Special Flood Hazard Area (SFHA). FEMA Flood Insurance Rate Map (FIRM) data indicate that the parcel lies within Zone AE, which represents areas subject to a 1% annual chance flood event (commonly referred to as the 100-year floodplain). Zone AE areas are characterized by defined flood hazards where base flood elevations (BFEs) have been established through hydraulic modeling.

In addition to the Zone AE designation, the parcel is situated in close proximity to a regulatory floodway, as shown in Figure 1. Regulatory floodways are portions of the floodplain reserved to convey floodwaters during high-flow events and are subject to stricter development and permitting requirements due to their role in maintaining flood conveyance capacity.

This spatial relationship between the parcel, the Zone AE boundary, and the adjacent floodway provides the regulatory basis for further elevation analysis. Because FEMA flood zones represent modeled flood risk rather than direct ground elevation measurements, parcel-scale topographic evaluation is necessary to better understand relative elevation conditions within the floodplain designation.

Accordingly, the subsequent analysis focuses on evaluating local elevation characteristics using USGS 3DEP digital elevation data and comparing elevation statistics for the subject parcel against its immediate surroundings. This approach supports floodplain interpretation by contextualizing the parcel's elevation relative to nearby terrain while recognizing the regulatory importance of FEMA flood zone boundaries.

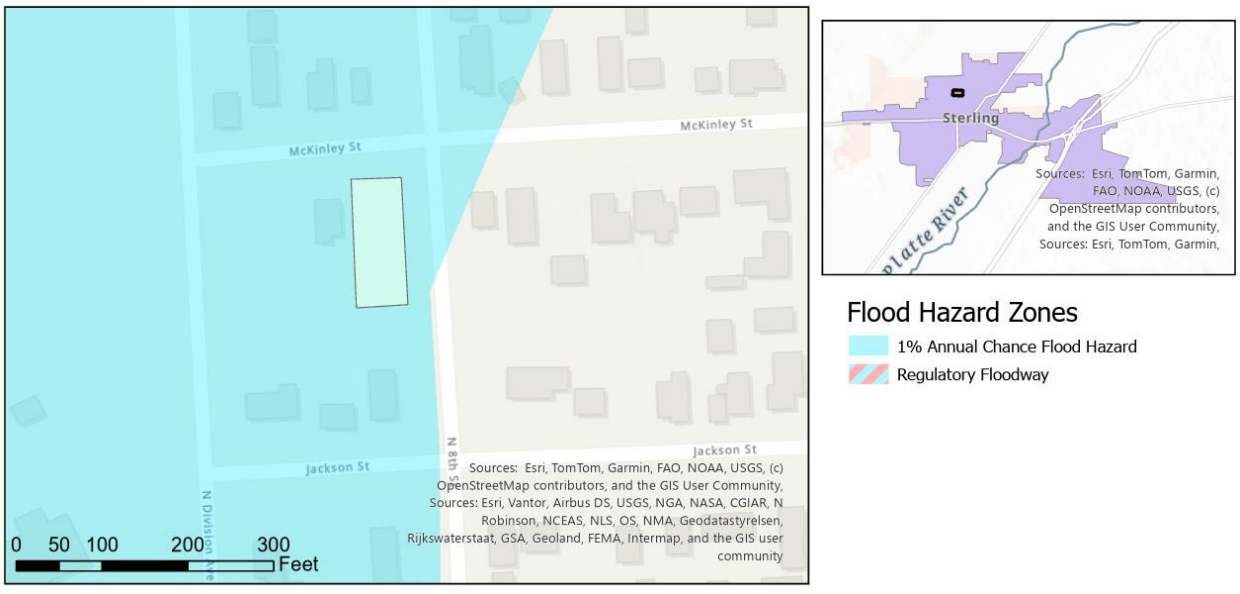

Figure 1. FEMA Flood Hazard Context for Subject Parcel.

2.3 Data Sources

- **USGS 3DEP Digital Elevation Model (DEM)**
    - Spatial resolution: 30 meters
- **Parcel boundary geometry**
- **Derived parcel buffer (300 ft)**

All datasets were projected into a common coordinate system and aligned prior to analysis.

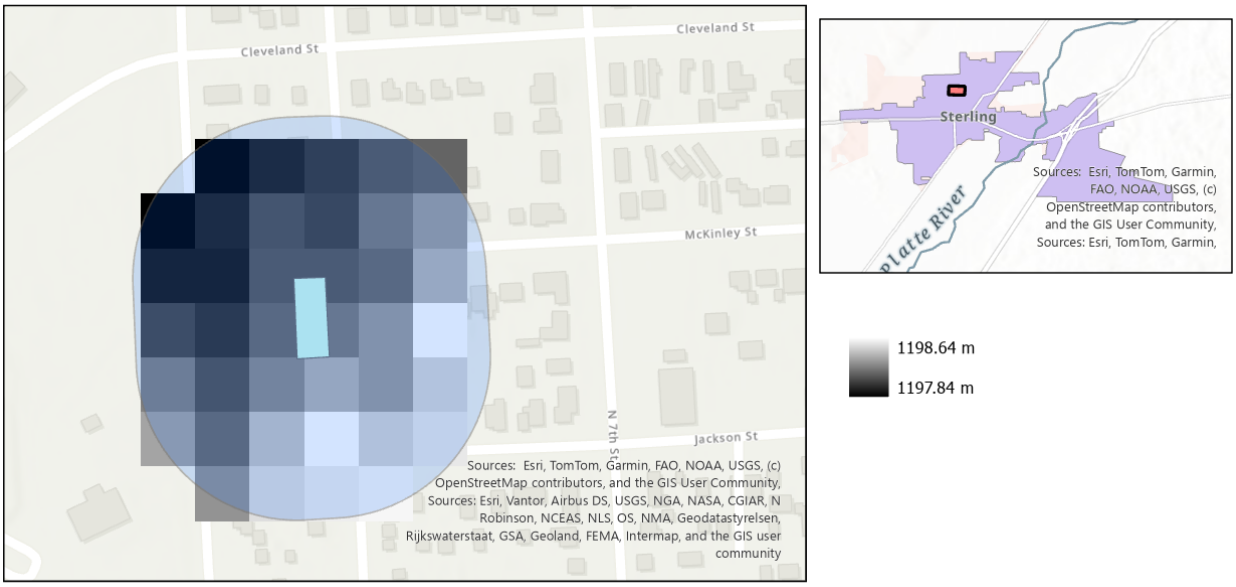

Figure 2. Subject parcel and 300-foot buffer overlaid on the clipped elevation surface used for zonal analysis.

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3. Analytical Approach

3.1 DEM Preparation

The USGS 3DEP DEM was clipped using Extract by Mask to ensure the elevation surface matched the parcel and buffer extents exactly. This step eliminated edge artifacts and ensured valid raster statistics.

Raster statistics were recalculated after extraction to support accurate symbology and analysis.

3.2 Hillshade Visualization (Contextual)

A hillshade raster was generated to visually assess terrain variability. While useful for orientation, hillshade results showed minimal visual contrast due to the flat nature of the terrain and the DEM's 30 m resolution.

Hillshade was retained strictly as contextual support, not as an analytical driver.

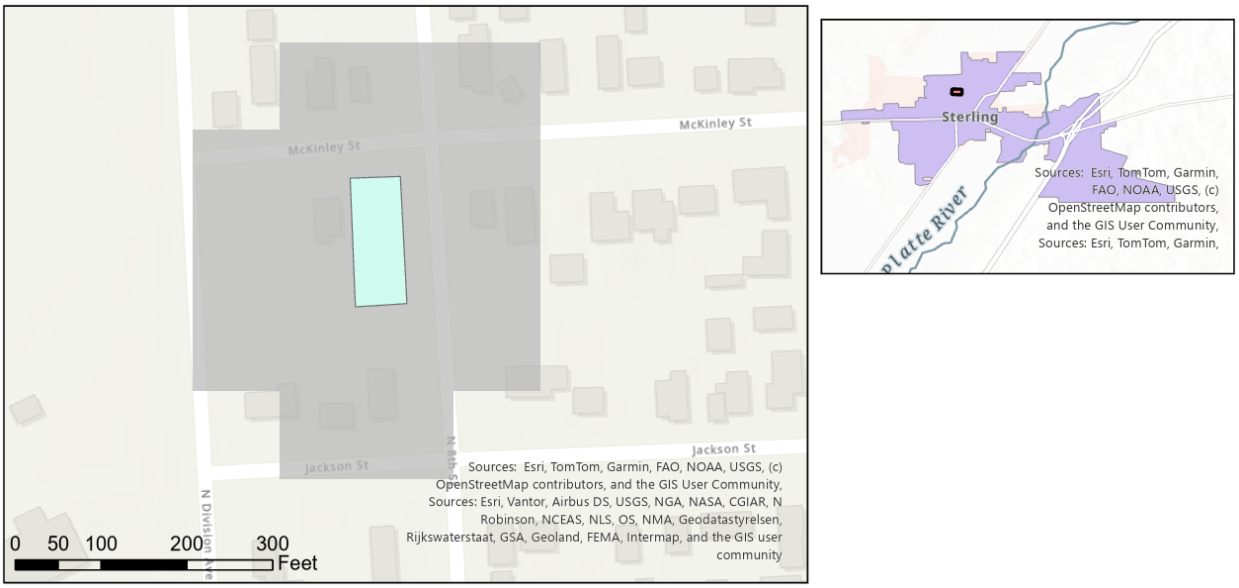


Figure 3. Hillshade visualization illustrating limited terrain relief at the parcel scale using 30-meter elevation data.

3.3 Zonal Statistics – Subject Parcel

Zonal Statistics as Table was run using:

- **Zone data:** Subject parcel polygon
- **Value raster:** Clipped DEM
- **Statistics:** All

This produced summary statistics describing the parcel's internal elevation variation.

Key results (Subject Parcel):

- Mean elevation: ~**1198.16 m**
- Elevation range: **~0.08 m**
- Standard deviation: **~0.04 m**

These values indicate the parcel is extremely flat, with minimal internal elevation variability.

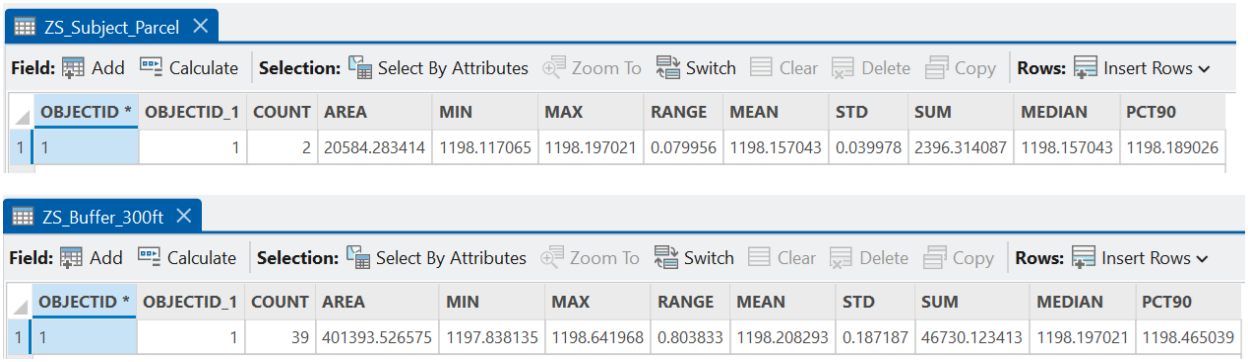
3.4 Zonal Statistics – 300 ft Buffer

The same zonal statistics process was repeated using the 300-foot buffer as the zone.

Key results (300 ft Buffer):

- Mean elevation: ~**1198.21 m**
- Elevation range: **~0.80 m**
- Standard deviation: **~0.19 m**

Compared to the parcel, the buffer exhibits greater elevation variability, though still relatively subtle in absolute terms.



ZS_Subject_Parcel

Field: Add Calculate | Selection: Select By Attributes Zoom To Switch Clear Delete Copy | Rows: Insert Rows

	OBJECTID *	OBJECTID_1	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	MEDIAN	PCT90
1	1	1	2	20584.283414	1198.117065	1198.197021	0.079956	1198.157043	0.039978	2396.314087	1198.157043	1198.189026

ZS_Buffer_300ft

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	OBJECTID *	OBJECTID_1	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	MEDIAN	PCT90
1	1	1	39	401393.526575	1197.838135	1198.641968	0.803833	1198.208293	0.187187	46730.123413	1198.197021	1198.465039

Figure 4. Zonal statistics summary comparing parcel elevation characteristics to surrounding terrain.

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4. Comparative Interpretation

The parcel and its surrounding buffer share nearly identical mean elevations, indicating the parcel does not sit topographically lower than its immediate surroundings.

However, the buffer area shows greater elevation range and variability, suggesting:

- Slightly more relief exists outside the parcel
- The parcel itself occupies a locally flatter micro-area

This pattern supports the interpretation that the parcel is not a local low point and does not appear to collect runoff due to surrounding topography alone.

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5. Summary of Findings

- The subject parcel exhibits very low internal elevation variability
- Surrounding terrain (300 ft buffer) shows greater, but still modest, relief
- Mean elevation values are nearly identical between parcel and buffer
- No evidence suggests the parcel occupies a topographic depression relative to its immediate surroundings

At a screening level, terrain conditions do not indicate elevated flood or drainage risk driven by local elevation differences.

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6. Limitations & Data Resolution Considerations

This analysis is subject to several important limitations:

6.1 DEM Resolution

The USGS 3DEP DEM used in this analysis has a 30-meter cell size, meaning:

- Small-scale elevation changes (curbs, shallow swales, grading) are not captured
- Parcel-scale relief may be underrepresented for small urban parcels

As a result, terrain variability should be interpreted relatively, not absolutely.

6.2 Raster–Vector Interaction

Zonal statistics require rasterization of vector zones. Small parcels may intersect only a limited number of DEM cells, which can:

- Reduce statistical sensitivity
- Produce conservative (smoothed) results

This limitation is intrinsic to raster-based terrain analysis.

6.3 Scope of Analysis

This assessment evaluates relative elevation only. It does not account for:

- Subsurface drainage
- Storm sewer infrastructure

- Soil infiltration capacity
- Localized grading or construction

Accordingly, results are intended for contextual and justification purposes, not engineering design.

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8. Conclusion

This parcel-scale terrain assessment demonstrates that the subject parcel is not topographically disadvantaged relative to its immediate surroundings. While elevation variation exists in the surrounding buffer, the parcel itself occupies a locally flat area with no evidence of relative depression.