# Evaluating Transit Equity and Access in the Lake Tahoe Basin

Hassle Free Ways to Get Around Lake Tahoe" - Trent Unruh - visitlaketahoe.com

TRPA has identified Community Priority Zones to better understand and address transportation equity in the Lake Tahoe Region. Building on this foundation, this project applies a vector-based exploratory spatial analysis to examine how existing and planned transit infrastructure aligns with the needs of transit-dependent populations.
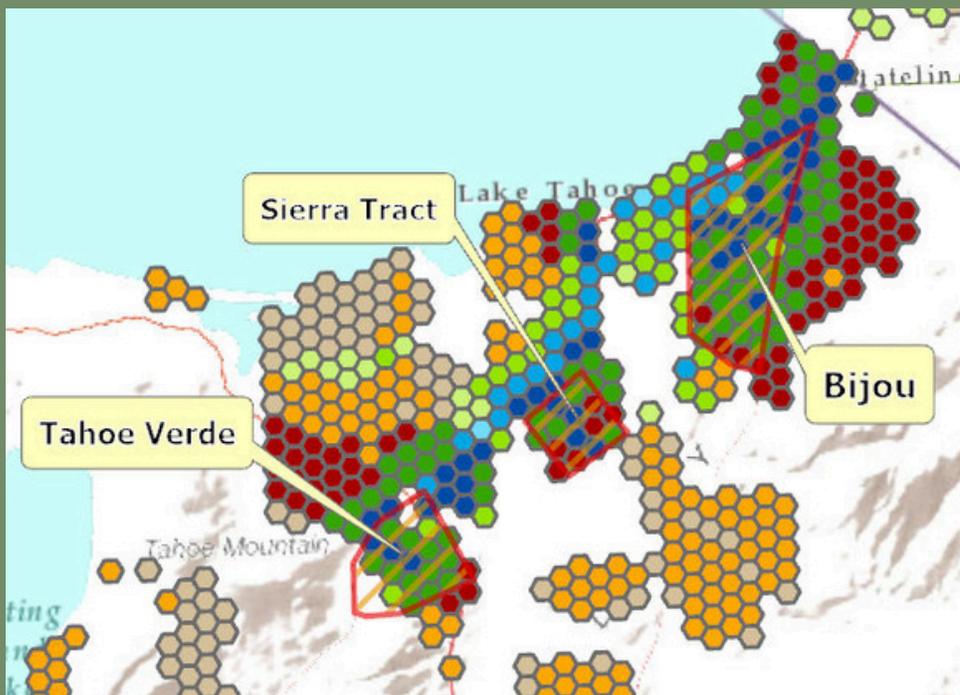
PRIMARY OBJECTIVES

1. **Inventory** and evaluate TRPA demographic and transportation datasets relevant to transit equity in the Lake Tahoe Region
2. **Quantify** spatial patterns of transit need using demographic indicators associated with transit dependency
3. **Assess** transit availability through analysis of bus service coverage, bus stop density, and active transportation infrastructure
4. **Identify** potential transit deserts by comparing transit need and transit availability using a hexagon-based spatial framework

Current and Proposed Transit Resources in the Lake Tahoe Basin

N

Total Transport Projects: 102

Projects that Intersect with Community Priority Zones: 44 of 102 (43%)

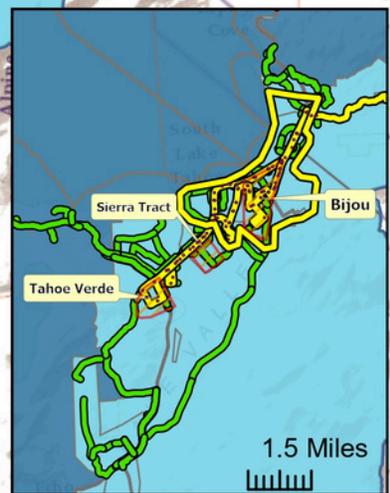**Projects within 1/4 mile of Community Protection Zones: 6 of 102 (6%)**

Kings Beach

Incline

1 Miles

Data Sources:
Tahoe Regional Planning Agency (TRPA) Tahoe Open Data Portal

Data Notes: Census block group-level demographic data (2022) and TRPA transportation and planning datasets. Census data clipped to residential land use areas.

Map Author: Liam Galleher
Date: February 2026

Sierra Tract

Bijou

Tahoe Verde

Legend

- Tahoe Bus Stops
- Community Priority Zones
- Tahoe Transit Routes
- Tahoe Bike Trails
- TRPA Boundary

Transport Projects (ATP, 2020)
- Active Transportation
- Corridor Revitalization/Complete Streets
- Operations & Maintenance
- Technology & Transportation System Management
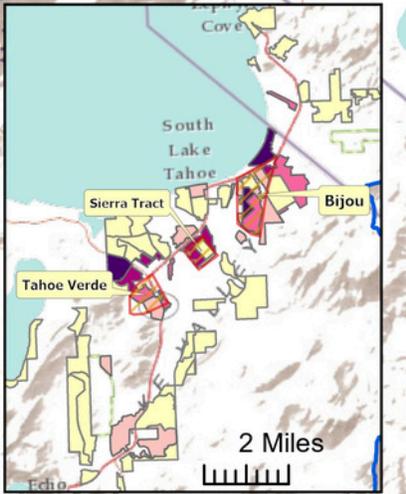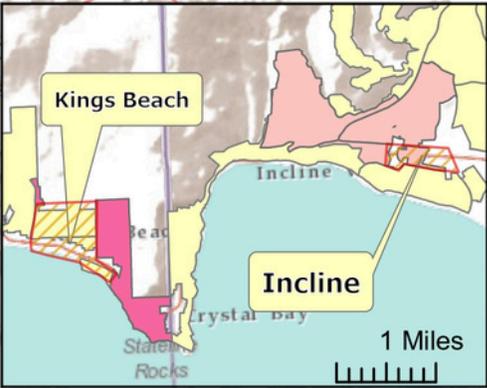- Technology & Transportation System Management
- Transit

1.5 Miles

0 1 2 4 Miles

Households Without Vehicle Access in the Lake Tahoe Basin

N
3 Miles
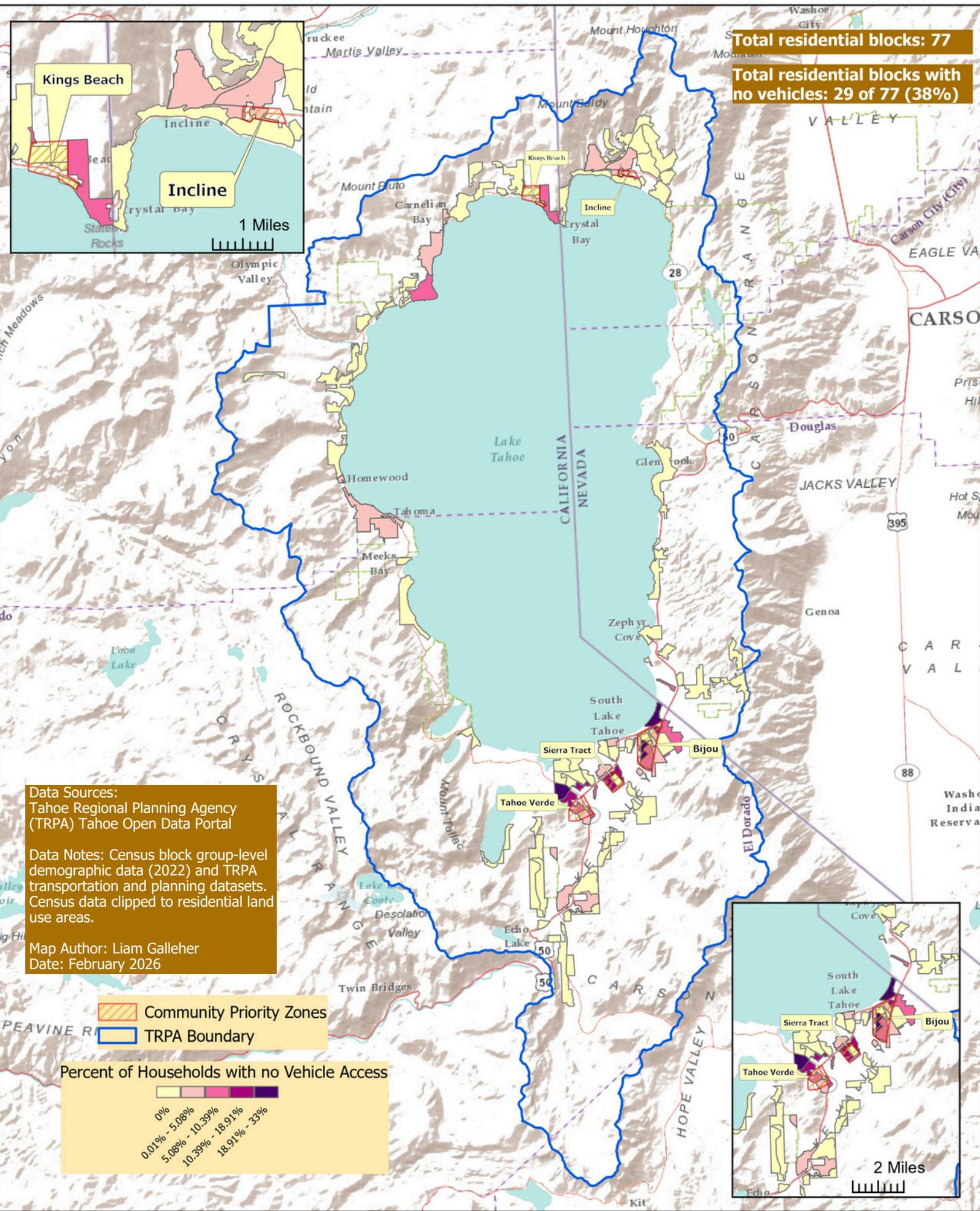
Total residential blocks: 77

Total residential blocks with no vehicles: 29 of 77 (38%)

Inset (upper left)

Kings Beach

Incline

1 Miles

Data block

Data Sources:
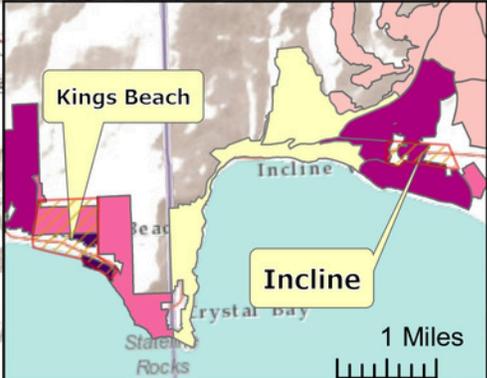Tahoe Regional Planning Agency (TRPA) Tahoe Open Data Portal

Data Notes: Census block group-level demographic data (2022) and TRPA transportation and planning datasets. Census data clipped to residential land use areas.

Map Author: Liam Galleher
Date: February 2026

Legend

Community Priority Zones

TRPA Boundary

Percent of Households with no Vehicle Access

0%
0.01% - 5.08%
5.08% - 10.39%
10.39% - 18.91%
18.91% - 33%

Inset (lower right)

South Lake Tahoe

Sierra Tract

Tahoe Verde

Bijou

2 Miles

Map labels

Mount Houghton
Washoe City
Martis Valley
Truckee
Incline
Mount Baldy
VALLEY
Mount Pluto
Kings Beach
Carnelian Bay
Incline
Crystal Bay
Carson City (City)
EAGLE VALLEY
CARSON
Olympic Valley
28
Lake Tahoe
CALIFORNIA
NEVADA
Glenbrook
Douglas
JACKS VALLEY
Homewood
Tahoma
Meeks Bay
Zephyr Cove
Genoa
CARSON VALLEY
Loon Lake
395
ROCKBOUND VALLEY
CRYSTAL RANGE
Mount Tallac
South Lake Tahoe
Sierra Tract
Bijou
Tahoe Verde
88
Washoe Indian Reservation
Lake Aloha
Desolation Valley
Echo Lake
50
El Dorado
CARSON
Twin Bridges
Zephyr Cove
South Lake Tahoe
Sierra Tract
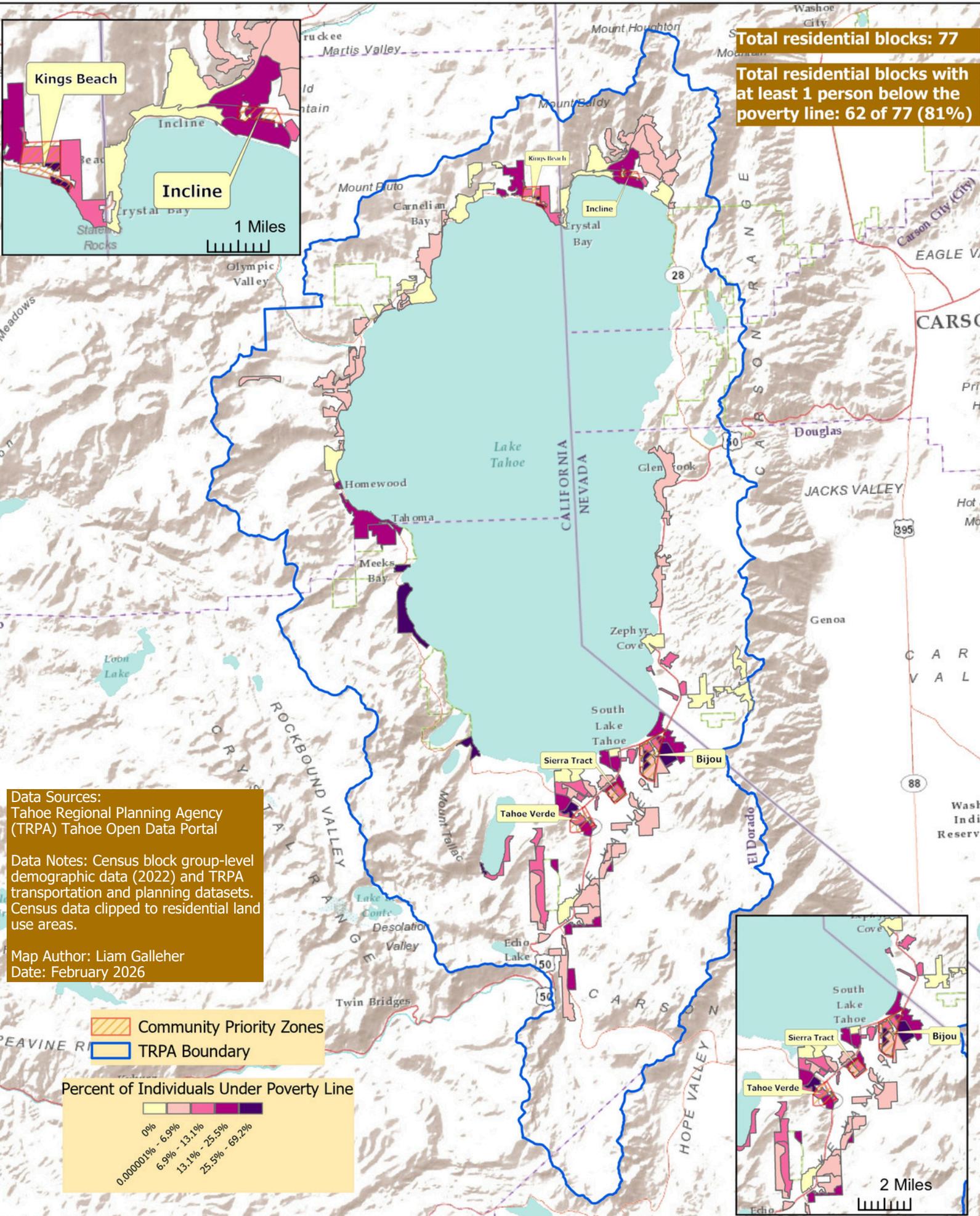Bijou
Tahoe Verde
PEAVINE R
HOPE VALLEY
Kit

Population Living Below the Poverty Line in the Lake Tahoe Basin

N

3 Miles

Total residential blocks: 77

Total residential blocks with at least 1 person below the poverty line: 62 of 77 (81%)

Kings Beach

Incline

1 Miles

Kings Beach

Incline

Crystal Bay

28

CARSON CITY (City)

EAGLE VAL

CARSO

Lake Tahoe

CALIFORNIA
NEVADA

Homewood

Tahoma

Meeks Bay

Glenbrook

Douglas

50

JACKS VALLEY

Genoa

Zephyr Cove

South Lake Tahoe

Sierra Tract

Bijou

Tahoe Verde

88

395

Washoe
Indian
Reserva

Data Sources:
Tahoe Regional Planning Agency (TRPA) Tahoe Open Data Portal

Data Notes: Census block group-level demographic data (2022) and TRPA transportation and planning datasets. Census data clipped to residential land use areas.

Map Author: Liam Galleher
Date: February 2026

Echo Lake

50

50

Twin Bridges

El Dorado

CARSON

HOPE VALLEY

PEAVINE RI

Zephyr Cove

South Lake Tahoe

Sierra Tract

Bijou

Tahoe Verde

2 Miles

///// Community Priority Zones

▬ TRPA Boundary

Percent of Individuals Under Poverty Line

0%
0.000001% - 6.9%
6.9% - 13.1%
13.1% - 25.5%
25.5% - 69.2%
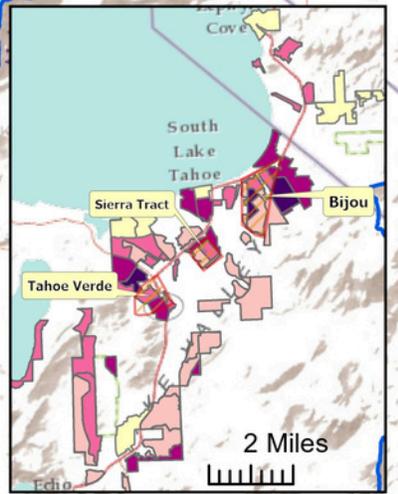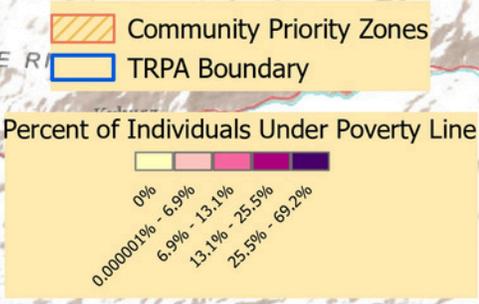
Individuals with a Disability in the Lake Tahoe Basin
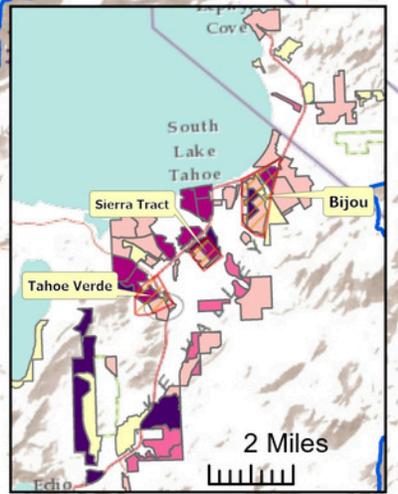
N
3 Miles

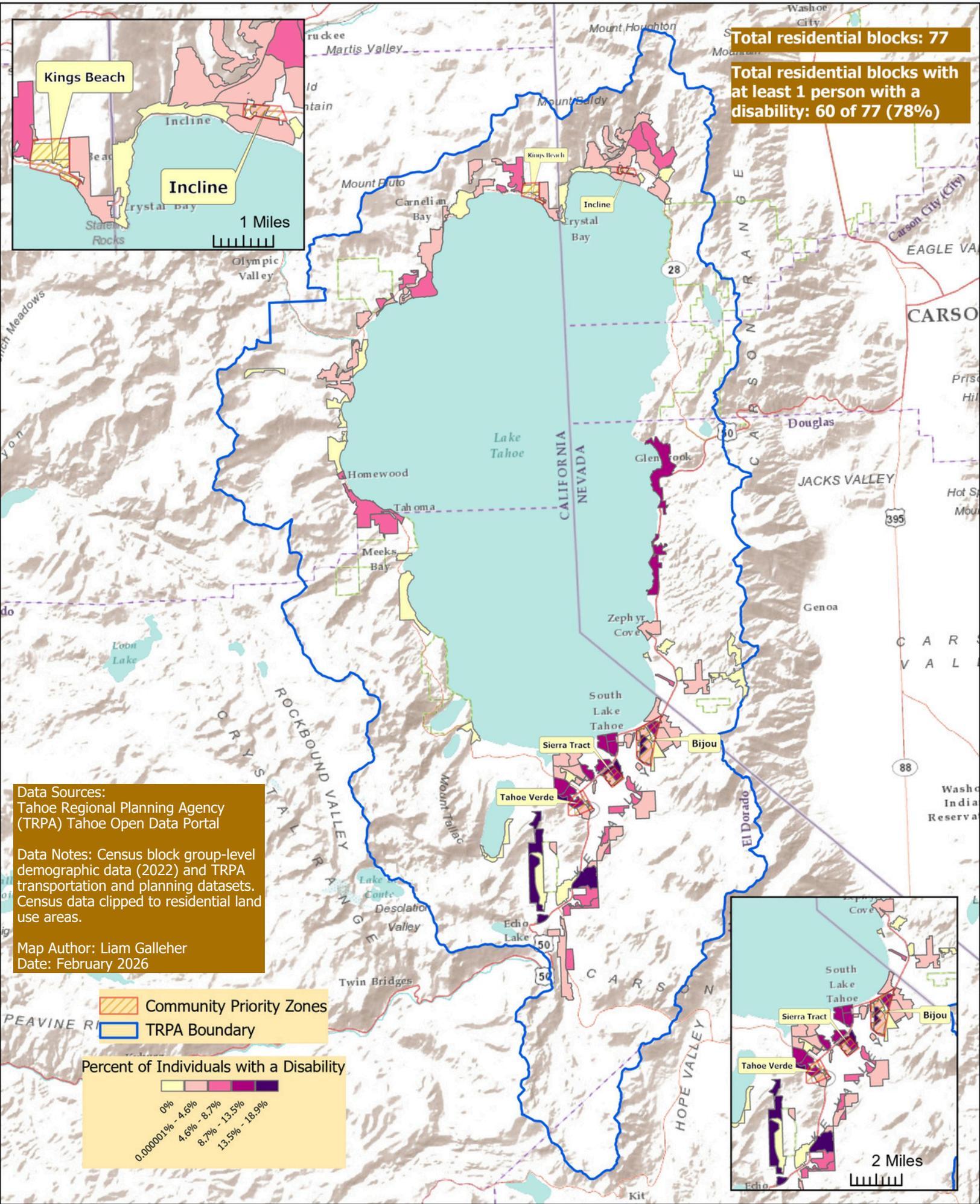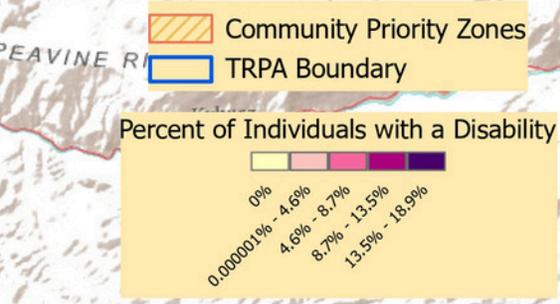**Total residential blocks: 77**

Total residential blocks with at least 1 person with a disability: 60 of 77 (78%)
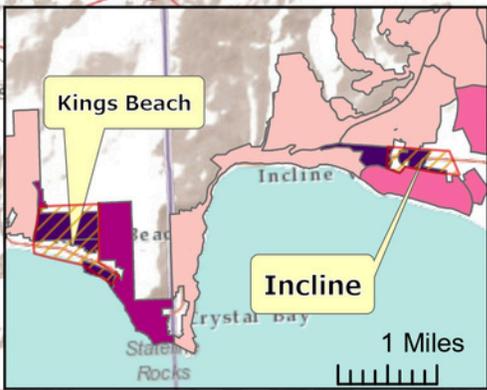
Kings Beach

Incline

1 Miles

Data Sources:
Tahoe Regional Planning Agency (TRPA) Tahoe Open Data Portal

Data Notes: Census block group-level demographic data (2022) and TRPA transportation and planning datasets. Census data clipped to residential land use areas.

Map Author: Liam Galleher
Date: February 2026

Community Priority Zones

TRPA Boundary

Percent of Individuals with a Disability

0%
0.000001% - 4.6%
4.6% - 8.7%
8.7% - 13.5%
13.5% - 18.9%

2 Miles

Black, Indigenous, and People of Color (BIPOC) Population in the Lake Tahoe Basin
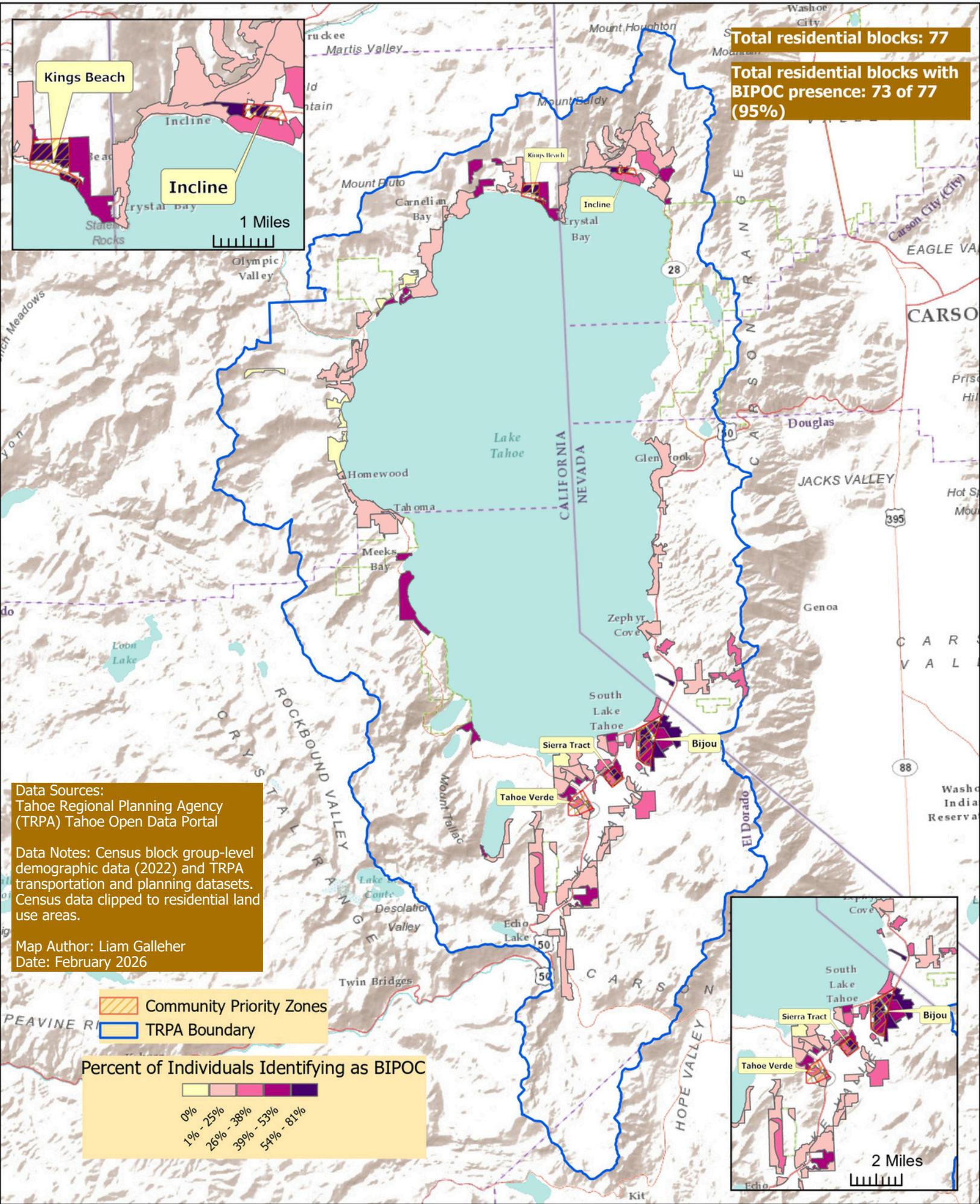
N
3 Miles

Total residential blocks: 77

Total residential blocks with BIPOC presence: 73 of 77 (95%)

Kings Beach

Incline

Kings Beach

Incline

1 Miles

Crystal Bay

Mount Houghton

Mount Baldy

28

Carson City (City)

EAGLE VAL

CARSO

Lake Tahoe

CALIFORNIA
NEVADA

Homewood

Glenbrook

Douglas

JACKS VALLEY

50

Hot Sp
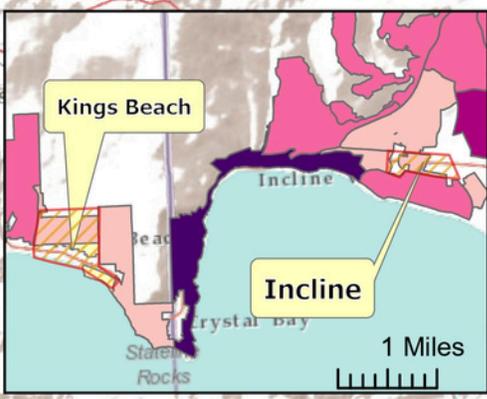
395

Tahoma

Meeks Bay

Zephyr Cove

Genoa

C
AR
VAL

Loon Lake

Data Sources:
Tahoe Regional Planning Agency (TRPA) Tahoe Open Data Portal

Data Notes: Census block group-level demographic data (2022) and TRPA transportation and planning datasets. Census data clipped to residential land use areas.

Map Author: Liam Galleher
Date: February 2026

South Lake Tahoe

Sierra Tract

Bijou

88

Washo
India
Reserva

Tahoe Verde

El Dorado

Echo Lake

50

Twin Bridges

50

Zephyr Cove

South Lake Tahoe

Sierra Tract

Bijou

Community Priority Zones

TRPA Boundary

Tahoe Verde

PEAVINE RI

Percent of Individuals Identifying as BIPOC

0%   1% - 25%   26% - 38%   39% - 53%   54% - 81%

2 Miles

HOPE VALLEY

Kit

Echo
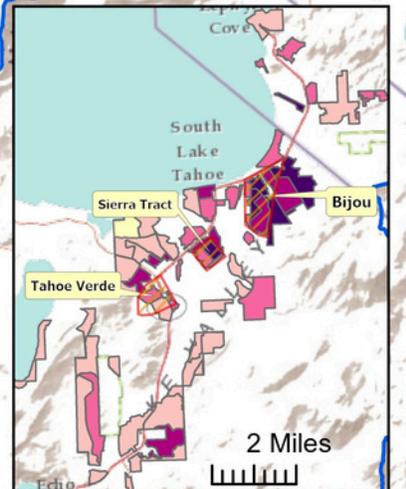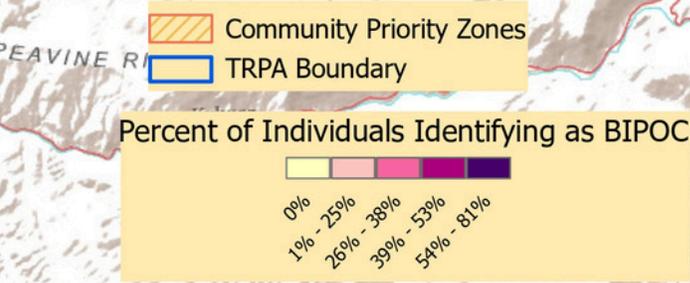
Senior Population in the Lake Tahoe Basin

N
3 Miles

Kings Beach

Incline

Total residential blocks: 77

Total residential blocks with at least 1 person above the age of 65: 76 of 77 (98.7%)

1 Miles

Community Priority Zones
TRPA Boundary

Percent of Individuals Over the Age of 65

0%
0.01% - 21.8%
21.8% - 31.4%
31.4% - 50.8%
50.8% - 78.1%

Kings Beach

Incline

Crystal Bay

Carnelian Bay

Homewood

Tahoma

Meeks Bay

Glenbrook

Zephyr Cove

South Lake Tahoe

Sierra Tract

Bijou

Tahoe Verde

Echo Lake

Lake Tahoe

CALIFORNIA
NEVADA

CARSON RANGE

Douglas

JACKS VALLEY

Genoa

CRYSTAL RANGE

ROCKBOUND VALLEY

Mount Tallac

Lake Aloha

Desolation Valley

Twin Bridges

HOPE VALLEY

CARSON

EL DORADO

Zephyr Cove
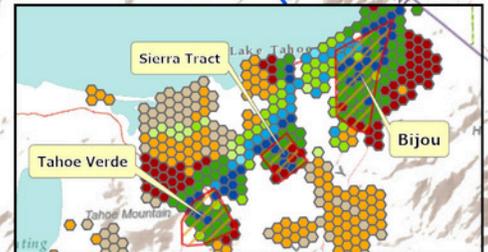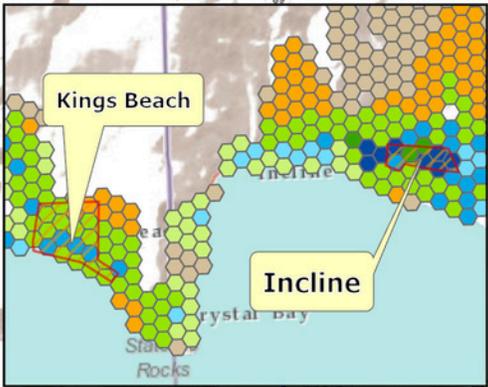
South Lake Tahoe

Sierra Tract

Bijou

Tahoe Verde

2 Miles

Transit Need and Transit Availability in the Lake Tahoe Basin
Identifying potential transit deserts using a hexagon-based analysis

N

2 Miles

Kings Beach

Incline

Kings Beach

Incline

Data Source: Tahoe Regional Planning Agency (TRPA) Tahoe Open Data Portal
Notes: Transit need and availability indices calculated at the hexagon level using demographic and transportation datasets.
Author: Liam Galleher
Date: February 2026

Sierra Tract

Bijou

Tahoe Verde

Sierra Tract

Bijou

Tahoe Verde

Community Priority Zones

TRPA Boundary

Transit Need — High, Medium, Low

Transit Availability — Low, Medium, High
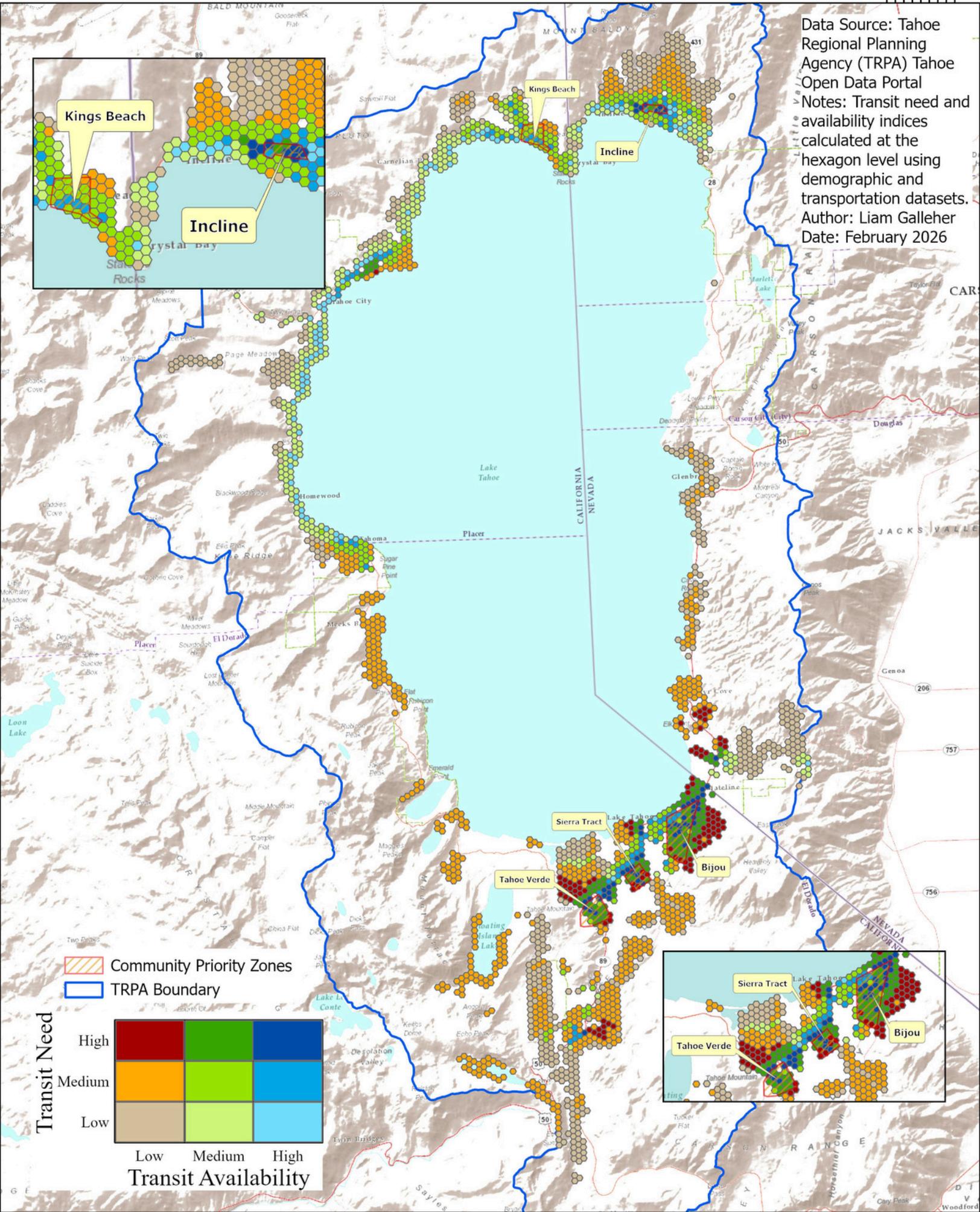
Interpretation of Results: Transit Need and Transit Availability

Distribution of Transit Need Index Scores
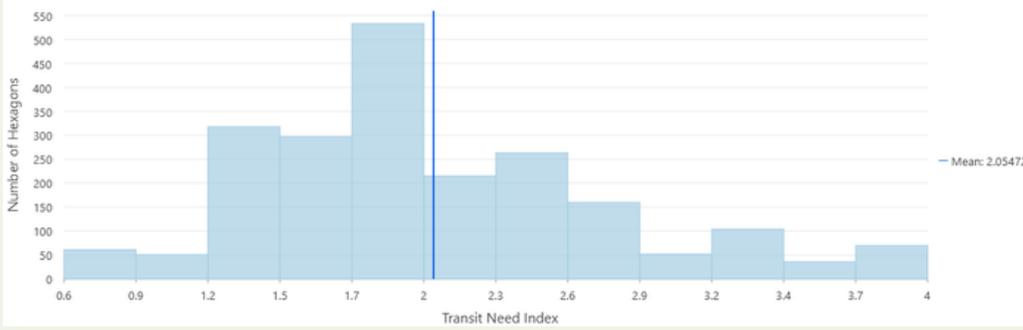
Distribution of Transit Availability Index
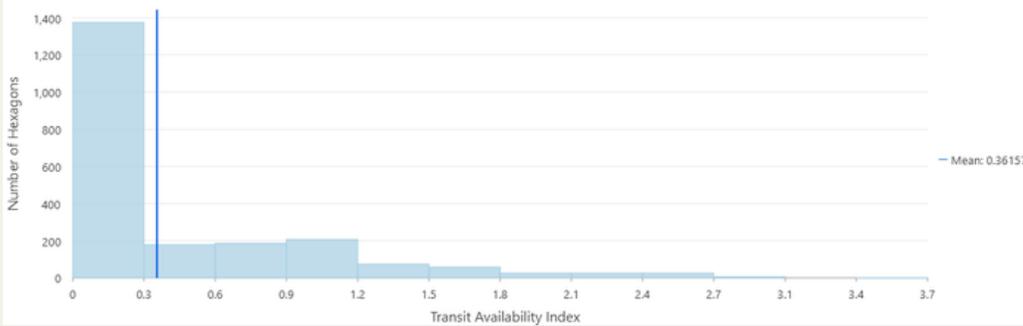
OVERVIEW
The bivariate choropleth map comparing transit need and transit availability reveals clear spatial patterns across the Lake Tahoe Region. Areas of high transit need cluster in established town centers and residential corridors, particularly in South Lake Tahoe, Kings Beach, and Incline Village. These areas are characterized by higher concentrations of populations more likely to rely on public transit, including households without vehicles, individuals living below the poverty line, individuals with disabilities, and higher overall population density. Transit availability is more unevenly distributed. While many town-center hexagons exhibit moderate to high availability, large portions of the region display low transit availability, particularly in more dispersed residential areas. The transit availability index histogram shows a distribution skewed toward lower values, indicating that high levels of transit connectivity are spatially limited. When transit need and availability are analyzed together, several hexagons emerge as high-need / low-availability areas, representing potential transit deserts. These locations warrant particular attention, as they reflect areas where social vulnerability and limited transit access overlap.

COMMUNITY PRIORITY ZONES
Community Priority Zones (CPZs) generally correspond with areas of elevated transit need. Many CPZs also coincide with moderate to high transit availability, particularly in South Lake Tahoe, where bus stop density and active transportation infrastructure are relatively concentrated. However, the bivariate map also reveals potential transit deserts outside of designated Community Priority Zones. Several high-need / low-availability hexagons occur in residential areas adjacent to, but not formally included within, CPZ boundaries such as Bijou and Sierra Tract. This suggests that while the CPZ framework captures many high-need communities, it may not fully encompass all areas where residents face barriers to transit access. These findings highlight the value of a region-wide, hexagon-based analysis for identifying localized disparities that may be overlooked by zone-based approaches alone.

LIMITATIONS
This analysis is a preliminary, exploratory assessment and is subject to several limitations. First, the transit need index assumes equal weighting of all demographic indicators, when in reality some factors like "zero-vehicle households" may have a stronger influence on transit dependency than others. Second, the analysis focuses on spatial access and infrastructure presence, rather than service quality. Additionally, active transportation coverage was measured using infrastructure length and did not account for current facility condition, or safety. These factors may influence actual accessibility and should be considered in future analyses.

RECOMMENDATIONS
This analysis is a preliminary, exploratory assessment and is subject to several limitations. First, the transit need index assumes equal weighting of all demographic indicators, when in reality some factors like "zero-vehicle households" may have a stronger influence on transit dependency than others. Second, the analysis focuses on spatial access and infrastructure presence, rather than service quality. Additionally, active transportation coverage was measured using infrastructure length and did not account for current facility condition, or safety. These factors may influence actual accessibility and should be considered in future analyses.

Methods Part 1:
Descriptive Statistics and Mapping

DATA SOURCES

All spatial datasets used in this analysis were obtained from the Tahoe Regional Planning Agency (TRPA) Tahoe Open Data Portal, including demographic, transportation, and planning layers. The spatial extent of the analysis was limited to the TRPA jurisdictional boundary. All spatial processing, analysis, and visualization were conducted using **ArcGIS Pro**. The primary unit of analysis for Part 2 was a hexagon-based demographic tessellation layer provided by UCLA Geospatial. This layer integrates U.S. Census block group–derived demographic estimates with zoning data. Only hexagons with a residential population greater than zero were included in the transit desert analysis to ensure that results reflected inhabited areas.

TRANSIT RESOURCES AND COMMUNITY PRIORITY ZONES (MAP 1)

Current and proposed transit resources were mapped using TRPA transportation datasets, including Tahoe bus routes, bus stops, and Regional Transportation Plan (RTP) projects associated with the Active Transportation Plan, Transit Master Plan, and TART Systems Plan Update. Community Priority Zones and the TRPA jurisdictional boundary were included for spatial context. To quantify project overlap with Community Priority Zones, the Select By Location tool was used with RTP projects as the target features and Community Priority Zones as the selecting features, using the intersect spatial relationship. Selected projects were exported to a new feature class and counted. A second selection was performed using a ¼-mile buffer around Community Priority Zones, created with the Buffer tool, to identify projects within walking distance. Percentages were calculated by dividing selected project counts by the total number of RTP projects.

DEMOGRAPHIC CHOROPLETH MAPPING (MAPS 2–6)

Demographic variables used to identify Community Priority Zones were mapped at the U.S. Census block group level (2022), clipped to residential areas using the TRPA Regional Land Use layer and the Clip tool to better represent inhabited areas.

The following demographic variables were mapped:

- Percentage of households without vehicle access
- Percentage of population living below the poverty line
- Percentage of individuals with a disability
- Percentage of population identifying as Black, Indigenous, or People of Color (BIPOC)
- Percentage of population aged 65 and older

Where raw counts were provided, percentage fields were calculated using the Calculate Field tool with Python expressions (*example code:* With_Disab / Total_popu * 100). Each choropleth was classified into five classes, with block groups containing a value of zero assigned to the first class, and remaining values divided into quartiles based on field statistics. All demographic maps included two inset map frames focusing on Community Priority Zones in South Lake Tahoe and Incline Village–Kings Beach.

Methods Part 2:
Transit Desert Analysis

STUDY UNITS

Transit desert analysis was conducted using a hexagon-based demographic tessellation layer, integrating Census demographic estimates and zoning information. Hexagons with a residential population of zero were excluded using an attribute selection.

TRANSIT NEED INDICATOR SCORING

Transit need was defined using five indicators: BIPOC rate, poverty rate, disability rate, zero-vehicle household rate, and total population per hexagon. For each indicator, hexagons with a value of zero were assigned a score of 0. Quartile thresholds (Q1, median, Q3) were calculated using field statistics for non-zero values. Scores were assigned using Calculate Field with Python conditional expressions, for example:

```
0 if !hex_busbuffer_int_Statistics2.SUM_covered_area! is None else
!hex_busbuffer_int_Statistics2.SUM_covered_area!/!main_ExportFeatures.hex_area!
```

A Transit Need Index was calculated by averaging the five indicator scores for each hexagon.

TRANSIT AVAILABILITY INDICATORS AND SCORING

Transit availability was quantified using three connectivity indicators:
  1. Bus Service Coverage
Bus stops were buffered by ¼ mile using the Buffer tool. Buffers were intersected with hexagons using Intersect, and buffered area within each hexagon was summarized using Summary Statistics. Coverage was calculated as the proportion of hexagon area covered by the buffer.
  2. Bus Stop Density
Bus stop counts per hexagon were calculated using a Spatial Join with hexagons as target features. Density scores were derived directly from stop counts.
  3. Active Transportation Coverage
Winter-maintained active transportation facilities were intersected with hexagons. Segment lengths were calculated using Calculate Geometry, and total length per hexagon was summarized using Summary Statistics.

Bus service and active transportation indicators were scored using the same quartile-based method as transit need indicators. A Transit Availability Index was calculated as the average of the three connectivity scores.

BIVARIATE CLASSIFICATION AND VISUALIZATION

Transit Need and Transit Availability indices were reclassified into three classes (low, medium, high) using natural breaks. A bivariate classification field was calculated using the expression:

(!need_class! * 10) + !avail_class!

This encoding produced nine unique bivariate classes representing all combinations of need and availability. A bivariate choropleth map was created to identify potential transit deserts, with Community Priority Zones and the TRPA boundary included for reference.

EXPLORATORY OUTPUTS

Histograms of the Transit Need Index and Transit Availability Index were generated using ArcGIS Pro charting tools to assess index distributions and support interpretation of spatial patterns.

References

Aman, J. J. C., & Smith-Colin, J. (2020). Transit deserts: Equity analysis of public transit accessibility. Journal of Transport Geography, 88, 102850.

Tahoe Regional Planning Agency. (2023). Transportation Equity Study. TRPA.

Tahoe Regional Planning Agency. (2020). Regional Transportation Plan. TRPA.

Tahoe Regional Planning Agency. (2024). Tahoe Open Data Portal: Demographic and transportation datasets. TRPA.

United States Census Bureau. (2022). American Community Survey 5-year estimates. U.S. Department of Commerce.

All spatial analyses and visualizations were conducted in ArcGIS Pro using datasets obtained from the TRPA Tahoe Open Data Portal.