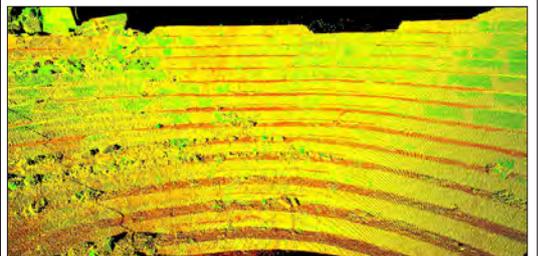


2008



Portions of the 13th century stepped-well, considered sacred, collapsed in July 2008. Following detailed studies, 3-D High Definition Survey, Ground Penetrating Radar Survey (GPRS) and structural analysis, conservation works have now commenced.



## CONSERVATION OF HAZRAT NIZAMUDDIN'S BAOLI

### TASK:

Reconstruction of the collapsed wall of the baoli and conservation of the remaining part to avoid any future decay

### PURPOSE:

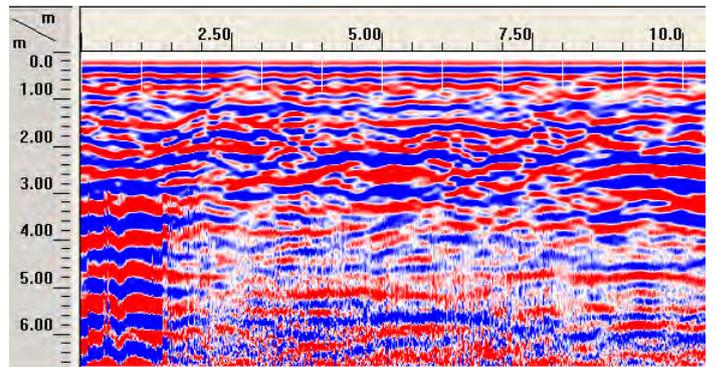
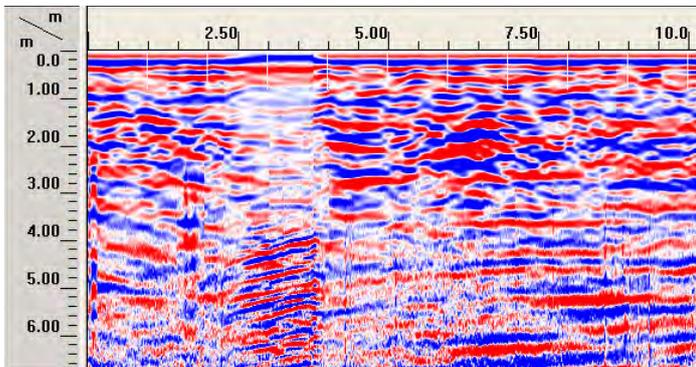
- Conservation of this extremely significant monument of National importance.
- Safety of adjoining structures, pilgrims to the Dargah.

### ACTION TAKEN:

- Several community meetings held with local stakeholders to plan conservation works which will bring in significant inconvenience for movement to the Dargah for a 3-4 month period.
- Conservation works on the partially collapsed structure are further complicated by the high density of new structures that are built all around the Baoli and by the steady inflow of pilgrims; over 400 of who walk over the collapsed portion every hour.
- Since the partial collapse in August 2008 the following works have been undertaken:
  - Draining out the water from Baoli as a continuous process
  - Structural investigations and recommendations for the structure
  - 3D High Definition Survey of the monument
  - Constant monitoring by fixing over 200 glass tell-tale on the wall surfaces to monitor any movement.
  - Geo-technical investigations of the baoli to understand the original construction details and to analyse the actual condition of strata behind the wall. Results are expected by mid-December 2008.
  - Structural supports on the corridor above the collapsed wall to provide minimum safety for pilgrims who continue to use this route.
  - Diverting the drain bring water from abulution water into the baoli by building a sump
  - Rebuilding alternate accommodation for the house that stands immediately above the collapsed portion as this would require to be dismantled to carry out any conservation works below.

### NEXT STAGE:

- Dismantle remaining portions of the house standing over the collapsed portion as the alternate house is nearing completion.
- Stop movement of Pilgrims from the corridor along the Baoli.
- It has been established that the lower level of Baoli walls were covered with a thick layer of chemical epoxy in 2002-3; this has led to considerable buckling of the walls as a result of hydraulic pressure. It is proposed to carefully remove this epoxy layer.
- Reconstruct the missing portion of collapsed masonry
- Define a systematic conservation programme when the results of the Geo-technical studies become available.
- Providing structural supports near the collapsed wall before reconstruction of the wall
- Raking and repointing of the wall using appropriate lime mortar.
- Fixing stone lattice screens on the arches of the corridor along the Baoli.



### TASK:

- Impact Echo test
- Ground Penetration Radar Survey
- Chemical analysis of the mortars
- Geotechnical Investigations

### PURPOSE:

- To determine the original constructional details, thickness of the wall and back filling.
- To locate the cavities, flaws etc. in the random rubble masonry
- Analysis of the condition of the surrounding soil
- To determine the main cause of failure and to identify future threats.

### ACTION TAKEN:

- Impact Echo test carried out at 1800 points on three walls on a grid pattern
- GPRS done on the top of the wall carried out traverses different frequencies on the top of the masonry wall and slightly away from it
- Mortar samples are collected from the site for chemical analysis to identify the original composition of lime mortar
- Boring carried out at two locations up to a depth of 23 m to collect the soil samples for the tests
- The field data is under analysis process by the experts.

### NEXT STAGE:

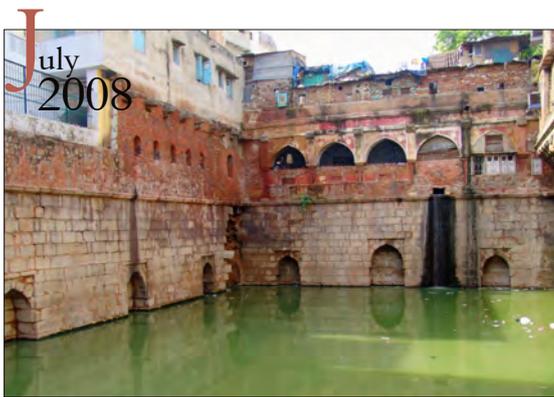
- Data will be analysed to identify the original filling material and construction details
- Appropriate conservation strategy would be written out and discussed prior to implementation

*The GPRS study helped reveal the voids behind the stone walls which helped in planning the conservation works.*

2009



*For over seven centuries millions have used water from this stepped well; in keeping with requests from the Dargah Committee and local community, the conservation works on the collapsed portions of the baoli were coupled with a mammoth effort to clean the step-well of all debris, 700 years of accumulated dust. The manual lifting of sludge required over 8000 man-days of work.*



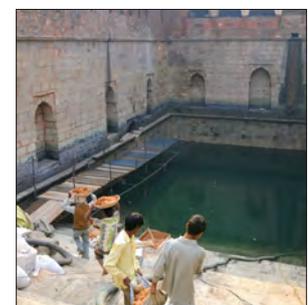
Built during the lifetime of Hazrat Nizamuddin Auliya in the years 1321-22, this is the only Baoli in Delhi which still has underground springs. In July 2008, portions of the Baoli collapsed and after exhaustive scientific analysis and consultation with the community, conservation works to rebuild the collapsed portion could commence. For the first time in centuries, the baoli was de-silted to its original depth of 80 feet below the ground level and major repairs including the removal of the 20<sup>th</sup> century epoxy layer carried out



Craftsmen completing the reconstruction of the collapsed portion reusing the original stone. This required exhaustive studies, analysis, strict supervision, traditional materials and the most skilled and determined craftsmen to work tirelessly



Over 700 years of accumulated debris was removed from the baoli



Work is now ongoing to repair vault. The underground passage was originally used to access the Baoli from the courtyard of the mosque, following wuzu. Though this passage is now, portions discovered during conservation works are being repaired, including re-installing collapsed keystones of the vaulted roof.

### TASK:

Conservation of Hazrat Nizamuddin Baoli

### PURPOSE:

- Repair collapsed portions of Baoli
- Remove modern materials such as chemical epoxy that have accelerated the decay process
- Enhance the setting of the baoli, especially by replacing modern materials used in public areas with traditional materials.

### ACTION TAKEN:

#### Structural analysis

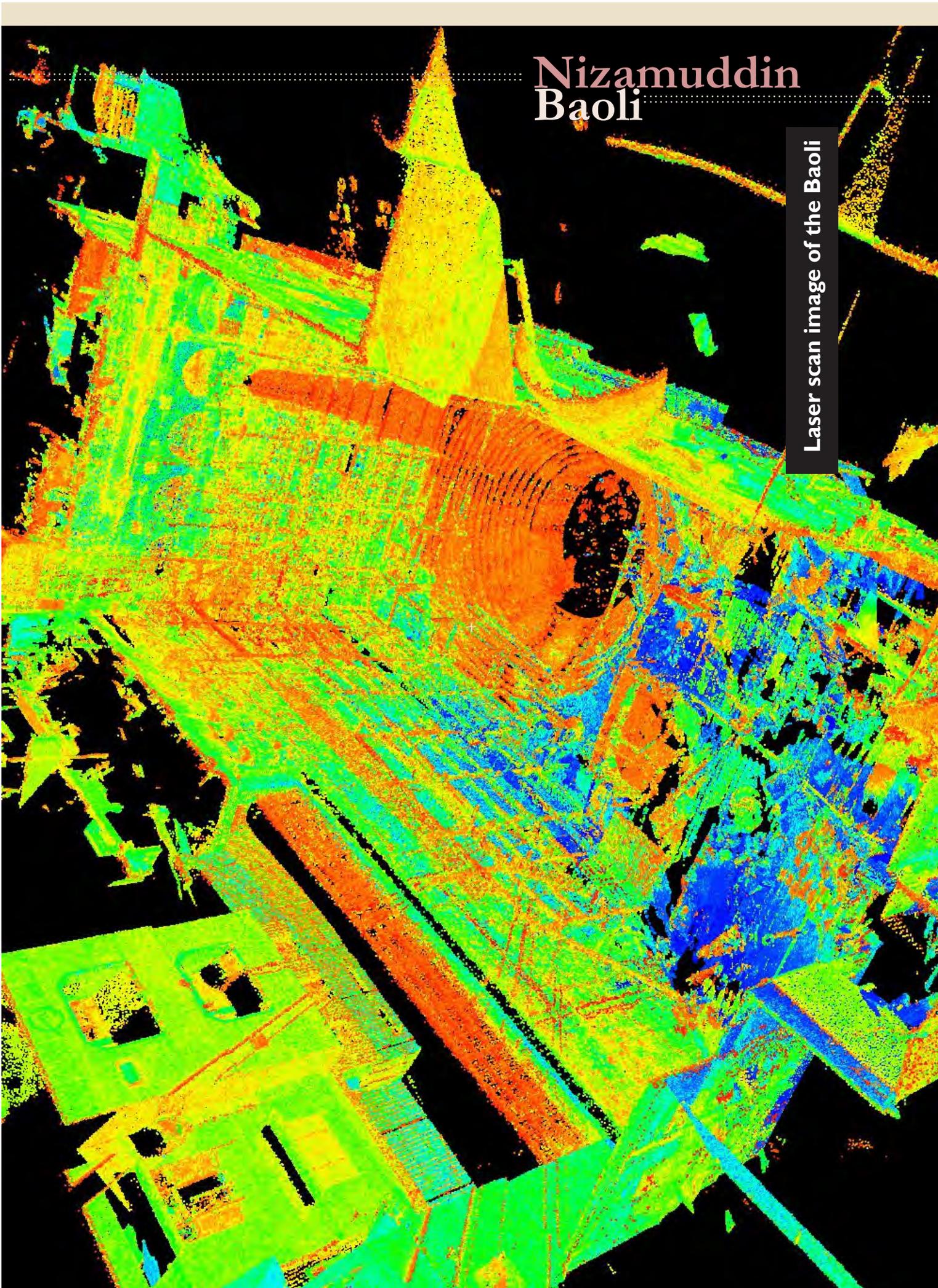
- Following the collapse of a portion of the Baoli in July 2008, detailed geotechnical studies, structural analysis was carried out by national and international experts as a precursor to conservation works.
- To carry out an accurate condition assessment, sectional profiles were created using 3 D laser scanning data that allowed actual structural deformations to be mapped.
- A structural analysis of the structures surrounding the baoli, especially the southern arcade was also carried out.

#### Repair of the collapsed wall

- The rebuilding of the collapsed wall was a priority especially since thousands of pilgrims use the passage over the collapsed portion to reach the Dargah.
- As a first step, temporary shoring was installed to prevent further collapse and safeguard pilgrims.
- Conservation works could commence only once the structure built over the collapsed portion was demolished. This demolition was carried out after AKTC had built an alternate dwelling unit for the family.
- For four weeks during critical conservation works, the passage leading to the Dargah had to be closed for pilgrims, possible only with significant community support.
- The collapsed portion was rebuilt and portions of the Baoli dismantled prior to rebuilding using traditional building materials and building techniques. Works were carried out from sunrise to sunset for over six months to rebuild this portion.
- Ashlar facing stones which had fallen in the Baoli and were buried in the sludge were lifted manually collected and reused.
- Conservation works also required the careful and painstaking removal of a 3-5 cm thick epoxy layer applied to the Baoli in 2002 by the Delhi Jal Board. This treatment used for concrete tanks was inappropriate for the historic structure and accelerated decay.

# Nizamuddin Baoli

Laser scan image of the Baoli





- Following the rebuilding of the collapsed portion and the removal of epoxy, the entire wall surface was grouted and re-pointed with lime mortar to fill the underlying voids identified in the GPRS study.
- During conservation works a passage leading from the Baoli to the Mosque at the Dargah, possibly used by the saint, Hazrat Nizamuddin Auliya was discovered.
- Works are now ongoing to remove rubble filled in this passage and carry out required repairs to the vaulted roof of this passage – portions of which have collapsed.

#### De-silting of the well

- Conservation works on the collapsed portion were an opportunity to de-silt the well of the debris accumulated over hundreds of years. This was done manually while ensuring that a few inches of water remained in the Baoli to respect the community sentiment and allow the fish to remain.
- A water quality test of the stagnant Baoli water before reconstruction revealed very high levels of E coli indicating sewage contamination. Following re-laying over 100 m of sewer pipes, by AKTC, as part of the conservation initiative, the ground water sources as well as the well water were retested post reconstruction and it was found that the water quality had considerably improved with a drastic reduction in E-Coli levels .

As part of conservation works, the water from the Wuzu area – draining into the Baoli was re-routed in a complex procedure that required a pumping station to be installed in the narrow lanes leading to the Dargah.



*Removing epoxy layer and cement mortar*

#### **NEXT STAGE:**

- The discovered passage that originally led from the Baoli to the Mosque in the Dargah complex will be repaired; this would require re-fixing keystones, several of which have collapsed, using traditional techniques.
- Once 19 families residing on the southern arcade are relocated into new houses to be built for them, the southern arcade would require urgent conservation works.
- Digital monitoring systems would be fixed at various location to monitor the structural stability of the monument for a period of at least two years.
- Stone lattice screens would replace the metal grills in the arched openings of the corridor passage leading to baoli.
- Cement plaster from the wall and the ceiling surfaces will be removed and redone with appropriate materials and designs.
- Flooring of the corridor will be redone with appropriate slopes and designs.

## NIZAMUDDIN BAOLI

### TASK:

Providing alternate dwelling unit in lieu of structure over Baoli to be demolished.

### PURPOSE:

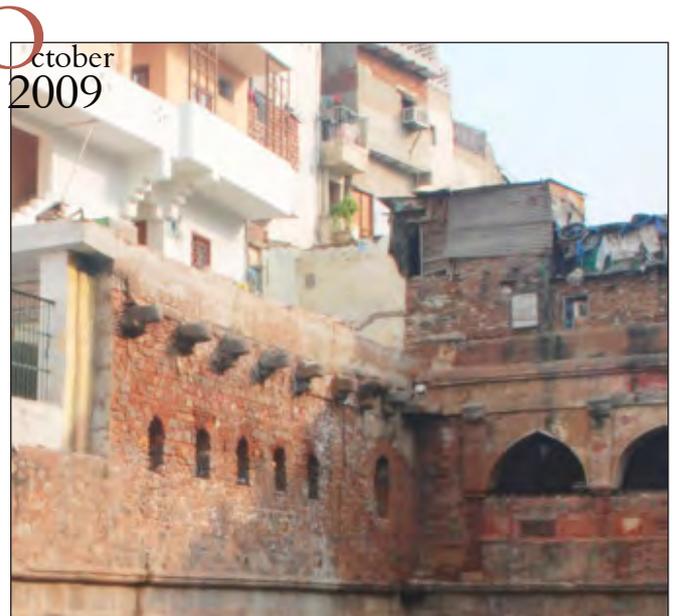
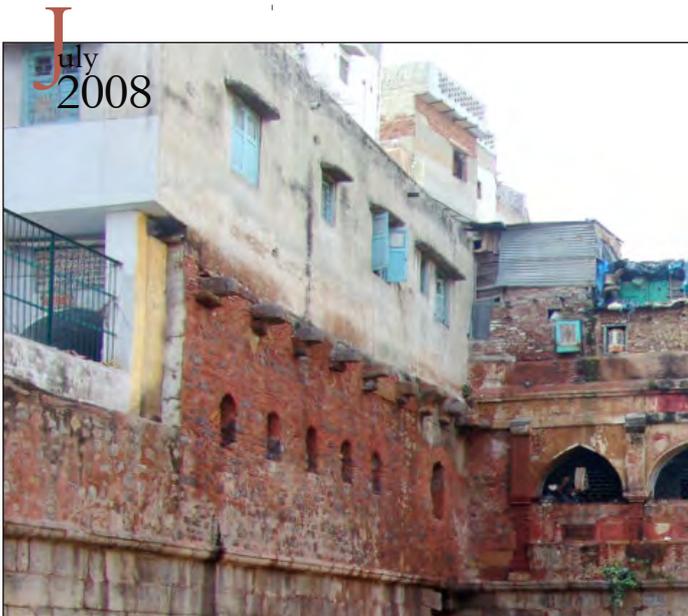
- Conservation works on the collapsed portion could not commence until this structure was dismantled. An alternate structure was thus built prior to dismantling the original structure.

### ACTION TAKEN:

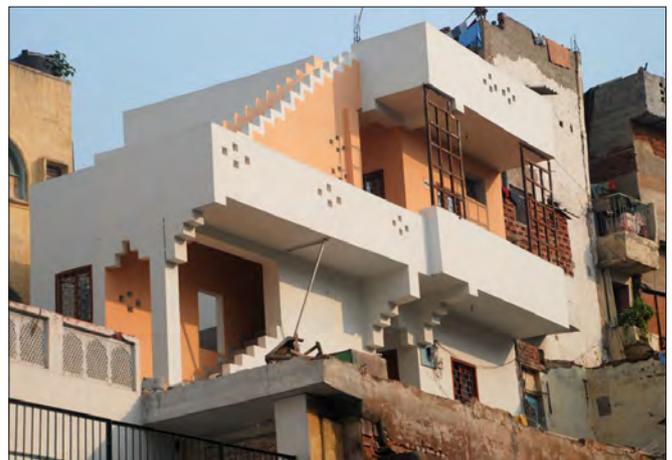
- After prolonged consultation with the owners, the alternate dwelling unit was designed to cover a similar area of the original construction.
- The construction, including the interior finishing has now been completed.

### NEXT STAGE:

Remove concrete from over the passage of the baoli and strengthen the vaulted masonry.



*The dwelling unit built, in the 1980's, over the covered Baoli passage was dismantled with the co-operation of the owner family and after constructing an alternate unit – recessed from the Baoli structure*



2010

# NIZAMUDDIN BAOLI



Archival view of Nizamuddin Baoli  
in early 20<sup>th</sup> century



Baoli wall collapsed in July 2008



Conservation works in progress





### TASK:

Restore the architectural character and enhance the setting of the 14<sup>th</sup> century stepwell.

### PURPOSE:

To restore the spirit of the place which also serves as a major entrance to the Dargah.

### ACTION TAKEN:

- The portion of the Baoli that collapsed in 2008 was repaired in 2009.
- Following the relocation of families living over the southern arcade this was extensively repaired since June 2010.
- Major structural repairs on the roof were required.
- The metal screens in the five arched openings were replaced with sandstone lattice screens.
- The cement plaster on the wall surfaces was replaced with lime plaster.
- The passage running along the Baoli eastern wall and southern wall required extensive repairs including lowering floor levels by over 40 cm.
- The cement plaster and terrazzo on the walls was removed and replaced with marble dado and lime plaster on the vaulted surfaces.
- The wall on the northern half of the eastern side was lowered to original levels.

### NEXT STAGE:

- In consultation with building owners carry out façade improvement along major houses around the Baoli.
- To repair the Chini Burj that stands on the north-western edge.



# CONSERVATION

HAZRAT NIZAMUDDIN BAOLI



Installing Sandstone Jaali





Repair works in the Corridor

