Population Distribution and Monitoring Proximity

Methodology and Definitions

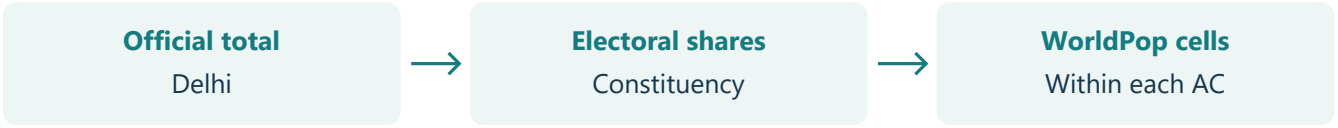
The daily air-quality reports ask two population questions: how people are distributed around the monitoring network, and how many live near monitors reporting poor air. This note explains those estimates and the terms used in the reports.

Three inputs, three different roles

The official projection sets the total. The Delhi NCT total for 2026 is **2,26,74,000 residents**, or 2.2674 crore, projected for 1 July 2026.[1]

Electoral shares allocate it to constituencies. Each of the 70 Assembly Constituencies receives a share in proportion to its registered electors in the 2025 election data.[1]

WorldPop places people within each constituency. The constrained 2026 grid, release R2025A v1, provides relative densities in cells approximately 100 m wide.[1]



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These estimates concern residents. They do not count the people travelling, working or attending school near a monitor at a particular hour.

[1] Sources: Technical Group on Population Projections, July 2020, Table 11, printed p84; 2025 Delhi electoral data; WorldPop 2026 constrained R2025A v1. Sources checked 18 October 2026.

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Allocating population to grid cells

First allocate the official total

```
P_AC = P_Delhi x E_AC / sum(E_AC)
```

P_Delhi is the official population projection for Delhi NCT. **E_AC** is the estimated registered-elector count in a constituency. **P_AC** is the population allocated to it.

The adopted elector counts are calculated from votes cast divided by the published turnout fraction, then rounded. They are checked against the CEO Delhi roll summary. Votes cast are not themselves used as population shares.[1]

Then distribute that allocation within the constituency

```
P_cell = P_AC x G_cell / sum(G_in_AC)
```

G_cell is the WorldPop count in one eligible cell. The denominator sums WorldPop counts over eligible cells in the same constituency. WorldPop therefore supplies the shape; it does not set the city or constituency total.[2]

Cells keep the raster's native alignment. A cell belongs to Delhi when its centre falls inside the NCT boundary. Small gaps in the constituency boundaries take the nearest constituency polygon, measured in UTM zone 43N, before allocation.

Each constituency is normalised after clipping to Delhi. Its cells must sum to its full allocation, and all constituencies together must sum to the official city total. Missing data or an empty constituency stop the calculation.

The same official 1 July projection is used throughout a reporting year. The 2026 grid and 2025 electoral shares remain separate, explicitly dated inputs.

[1] Sources: 2025 Delhi Assembly turnout data and CEO Delhi elector summary, 17 January 2025; Technical Group, July 2020, Table 11, p84. [2] WorldPop R2025A v1 release documentation; checked 18 October 2026.

Station zones and population weights

A zone assigns every place to one monitor

A Voronoi zone is the patch of Delhi assigned to a station point by the nearest-station map. The zones meet without overlap and partition Delhi. A large zone indicates wider spacing between monitors; it does not establish that the air is more polluted.

The adopted network has **53 zones containing 55 mapped monitors**. Pusa and Mundka each group two nearby monitors. Reporting monitors without mapped coordinates remain in the station readings but cannot contribute to mapped population estimates.[1]

A population weight describes a zone's share

```
weight_zone = P_zone / sum(P_zones)
```

A zone's population is the sum of the allocated residents in its grid cells. Its weight is that population divided by the population across the mapped zones.

The weighted average follows those shares

```
weighted_value = sum(weight x zone_value)
```

Available monitors sharing one zone are averaged before that zone is weighted. If some zones have no usable reading, weights are normalised over the zones that reported. The available weights then sum to one.

For a year-on-year pollution comparison, the same adopted weights are applied on both sides, using the stations eligible for that comparison. A change of population model must not be mistaken for a change in pollution.

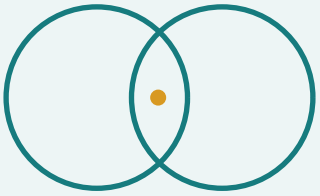
A weighted city average gives more influence to readings near more residents. It does not correct a monitor's calibration or establish the concentration at every home.

[1] Source: adopted station geometry, population surface and station-weight tables, verified 18 October 2026. [2] Population inputs: official July 2020 projections, 2025 electoral shares, WorldPop 2026 R2025A v1.

Proximity circles and network coverage

Circles and zones answer different questions

A station's catchment is its circular proximity area, clipped to Delhi NCT. Its population includes everyone modelled within that circle, even where another station is nearer. A zone instead allocates every place exclusively to one station.



Count the overlap once.
Separate station circles overlap. Network coverage uses their combined area, not the sum of station headcounts.

The thresholds describe geographical proximity

The reports use 0.5 km, 2 km and 4 km thresholds. EPA neighbourhood-scale guidance informs the choice of 4 km. It does not prescribe a universal radius within which a monitor represents every resident's air.[1]

Network coverage counts each resident once

Network coverage is the share of modelled residents whose nearest mapped monitor is within the stated distance. Equivalently, the combined proximity areas cover those residents once. Distances use grid-cell centres; discretisation can create small differences at a circle's edge.

People near Poor or worse

For the daily count, include zones where the highest screened monitor AQI exceeds 200. Combine their 4 km circles, clip to Delhi, and sum the allocated cell populations once. Existing quality screens determine which monitor readings qualify.[2]

This is an estimate of residents living near those readings. It is not a measurement of each person's exposure.

[1] Source: EPA, 40 CFR Part 58, Appendix D, sections 1.2 and 4.7; checked 18 October 2026. [2] Population-based coverage approach: Manoj Kumar, India Air Quality & Energy Insights. Calculation definitions verified against the adopted population method, 18 October 2026.

Definitions and limits of interpretation

Reach km

The greatest distance to a nearest monitor among the populated grid cells assigned to it by the distance calculation. Reach is not a validated representation radius.

Avg km

The population-weighted mean distance from residents in a nearest-monitor zone to that monitor. It is a distance statistic, not a pollution average.

Population weight

A station zone's share of the modelled resident population. It differs from the station's 4 km circle population, because circles overlap and zones are exclusive.

WorldPop grid

A modelled map of resident population in small cells. The year 2026 identifies the estimate's target year; it does not mean that a new census counted every cell in 2026.

Electoral anchor

The constituency allocation based on registered electors. It assumes a common residents-per-elector ratio. Differences in age structure, registration and migration can cause local allocation errors.

What the checks establish

Population conservation, correct spatial alignment and consistency across outputs can be tested. Settlement and water-cover maps provide plausibility checks. Neither these checks nor electoral anchoring proves exact station-level headcounts.

[1] Sources: adopted distance, catchment and weighting calculations, checked 18 October 2026; WorldPop Global2 release documentation, R2025A v1. Electoral input: 2025 Delhi election data.

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Sources and reproducibility

The exact WorldPop release is retained because its R2025A product is labelled alpha and may be updated. A new download is not silently substituted. The official annual total and the 2025 electoral shares remain independent inputs.

Primary sources

Official population projections, July 2020, Table 11, printed page 84

CEO Delhi constituency elector summary, 17 January 2025

WorldPop constrained 2015 to 2030 catalogue, R2025A v1

WorldPop India 2026 constrained 100 m population raster

WorldPop Global2 methods, assumptions and limitations

EPA monitoring-network design, 40 CFR Part 58, Appendix D

Manoj Kumar: Delhi's air-quality monitoring network

Identity of the adopted raster

India 2026 constrained count raster, Global2 R2025A v1. File: ind_pop_2026_CN_100m_R2025A_v1.tif.

SHA256: 5358e164ba226be7049d4b1549ae6c44
096e7ceb6649facebd1af15fbe196c21

Checks recorded at adoption

All 70 constituency allocations preserve their electoral shares and sum to 2,26,74,000 residents for 2026. Station coordinates and pollution-quality screens are held fixed. The largest station-weight changes are inspected against settlement and water cover. These checks support reproducibility and plausibility; they are not a new population survey.

[1] Sources: named primary documents and adopted calculation records, checked 18 October 2026. WorldPop data are licensed CC BY 4.0. This note describes the population basis adopted on 18 October 2026.