February 3, 2025

Alexander Mulhall
Town Administrator
Town of Lake City

Re: **Lake City, CO – Town of Lake City Scoping Project Memo**

Lake City is a community in Hinsdale County, Colorado named after Lake San Cristobal, the second-largest natural lake in Colorado. The town was built in the Lake Fork River valley within the San Juan Mountain Range. Lake Fork, a mapped Zone AE with floodway, flows in a northward direction through Lake City and is fed by numerous gullies and tributaries down the steep slopes lining Lake City.

Runoff across Lake City is not conveyed to the Lake Fork River, so the town experiences flooding on more than an annual basis. The proposed Project will attempt to address the flooding issues and provide alternative analyses for flood risk mitigation.

The Town has identified two main sources of this frequent flooding:

1. **Gully Flows**: These are flows of sediment-laden water (debris flows) that come down steep gullies and enter the Ball Flats area from the east. The debris clogs the drainage systems, resulting in water pooling in the town and causing property flooding. Debris flows and deposition are greatest east of Pine Street.
2. **Valley Flows**: Across the Ball Flats area, floodwaters generally flow from the south to the north. This type of flooding is generally fed by gully flows and therefore has debris flow potential. Valley flows consistently impact properties and infrastructure.

As part of this scoping effort, a conceptual clear-water surface water model was developed to understand flood areas of concern. Figure 1 presents the resulting conceptual depth mapping and general flowpaths around the Ball Flats area. Two major sites of concern are identified in red: (1) the electric supply (specifically two electrical boxes located near the southern end of town) and (2) the wastewater treatment plant at the northern end of town. Areas within town that could potentially benefit from stormwater design are circled in pink and areas that could potentially benefit from debris flow mitigation are circled in yellow.

WSP
2000 S. Colorado Blvd., Suite 2-1000
Denver, CO 80222
Tel: +1 (303) 935-6505
Fax: +1 (303) 935-6575
wsp.com

Continued...

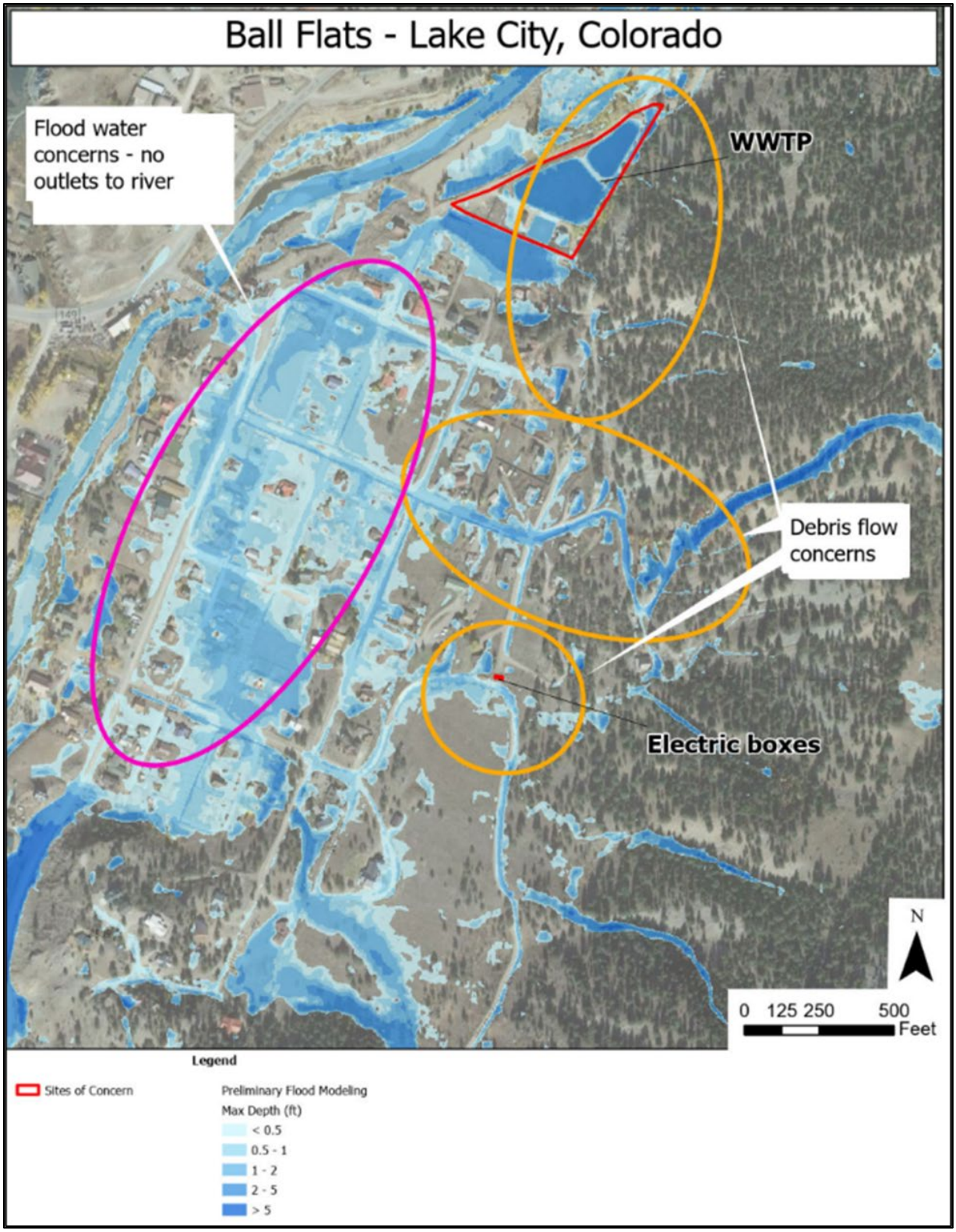

Figure 1 – Ball Flats Natural Flow Paths with Conceptual Depth Mapping and Major Infrastructure Sites of Concern

Continued...

Data Review

Available Data

The drainage area encompassing the areas of interest is less than approximately 5 square miles. Available data sources for the flood risk mitigation analyses within this drainage area are listed in Table 1.

Table 1 – Available Data Sources for Marty Flood Risk Mitigation

Source	Available Dataset(s)
Town and Community of Lake City	• Understanding of frequently flooded areas and drainage infrastructure • Existing buildings and planned construction • Understanding of storm types (i.e. summer thunderstorms, rain-on-snow, etc.) and intensity leading to flood issues • Typical maintenance requirements and schedule – useful for informing historical debris flow depths/volume (clogged culverts and ditches) • Local understanding of vegetation conditions – presence of beetle-kill trees and/or wildfire potential not evident on available aerial imagery
USGS National Elevation Dataset	0.5-ft resolution digital elevation model (DEM) across town and 1-ft resolution DEM for approximately 1,000-ft outside of town. USGS 1-meter resolution DEM elsewhere.
FEMA Flood Map Service Center	Regulatory floodplain, peak flows, and flood profiles. The Effective model may be obtained and used to estimate water surface elevations along the Lake Fork River.
Natural Resources Conservation Service (NRCS) Web Soil Survey	Spatial soils data, including hydrologic soil group (HSG) classifications are provided as spatial data. Needed for evaluation of infiltration potential and general soil particle sizing for debris flow potential.
National Land Cover Database	Land cover classifications for evaluation of surface roughness and infiltration potential.
NOAA Atlas 14	Point precipitation depths for various recurrence intervals. Needed for rainfall runoff analyses and determination of peak flows.
Google Earth	Aerial imagery, may be used to supplement land cover analyses and inform hydraulic modeling.

Data Gaps

There are no local weather stations, so rainfall depths and storm intensities may be estimated based on nearby drainage basins and communication with the community for an understanding of typical storm conditions.

Though high-resolution topographic datasets are available, the current cost estimate includes time for a site visit and supplementary survey data.

Survey data should include, at a minimum, cross-sections upstream and downstream of all locations of interest, culvert dimensions and elevations, ditch cross-sections. Coordination with property owners will be required for survey access.

Parcel data, including number of units, inhabitants data, costs associated with previous flood events, and other relevant information will be necessary to support benefits-cost analyses (BCA).

Continued...

Hydrologic and Hydraulic Surface Water Modeling

The scope of work for developing a hydraulic model representative of the existing conditions flooding observed in Lake City involves the development of a debris flow model and a clear-water storm drainage model. The debris flow model will evaluate sediment deposition and clogging of the existing stormwater drainage network to inform the initial conditions of the storm drainage model.

The existing conditions flood model will be leveraged as a base for any proposed flood mitigation alternative analysis.

Existing Conditions Analyses

A hydrology review will be conducted to establish design rainfall and inflow conditions. The runoff potential of the steep debris-flow areas will be evaluated with consideration of tree cover, soil type, and debris flow parameters such as sediment concentration, yield stress, and viscosity.

A detailed 2D HEC-RAS model, the U.S. Army Corps of Engineers' Riverine Analysis Software, will be created for the drainage area, covering an area of less than five square miles. This model will include precipitation inflows and evaluation of debris flow. Necessary data will include detailed topography and site survey data, building footprints, and hydraulic structures.

A pipe network geometry for the developed area will be created using the Storm Water Management Model (SWMM) integrated within the 2D HEC-RAS platform. SWMM will be used to evaluate the existing storm drainage systems within the developed areas. Because SWMM is not capable of evaluating debris flows, the 2D debris flow model will be used to inform the initial conditions (i.e. clogging and capacity) of the stormwater drainage network.

Sensitivity analyses will be performed, focusing on roughness values, initial abstraction, curve number (CN), design storm intensity, and the selection and parameters of non-Newtonian equations (including sediment concentration, yield stress, and viscosity). The sensitivity analyses will be leveraged to support model validation and calibration to known flood conditions.

Finally, coordination with the community will include a one-hour virtual meeting to discuss results and confirm understanding, followed by the preparation of an existing conditions technical memo detailing the hydrology and hydraulics (H&H) analyses and identified flood issues for mitigation.

Debris Flood Mitigation Alternatives Analyses

As part of this Project, a list of potential alternatives will be developed and presented to the community for their input and determination of priorities. It is anticipated that a combination of alternatives will be evaluated for technical feasibility and compliance with BRIC grant requirements.

The existing conditions model will be leveraged as the basis for alternatives analyses. This scope includes consideration of up to four (4) proposed alternatives model geometries. Potential debris flow and flood mitigation alternatives include, but are not limited to:

- Debris fences
- Embankments
- Diversion Channels
- New and/or upsized culverts
- Roadway Paving, curb and gutter design
- Improved stormwater connectivity to the Lake Fork River

Continued...

A desktop environmental analysis, including evaluation of wetlands, threatened and endangered species, historic protected areas, and other relevant environmental concerns will be performed. A tech memo detailing the environmental assessment and identifying permitting requirements will be provided.

A hydraulics report detailing the available data, hydrologic and hydraulic modeling and alternatives analyses will be developed in conjunction with conceptual design drawings.

The construction design drawings will be developed at the 10-percent, 30-percent, and 60-percent design stage for one (1) preferred alternative. A construction cost estimate will be developed for the 60-percent stage for the preferred alternative only.

Application Development

A benefit cost analysis (BCA) will be completed for the 60-percent design alternative using FEMA's online BCA tool.

This grant application is anticipated for Fiscal Year 2027. Permit applications to local, state, and federal agencies may be required and will be submitted after the full project award.