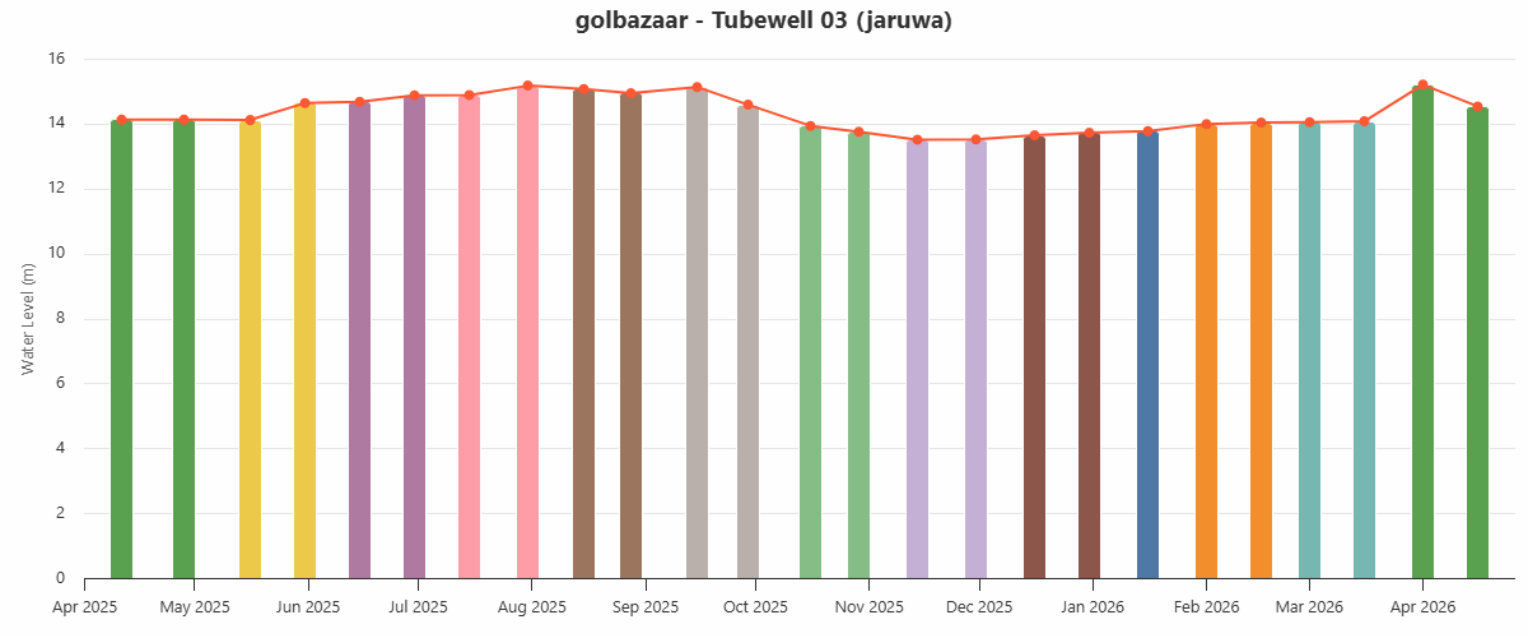
GROUNDWATER MONITORING SYSTEM

Tubewell Observation Report

1 GOLBAZAAR, JARUWA — WARD 3

TW 03

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Opening to Ground (Fixed)	TW
Golbazaar	03	Jaruwa	2025-04-28	14.12 m	0.60 m	T-03

In Golbazar study area, the monitoring/observation wells at Jaruwa-3 is located in the Gangetic Plain at the Southern belt from Highway.

The lowest water level (approx. 13.5 m) observed in this shallow aquifer was somewhere during a period of November and December 2025 whereas maximum water level (approx. 15.2 m) occurred during a period of July – September 2025. The average water level (approx. 14.32 m) was observed during April 2025. However, the current live record shows the GW level of TW-15 is 14.72 m (as of 22/05/2026 @ 10.05 PM).

This indicates that the rainwater during monsoon is tapped into shallow, unconfined aquifers that are quickly contributed by surface water percolation through recharging process in this Shallow Aquifer. The water level remains constantly around ~15 m BGL, thereby reflecting a moderately deep aquifer. The minor fluctuations are visible month to month, but the line is relatively flat. The aquifer shows stability rather than sharp seasonal swings.

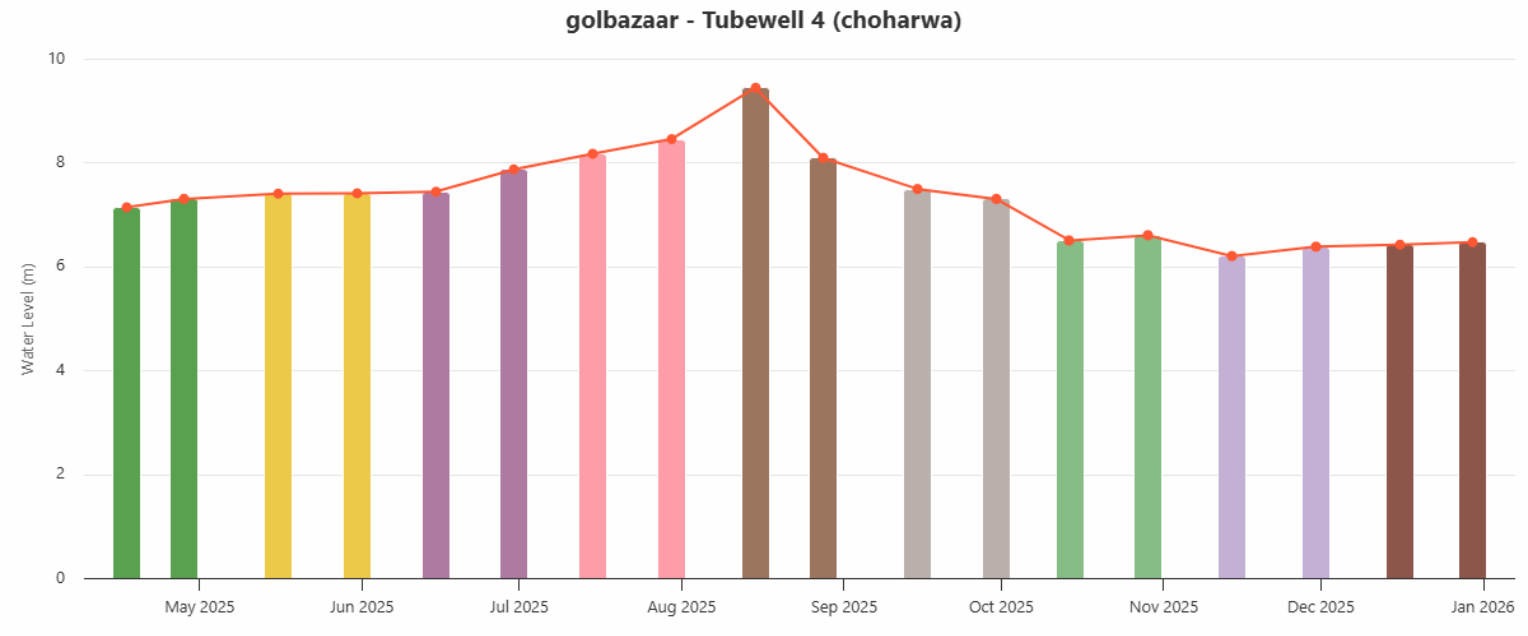
In Monsoon Period (July – Sept. 2025), the water table does not respond to the pronounced rise in water level indicating a limited recharge response or a deeper buffered aquifer. Whereas in Post Monsoon and Dry season (Oct 2025 – March 2026), water levels remain steady around ~15 m , with only minor declines thus indicating extraction and recharge are balanced, or that the aquifer is less sensitive to seasonal rainfall variations.

rises (shallower depth) during the monsoon season due to rainfall recharge and reduced pumping stress. After the rains, recharge slows, and groundwater extraction for irrigation/domestic use causes the water table to drop. By early 2026, the water level stabilizes around 20 meters. This suggests the aquifer has reached a balance between recharge (minimal in dry season) and extraction, reflects a minimal variation in water level.

This could mean the aquifer is either deep and confined with recharge occurring slowly and steadily or well buffered with extraction not exceeding natural replenishment. From these senses, this tubewell is a dependable source, less vulnerable to seasonal stress.

2 GOLBAZAAR, CHOHARWA — WARD 4 TW 4

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Opening to Ground (Fixed)	TW
Golbazaar	04	Chohorwa	2025-04-28	7.30 m	0.40 m	T-04

In Golbazar study area, the monitoring/observation well at Chohorwa-4 is in the Gangetic Plain at the Southern belt from Highway.

The highest water level (approx. 9.44 m) observed in this shallow aquifer was somewhere during the period of August 2025 whereas minimum water level (approx. 6.2 m) occurred during the period of November 2025. The average water level (approx. 7.337 m) was observed during late September 2025. However, the current live record shows the GW level of TW-15 is 7.7 m (as of 22/05/2026 @ 10.05 PM).

The water level fluctuates between ~7–9 m BGL. The water level reaches its peak level (shallower depth) around ~9 m around August 2025 thereby reflecting a shallower depth aquifer. The minor fluctuations are visible month to month. The water table gradually declines toward November 2025 stabilizing around ~7m by January 2026. This aquifer shows a clear monsoon recharge followed by post-monsoon decline, then stabilization.

In Monsoon Period (July – August 2025), the water table rises to ~9 m, reflecting strong rainfall recharge. This is consistent with monsoon-driven replenishment patterns. During post monsoon season (Sept. – Nov. 2025), the water table drops steadily to ~7 m, indicating extraction for irrigation and reduced recharge after rains. This period marks the most significant drawdown. Whereas in Dry season (Dec 2025 – Jan 2026), water levels remain steady around ~7 m, with only minor declines, but showing a balance between extraction and limited recharge. This tubewell therefore maintains a relatively steady baseline once the monsoon effect fades.

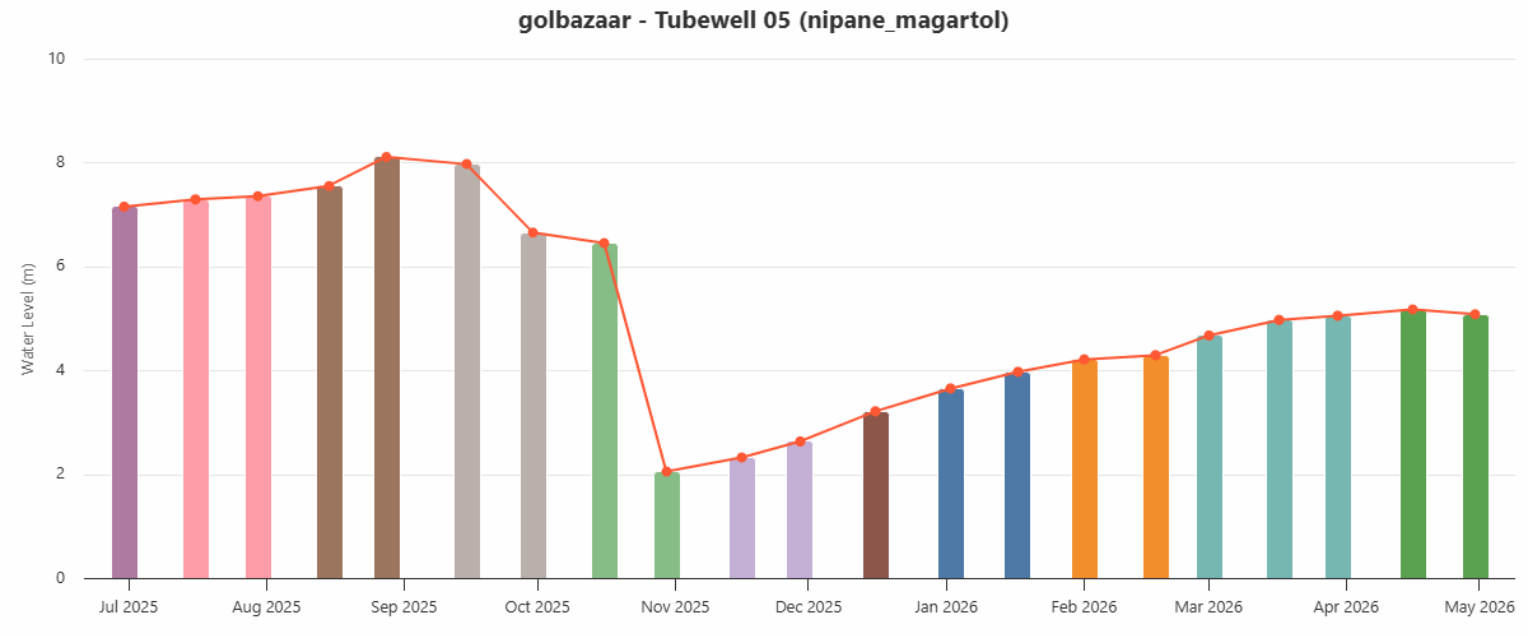
Regarding seasonal sensitivity, this tubewell shows clear monsoon recharge and post monsoon decline, but less dramatic fluctuation. Stability through the dry season suggests this aquifer is moderately buffered against seasonal

stress. Moderate depth and stability make this tubewell a dependable supply point. However careful monitoring is needed during post-monsoon season to avoid stress in the aquifer of this tubewell.

3 GOLBAZAAR, NIPANE MAGARTOL — WARD 5

TW 05

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Opening to Ground (Fixed)	TW
Golbazaar	05	Nipane Magartol	2026-03-30	5.05 m	0.45 m	T-05

In Golbazar study area, the S-TW at Npane Magartol-5 is located in the Gangetic Plain at the Southern belt from Highway.

The highest water level (approx. 8.11 m) observed in this shallow aquifer was somewhere during the period of late August 2025 whereas minimum water level (approx. 2.05 m) occurred during the period of Late October 2025. The average water level (approx. 5.23 m) was observed during late April 2026. However, the current live record shows the GW level of TW-15 is 5.5 m (as of 22/05/2026 @ 10.05 PM), thus indicating the gradually rise in the water level.

The water level fluctuates between ~2–8 m BGL. The water level (shallower depth) reaches its peak level around ~8 m around Sept. – Oct. 2025 thereby reflecting a shallower depth aquifer. The minor fluctuations are visible month to month. The water table then sharply declines to ~2m in November 2025 before gradually rising again through May 2026. This aquifer shows a pronounced seasonal swing, with one of the sharpest declines.

In Monsoon Period (July – Oct. 2025), the strong water table rise takes place at ~8 m, reflecting strong rainfall recharge. This is consistent with monsoon-driven replenishment patterns. During post monsoon season (Nov. 2025), the water table drops sharply to ~2 m, indicating extraction for irrigation and reduced recharge after rains. This period marks the most significant drawdown reflecting the most critical stress point in the cycle. Whereas in Dry season (Dec 2025 – May 2026), water levels gradually rises again around ~6-7 m by May 2026, thereby suggesting aquifer's resilience, but recovery is slower compared to the monsoon driven rise.

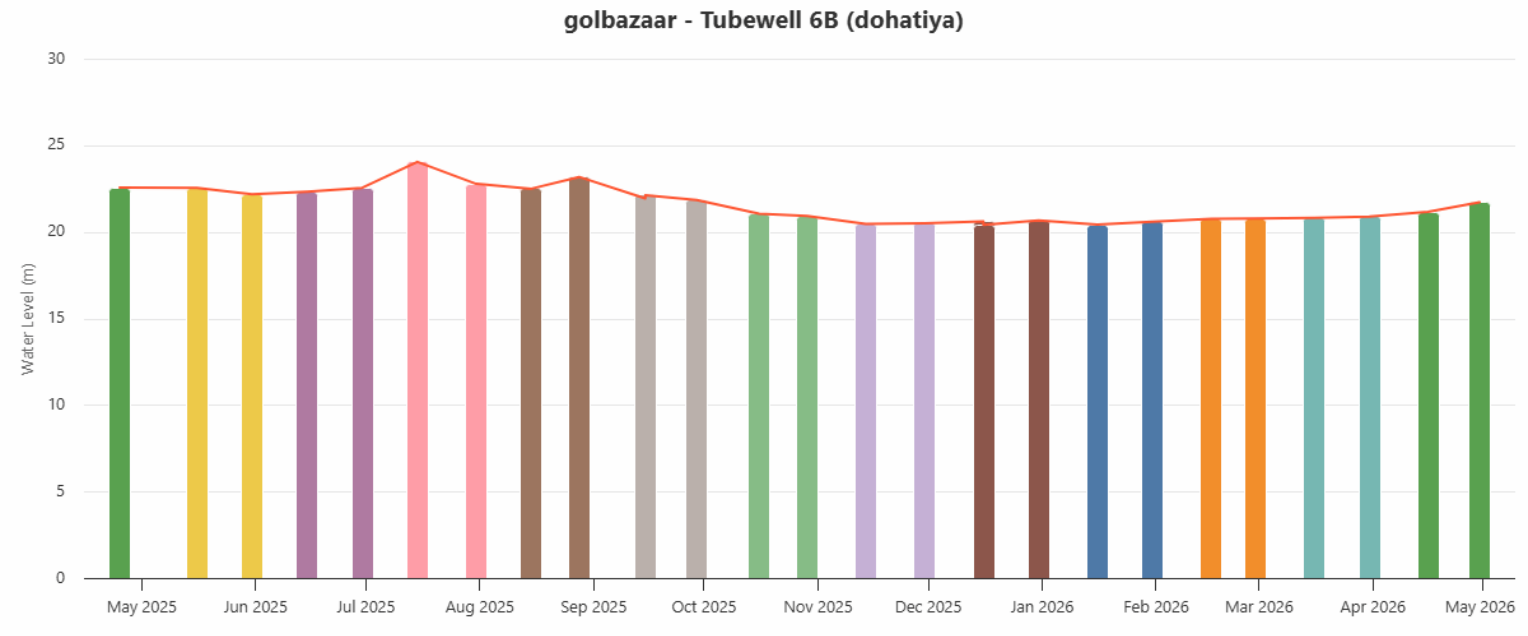
This tubewell reflects the shallow aquifer with sharp fluctuation with even more dramatic swings. The sharp dip in November highlights a period of acute stress. Since this month is a high-risk month; water scarcity or over

extraction could destabilize the aquifer. The gradual recovery through May 2026 suggests recharge pathways remain active, but extraction pressure is high. The shallow depth of this aquifer increases contamination vulnerability. This aquifer therefore exemplifies high season variability and hence vulnerability.

4 GOLBAZAAR, DOHATIYA — WARD 6

TW 6B

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Opening to Ground (Fixed)	TW
Golbazaar	06	Dohatiya	2026-04-30	21.71 m	0.79 m	T-6B

In Golbazar study area, this monitoring well at Dohatiya-6 is in the Gangetic Plain at the Southern belt from Highway.

The lowest water level (approx. 20.4 m) observed in this shallow aquifer was somewhere during the period of December 2025 whereas maximum water level (approx. 24.04 m) occurred during the period of Mid- July 2025. The average water level (approx. 21.56 m) was observed somewhere during Feb. 2025. However, the current live record shows the GW level of TW-6B is 22.5 m (as of 22/05/2026 @ 10.05 PM).

The water level fluctuates between 20-25 m BGL, thereby reflecting a moderately deep aquifer. The graph shows a peak (higher water level, i.e., shallower depth) around July 2025, followed by a gradual decline, stabilizing near 20 meters in early 2026.

The water table rises (shallower depth) during the monsoon season due to rainfall recharge and reduced pumping stress. After the rains, recharge slows, and groundwater extraction for irrigation/domestic use causes the water table to drop. By early 2026, the water level stabilizes around 20 meters. This suggests the aquifer has reached a balance between recharge (minimal in dry season) and extraction.

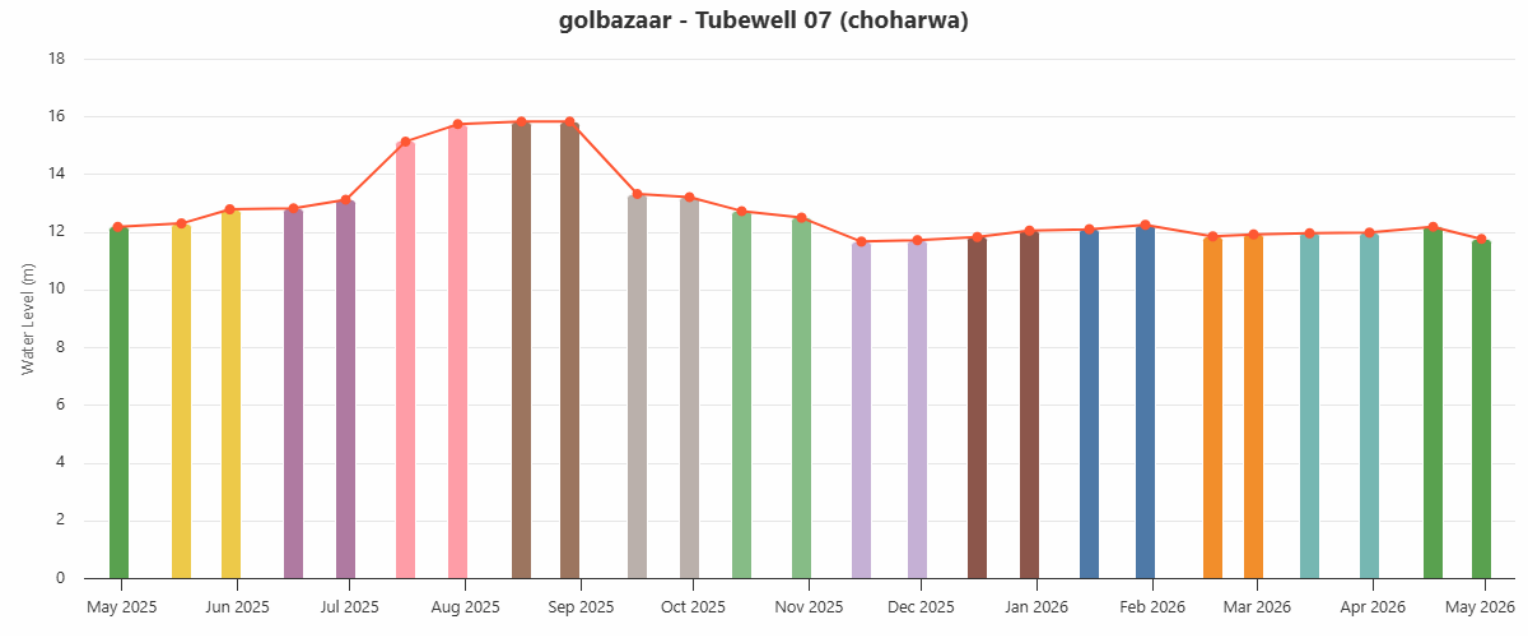
The data / chart reflects that this tubewell has a classic monsoon driven aquifer cycle i.e. recharge during rains, depletion afterward, and stabilization in the dry season. The relatively small fluctuation (~5 meters) indicates the aquifer is **resilient**, but continuous monitoring is essential to detect long-term decline.

Seasonal recharge is critical; over extraction in dry months lower the baseline further. Therefore, monthly tracking is effective for detecting stress points. Lastly, this tubewell seems reliable.

5 GOLBAZAAR, CHOHARWA — WARD 7

TW 07

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Opening to Ground (Fixed)	TW
Golbazaar	07	Chohorwa	2026-04-30	11.75 m	0.82 m	T-07

In Golbazar study area, this monitoring well at Chohorwa-7 is located in the Gangetic Plain at the Southern belt from Highway.

The lowest water level (approx. 11.66 m) observed in this shallow aquifer was somewhere during the period of November 2025 whereas maximum water level (approx. 15.82 m) occurred during the period of August 2025. The average water level (approx. 12.82 m) was observed in Oct. 2025. However, the current live record shows the GW level of TW-07 is 12.57 m (as of 23/05/2026 @ 12.05 PM).

The water level fluctuates between ~11–16 m BGL, thereby reflecting a shallower aquifer. The water level starts around 12 m in May 2025 and remains relatively stable through June. This reflects a typical dry-season equilibrium where groundwater is neither being replenished nor heavily depleted. This indicates water level is stable with moderate depth during pre-monsoon season (May – June 2025)

Water levels rise sharply from ~13 m in July to a peak of approximately 15–16 m in August. This is somewhat counterintuitive at first glance, this likely means the water table is rising (water gets closer to the surface), as monsoon (July -August 2025) rainfall drives significant aquifer recharge. The depth reading increasing could also reflect measurement convention differences, but the monsoon recharge effect is the dominant driver.

After the monsoon peak, levels drop sharply from ~16 m in August to around 12 m by November. This is the classic post-monsoon recession (September – November 2025) as recharge stops and groundwater is gradually drawn down through extraction and lateral drainage.

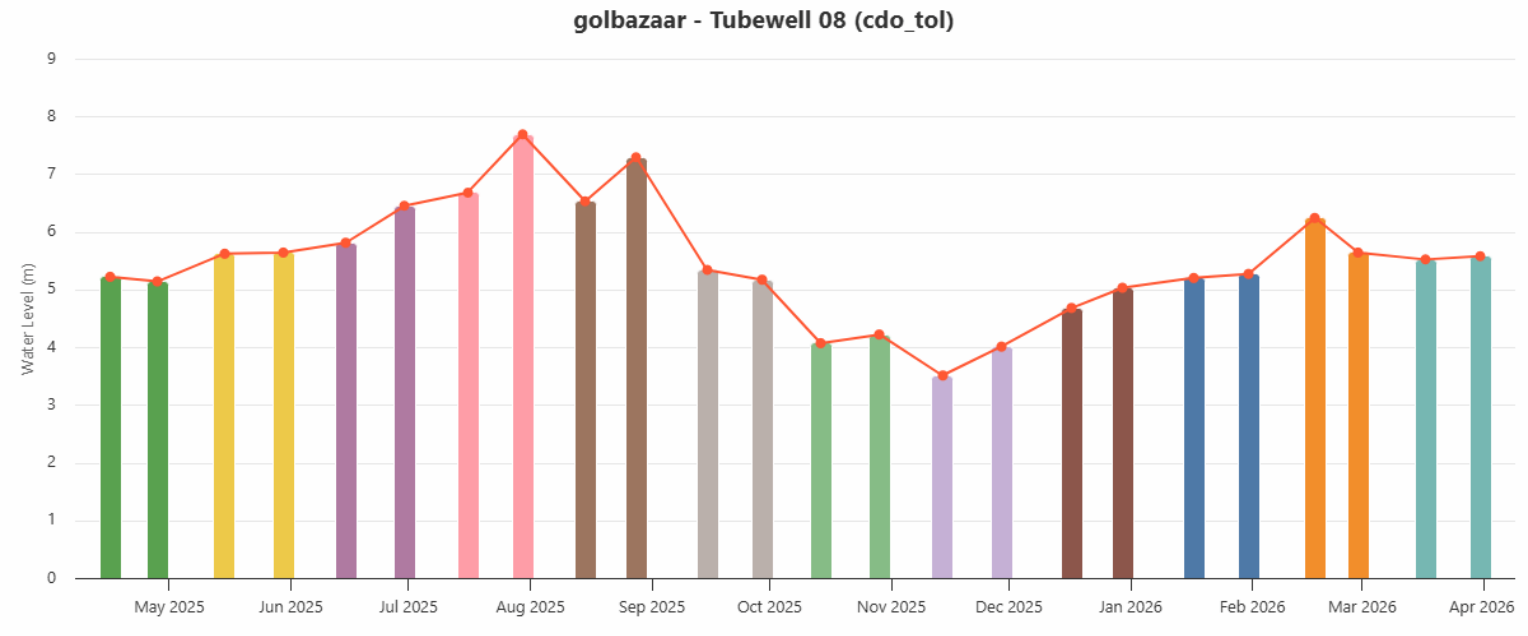
The water level stabilizes at approximately 12 m through the winter months and into early spring. This plateau suggests the aquifer reaches a dynamic equilibrium — slow natural discharge balanced against low recharge. Notably, there is no significant further depletion, which is a positive indicator of aquifer sustainability.

By May 2026, levels are back to where they started in May 2025, confirming a repeatable annual cycle with good recovery. This indicates cumulative extraction stress with minimal recharge during the dry season.

6 GOLBAZAAR, CDO TOL — WARD 8

TW 08

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Opening to Ground (Fixed)	TW
Golbazaar	08	CDO Tole	2025-05-30	5.64 m	0.66 m	T-08

In Golbazar study area, this monitoring well at CDO Tole-8 is located in the Gangetic Plain at the Southern belt from Highway.

The lowest water level (approx. 3.51 m) observed in this shallow aquifer was somewhere during the period of mid of November 2025 whereas maximum water level (approx. 7.69 m) occurred during the period of July 2025. The average water level (approx. 5.48 m) was observed in Mid-March 2026. However, the current live record shows the GW level of TW-08 is 6.3 m (as of 23/05/2026 @ 12.35 PM).

The water level fluctuates between ~4–8 m BGL, thereby reflecting a shallower aquifer. The graph shows a peak (higher water level, i.e., shallower depth) around august 2025 (~8 m), dips to ~4 m in November 2025, and rises again by March 2026.

The aquifer shows a strong rise in water level (~8 m), reflecting rainfall recharge during the monsoon (July – August 2025). This is consistent with monsoon-driven replenishment. The water table drops to ~4 m during post monsoon season (September-November 2025), suggesting heavy extraction for irrigation and reduced recharge after rains. This period marks the lowest levels in the cycle. This is a rapid recession of nearly 3.8 m in just 3 months,

During dry season (Dec 2025 – Feb 2026), water levels remain moderately low (~5–6 m), indicating limited recharge and steady use. This is the most concerning phase as water levels hit a minimum of ~3.5 m in this period, the lowest of the entire cycle. This deep dry-season trough suggests the aquifer is under stress during this period.

Unlike the sharp post-monsoon crash, recovery is slow and gradual, a rise in water level is visible again (~7–8 m) during pre-monsoon recovery (March–April 2026), possibly due to early rainfall or spring precipitation or reduced pumping before the agricultural cycle begins. This suggests the aquifer has reached a balance between recharge (minimal in dry season) and extraction.

The water level ranges between ~3.5 m and ~7.8 m — significantly shallower. This tubewell taps into a much

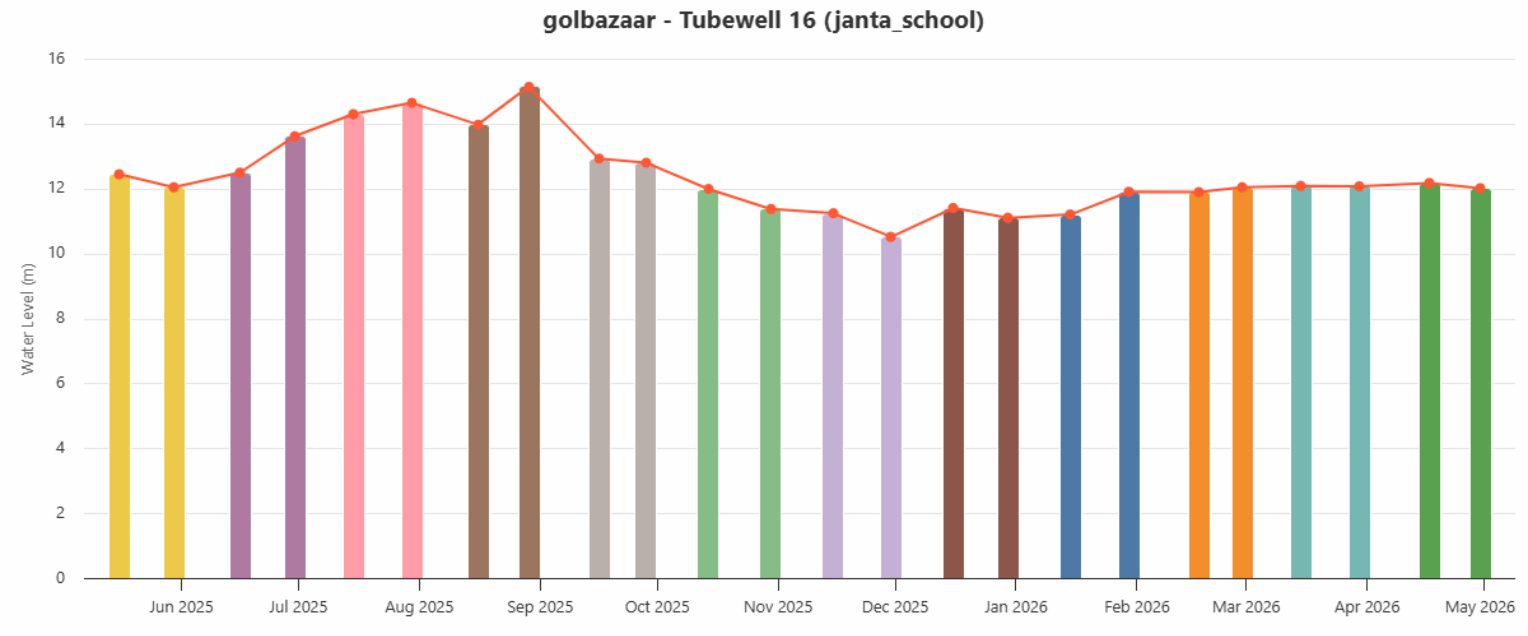
shallower aquifer, making it more sensitive to seasonal changes and potentially more vulnerable to contamination and rapid depletion. November is the period of maximum drawdown, which could pose risks for community water supply.

By April 2026, levels are back to where they started confirming a repeatable annual cycle with good but slow recovery. This indicates cumulative extraction stress with minimal recharge during the dry season. The asymmetry between fast depletion and slow recovery suggests this aquifer cannot fully buffer against prolonged dry spells.

7 GOLBAZAAR, JANTA SCHOOL — WARD 8

TW 16

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Opening to Ground (Fixed)	TW
Golbazaar	08	Janata School	2025-04-30	12.01 m	0.26 m	T-16

In Golbazar study area, this monitoring well at Janata School is located at Ward 08 in the Gangetic Plain at the Southern belt from Highway.

The lowest water level (approx. 10.51 m) observed in this shallow aquifer was somewhere during the period of late November 2025 whereas maximum water level (approx. 15.14 m) occurred during the period of August 2025. The average water level (approx. 12.39 m) was observed in June 2025. However, the current live record shows the GW level of TW-16 is 12.27 m (as of 23/05/2026 @ 15.15 PM).

The water level fluctuates between ~12–18 m BGL, thereby reflecting a shallower aquifer. The graph shows a peak (higher water level, i.e., shallower depth) around august 2025 (~18 m), declines to ~12 m in November 2025, and rises again by March 2026 and remains stable through May 2026.

The aquifer shows a strong rise in water level (~18 m), reflecting a strong rainfall recharge during the monsoon (July – August 2025). This is consistent with monsoon-driven replenishment. The water table drops to ~12-14 m during post monsoon season (September-November 2025), suggesting heavy extraction for irrigation and reduced recharge after rains. This period marks the lowest levels in the cycle marking the most significant drawdown. This is a rapid recession of nearly ~6 m in just 3 months.

During dry season (November 2025 – May 2026), water levels remain moderately low (~5–6 m), indicating limited recharge and steady use. This is the most concerning phase as water levels hit a minimum of ~10.5 m in this period, the lowest of the entire cycle. This deep dry-season trough suggests the aquifer is under stress during this period.

Unlike the sharp post-monsoon crash, recovery is slow and gradual, a rise in water level is visible again (~13–14 m) during pre-monsoon recovery (March–April 2026), showing a balcne between extraction and limited recharge

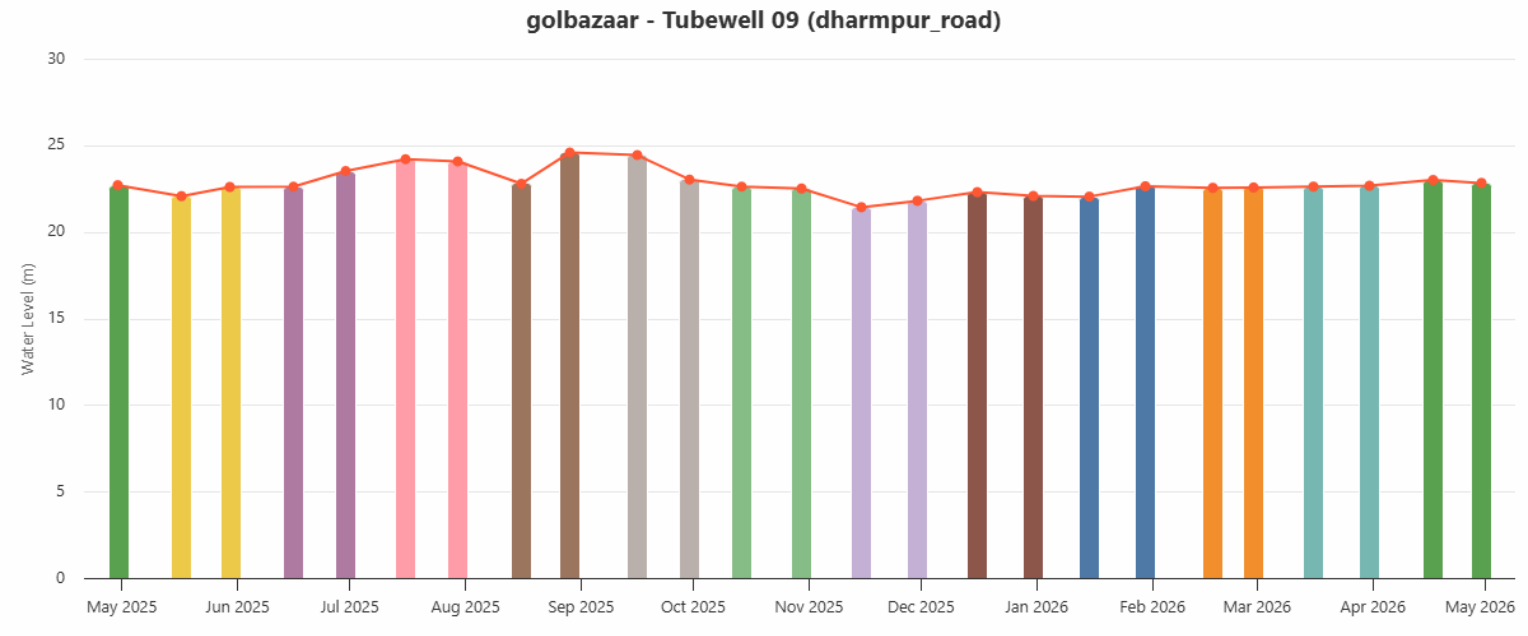
possibly due to early rainfall or spring precipitation or reduced pumping before the agricultural cycle begins. Stability through the dry season suggests this aquifer is more buffered against seasonal stress. This suggests the aquifer has reached a balance between recharge (minimal in dry season) and extraction. Moderate depth and stability make this tubewell a dependable supply point.

The data (graph) shows clear monsoon recharge and post-monsoon decline, but less dramatic fluctuation and maintains a relatively steady baseline compared to Ward 8 Tubewell No. 08 (which showed sharp fluctuations).

8 GOLBAZAAR, DHARMPUR ROAD — WARD 9

TW 09

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Opening to Ground (Fixed)	TW
Gobazaar	09	Dharmapur	2026-04-30	22.82 m	1.11 m	09

In Golbazar study area, this monitoring well at Dharmapur Road is located at Ward 09 in the Gangetic Plain at the Southern belt from Highway.

The lowest water level (approx. 21.42 m) observed in this shallow aquifer was somewhere during the period of November 2025 whereas maximum water level (approx. 24.59 m) occurred during the period of August 2025. The average water level (approx. 22.80 m) was observed somewhere during Mid-March 2026. However, the current live record shows the GW level of TW-09 is 23.93 m (as of 23/05/2026 @ 15.30 PM).

The water level fluctuates between ~22–25 m BGL, thereby reflecting a relatively deep aquifer. The graph shows only a minor variation across the year, with a highlighted point in July 2025 at ~24.2 m. The key point to note is that this aquifer demonstrates long-term stability, with no sharp seasonal swings.

During Monsoon (July-Sept. 2025), the data/chart shows a slight rise in water level (~24–25 m), suggesting some recharge from rainfall. However, the effect is silent compared to shallow aquifer. The water level remains steady around ~22-23 m during post monsoon season (Oct. Nov. 2025), indicating an extraction and recharge are well balanced, or that the aquifer is buffered by deep storage.

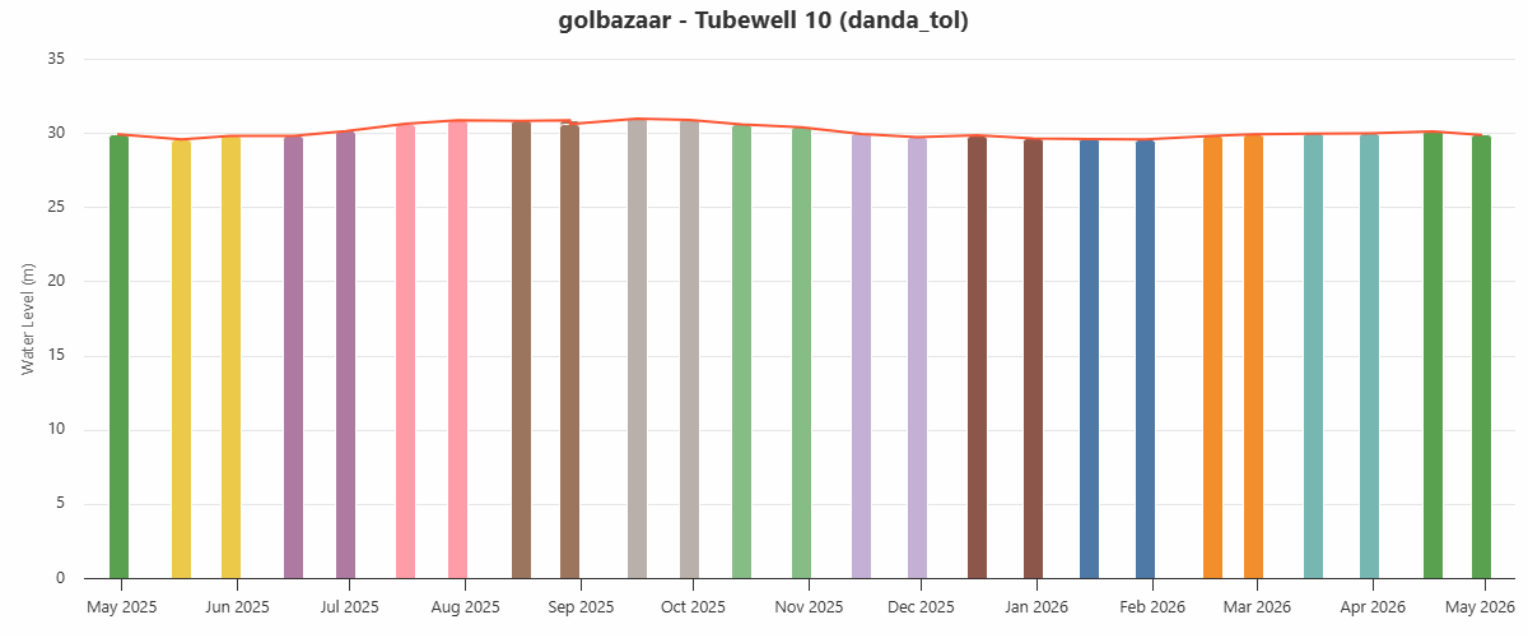
The well at Dharmapur shows deep aquifer stability indicating even less fluctuations. This indicates that the well is likely at a confined or semi-confined aquifer, less sensitive to immediate rainfall, but more resilient against the seasonal fluctuation and stress. Therefore, this tubewell maintains a consistent baseline. This site therefore exemplifies low seasonal vulnerability.

This indicates that the aquifer being stable makes this tubewell dependable for year-round supply. However, being stable, this aquifer can face long-term depletion if extraction exceeds recharge; and hence monitoring is essential to regulate.

9 GOLBAZAAR, DANDA TOL — WARD 10

TW 10

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Ope
Gobazaar	10	Danda Tole	2026-04-30	29.86 m	

In Golbazar study area, this monitoring well at Danda Tole is located at Ward 10 on the Gangetic Plain at the Southern belt from Highway.

The lowest water level (approx. 29.57 m) observed in this shallow aquifer was somewhere during the period of January 2026 whereas maximum water level (approx. 30.96 m) occurred during the period of Sept. 2025. The average water level (approx. 21.42 m) was observed somewhere in June 2025. However, the current live record shows the GW level of TW-10 is 30.65 m (as of 23/05/2026 @ 16.00 PM).

The water level remains consistently around ~30 m BGL, thereby reflecting a relatively deep aquifer. The graph shows only a minor variation and slight fluctuation in water level across the year, with no share seasonal swings. The key point to note is that this aquifer demonstrates long-term stability, and resilience with no sharp seasonal swings.

During Monsoon (July-Sept. 2025), the data/chart shows, unlike other shallow aquifers, there is no pronounced rise in water level and suggests a limited immediate recharge response, typical of deep aquifers. Similarly, the water level remains steady around ~30 m during post monsoon season (Oct. 2025 - May 2026) and indicates that the aquifer is buffered by deeper storage and less sensitive to seasonal rainfall.

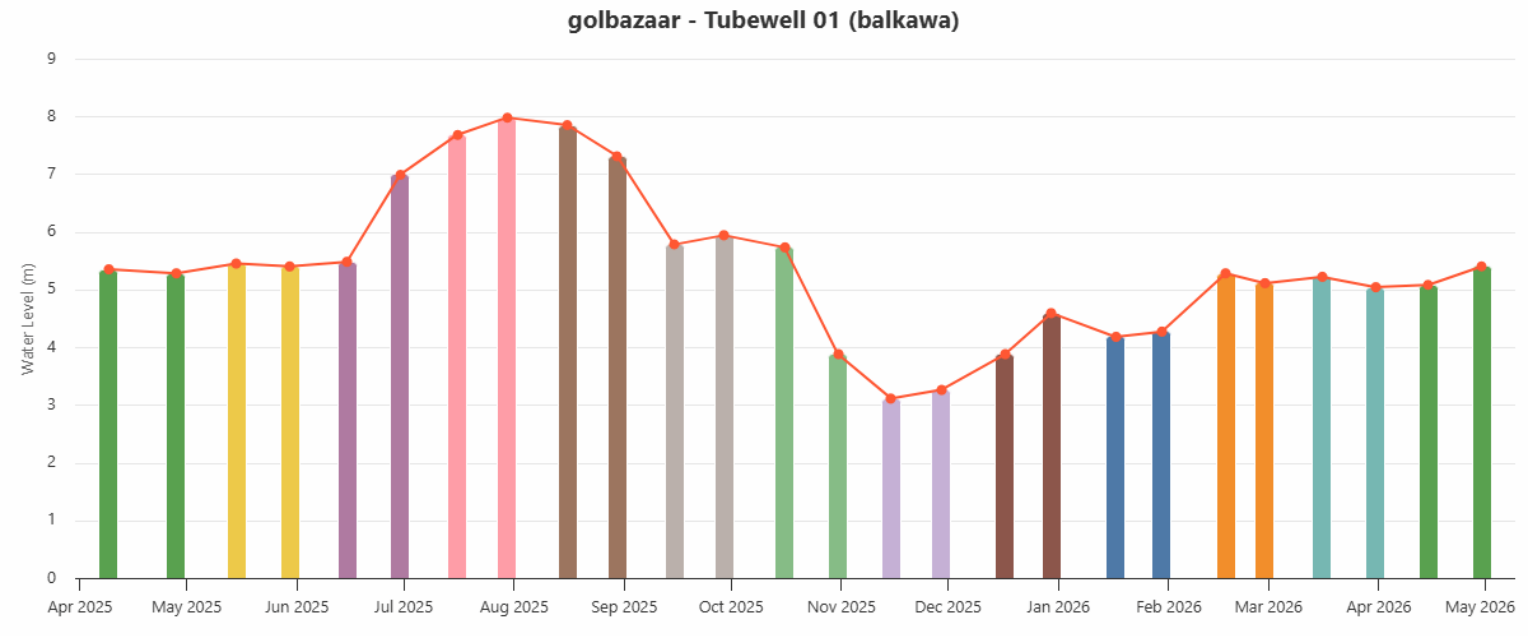
The well at Danda Tole shows deep aquifer and is stable, indicating less fluctuations. This indicates that the well is likely at a confined aquifer, with recharge occurring slowly and steadily, making it less vulnerable to short-term stress.

This site indicates that the aquifer being stable makes this tubewell dependable for year-round supply. However, being stable, this aquifer can face long-term depletion if extraction exceeds recharge; and hence monitoring is essential to regulate. This site exemplifies low seasonal vulnerability. As this site exemplifies low seasonal vulnerability, this tubewell maintains a consistent baseline

10 GOLBAZAAR, BALKAWA — WARD 11

TW 01

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Ope
Gobazaar	11	Balawa	2025-05-30	5.40 m	

In Golbazar study area, this monitoring well at Balkawa is located at Ward 11 on the Gangetic Plain at the Southern belt from Highway.

The lowest water level (approx. 3.11 m) observed in this shallow aquifer was somewhere during the period of Mid Nov 2025 whereas maximum water level (approx. 7.98 m) occurred during the period of late Jully 2025. The average water level (approx. 5.41 m) was observed somewhere in May/June 2025. However, current live record shows the GW level of TW-01 is 5.62 m (as of 23/05/2026 @ 16.40 PM).

The water level remains consistently around ~3-8 m BGL. The data/chart shows that the water table peaks at ~8 m (shallower depth) around July 2025 then the water level declines to its lowest level (~3m) in Nov 2025, followed by a gradual recovery through early 2026. The key point to note is that this aquifer demonstrates pronounced seasonal swings with clear monsoon recharge and post monsoon depletion.

During Monsoon (June-July 2025), the data/chart shows the strong rise in water level (~8m) reflecting rainfall recharge. This is a typical characteristic of shallow aquifer that responds quickly to precipitations. In Post monsoon (Oct. – Nov. 2025), the water level drops sharply to ~3m, indicating heavy extraction for irrigation and reduced recharge. This period marks the most critical stress point for this tubewell/aquifer. The dry season (Dec. 2025 – May 2026), indicates that the water level in this aquifer has a gradual rise (~5-6m) showing aquifer resilience and slow recharge. The data/chart shows that the recovery of the aquifer is slower compared to the monsoon-driven rise.

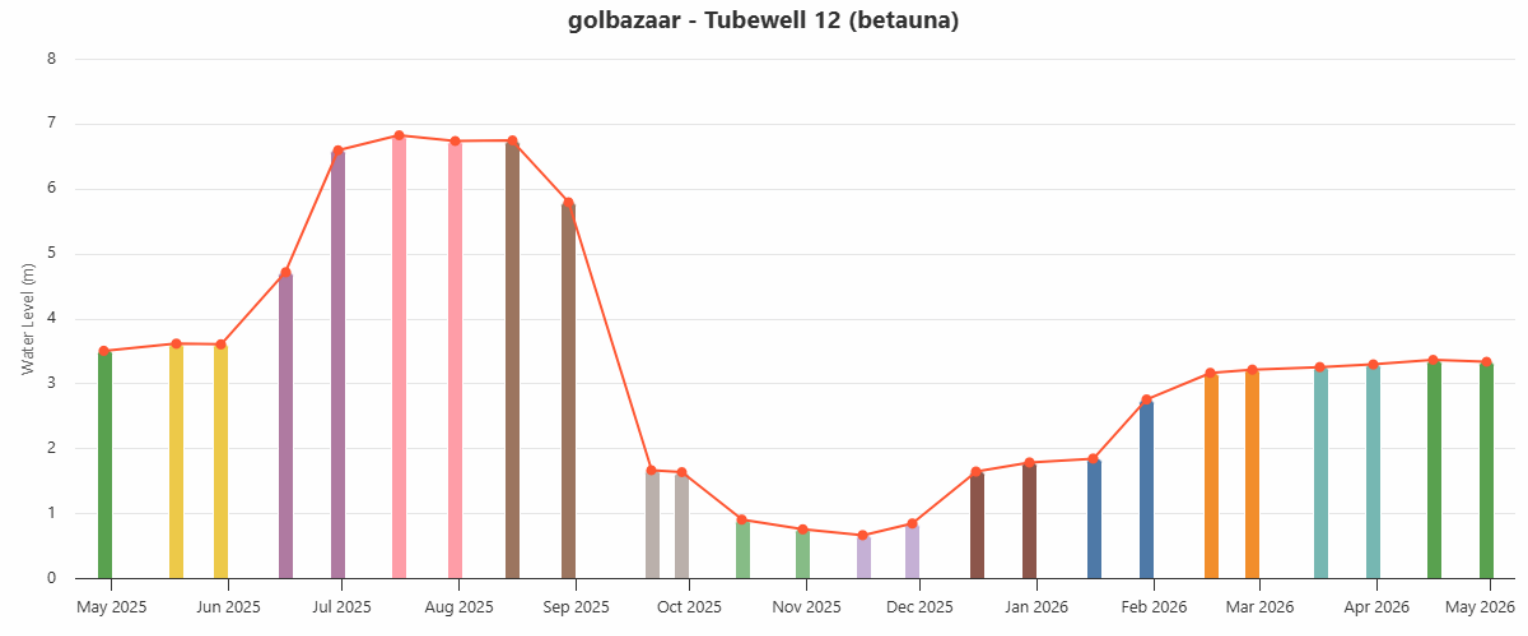
Like other shallow aquifers, this tubewell also shows seasonal sharp fluctuations. Unlike deep aquifers, this site (tubewell) is highly sensitive to rainfall and extraction. Regarding this tubewell site, quick recharge and depletion cycles suggest strong surface-aquifer interaction, but also higher contamination risk.

The data/chart indicates that Nov. 2025 is a high-risk month, and over extraction could destabilize the aquifer. This site requires contingency measures during post monsoon season to ensure supply consistency. This tubewell /aquifer being shallow aquifer increases the contamination vulnerability, requiring regular testing of the water quality. This site exemplifies high seasonal vulnerability, contrasting with deeper, buffered aquifers.

11 GOLBAZAAR, BETAUNA — WARD 12

TW 12

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Ope
Gobazaar	12	Balawa	2026-04-30	3.33 m	

In Golbazar study area, this monitoring well at Betauna is located at Ward 12 on the Gangetic Plain at the Southern belt from Highway.

The lowest water level (approx. 0.66 m) observed in this shallow aquifer was somewhere during the period of Mid Nov 2025 whereas maximum water level (approx. 6.82 m) occurred during the period of mid Jully 2025. The average water level (approx. 3.29 m) was observed somewhere in March 2026. However, current live record shows the GW level of TW-12 is 4.23 m (as of 23/05/2026 @ 21.00 PM).

The water level remains consistently around ~3-8 m BGL. The data/chart shows that the water table peaks at ~8 m (shallower depth) around July-Sept. 2025 then the water level declines sharply to its lowest level (~3m) in Nov 2025, followed by a gradual recovery through early 2026. The key point to note is that this aquifer demonstrates pronounced seasonal swings with clear monsoon recharge and post monsoon depletion.

During Monsoon (July-Sept. 2025), the data/chart shows the strong rise in water level (~8m) reflecting rainfall recharge. This is a typical characteristic of shallow aquifer that responds quickly to precipitations. In Post monsoon (Oct. – Nov. 2025), the water level drops sharply to ~3m, indicating heavy extraction for irrigation and reduced recharge. This period marks the most critical stress point for this tubewell/aquifer. The dry season (Dec. 2025 – May 2026), indicates that the water level in this aquifer has a gradual rise (~5-6m) showing aquifer resilience and slow recharge. The data/chart shows that the recovery of the aquifer is slower compared to the monsoon-driven rise.

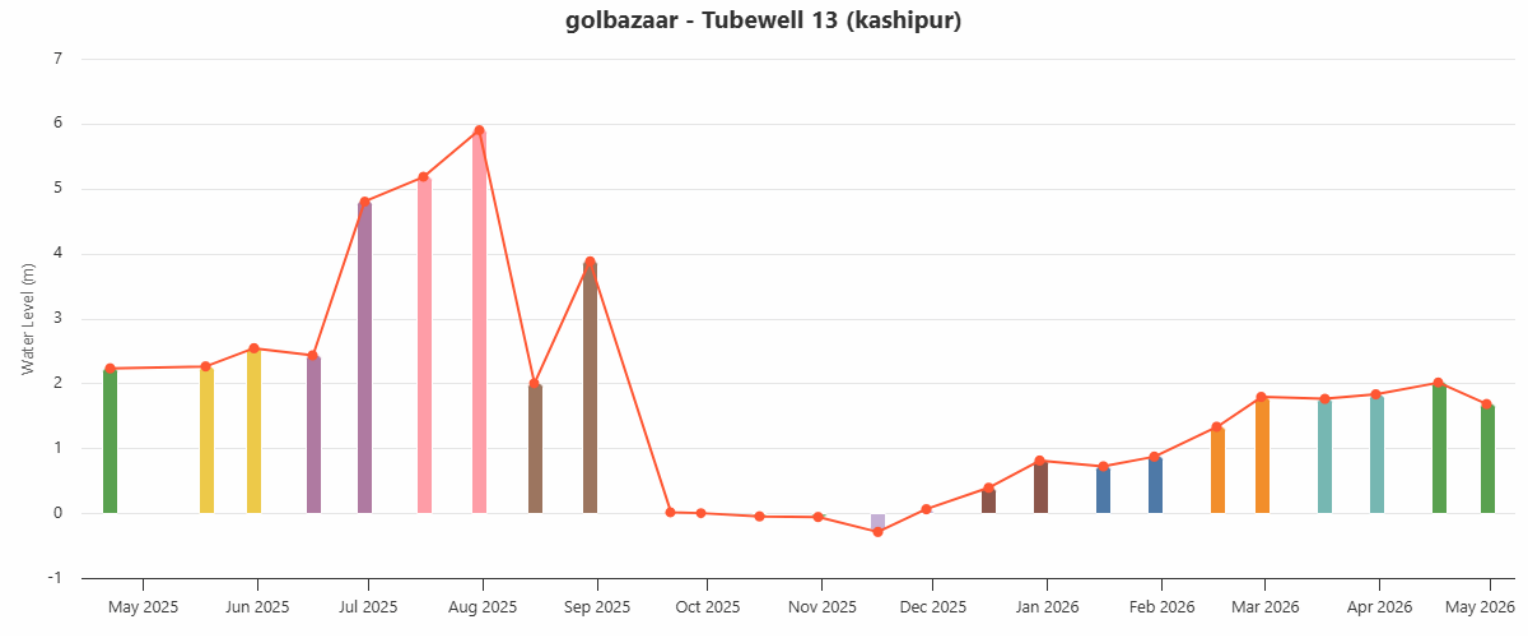
Like other shallow aquifers, this tubewell also shows seasonal sharp fluctuations. Unlike deep aquifers, this site (tubewell) is highly sensitive to rainfall and extraction. Regarding this tubewell site, quick recharge and depletion cycles suggest strong surface-aquifer interaction, but also higher contamination risk.

The data/chart indicates that Nov. 2025 is a high-risk month, and over extraction could destabilize the aquifer. This site requires contingency measures during post monsoon season to ensure supply consistency. This tubewell /aquifer being shallow aquifer increases the contamination vulnerability, requiring regular testing of the water quality. This site exemplifies high seasonal vulnerability, contrasting with deeper, buffered aquifers.

12 GOLBAZAAR, KASHIPUR — WARD 13

TW 13

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Ope
Gobazaar	13	Kashipur	2026-04-30	1.68 m	

In Golbazar study area, this monitoring well at Kashipur is located at Ward 13 on the Gangetic Plain at the Southern belt from Highway.

The lowest water level (approx. -0.29 m) observed in this shallow aquifer was somewhere during the period of Mid Nov 2025 whereas maximum water level (approx. 5.90 m BGL) occurred during the period of late Jully 2025. The average water level (approx. 1.76 m) was observed somewhere in mid-March 2026. However, current live record shows the GW level of TW-13 is 2.58 m (as of 23/05/2026 @ 21.00 PM).

The water level remains consistently between ~0-6 m BGL making it one of the shallowest aquifers in this Municipality. The data/chart shows that the water table rises sharply at ~8 m from May to July 2025 then the water level drops sharply to its lowest level (near zero) by Oct. 2025 and continues to remain low through early 2026, and then after gradually increases the water level again by May 2026. The key point to note is that this aquifer demonstrates extreme seasonal sensitivity, with rapid recharge and depletion cycles.

During Monsoon (May-July 2025), the data/chart shows the strong rise in water level (~6m) reflecting rainfall recharge. This is a typical characteristic of shallow aquifer that responds quickly to precipitations indicating strong surface-aquifer interactions. In Post monsoon (Sept. - Oct. 2025), the water level drops sharply near to ~zero, indicating heavy extraction and reduced recharge. This period marks the most critical stress point for this tubewell/aquifer with potential risk of wells running dry. The dry season (Nov. 2025 – Feb. 2026), indicates that the water levels in this aquifer maintain very low, showing limited recharge and sustained extraction pressure. With the start of post monsoon (March – May 2026), the gradual rise in water level (~4-5 m) takes place indicating aquifer resilience but slower recovery compared to monsoon-driven rise.

Like other shallow aquifers, this tubewell also shows sharper depletion even dropping to near aero. Unlike deep aquifers, this site (tubewell) is highly sensitive and vulnerable to rainfall and extraction. Regarding this tubewell site, the extreme fluctuations suggest strong dependence on surface recharge, with high contamination risk and drought vulnerability.

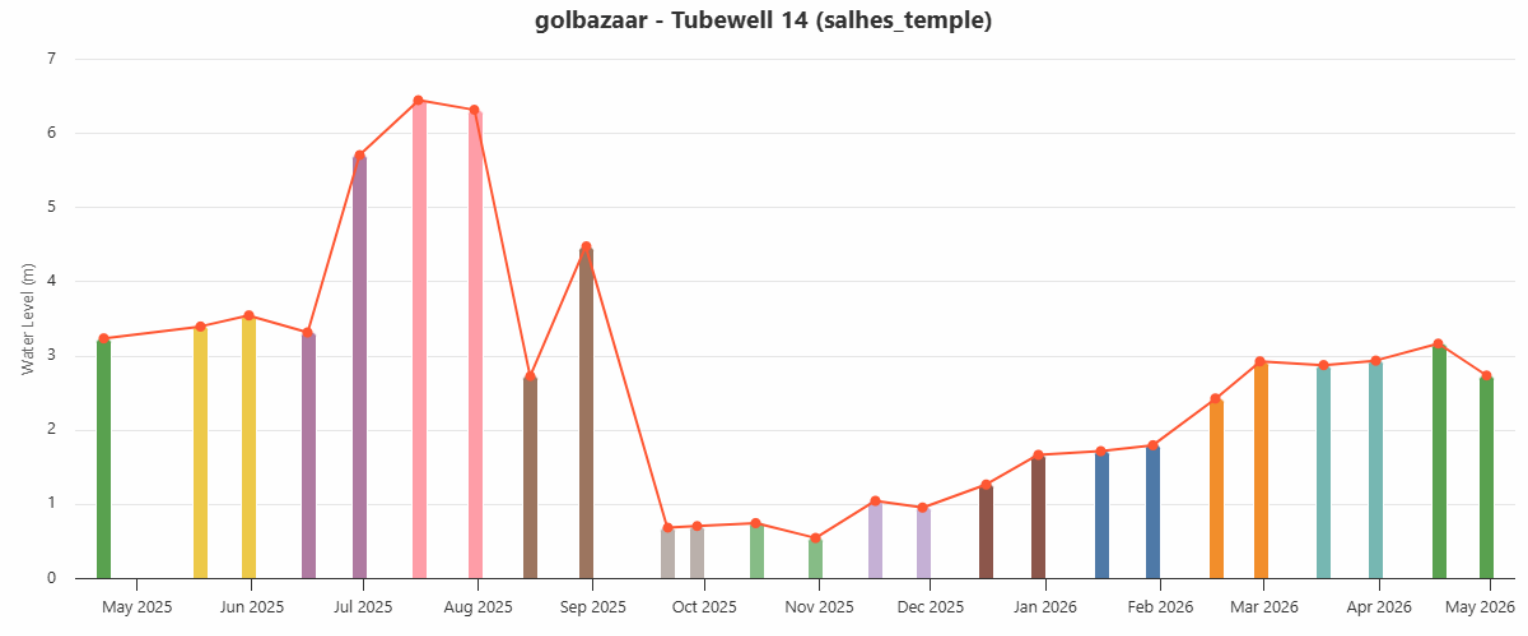
The data/chart indicates that Oct. 2025 - Feb 2026 is a high-risk period indicating water scarce situation possibly due to complete drying of wells during this dry period of the cycle. This tubewell /aquifer being shallow in depth increases the contamination vulnerability, requiring regular testing of the water quality.

This site exemplifies extreme seasonal vulnerability, making it a priority for resilience planning measures. Therefore, community requires contingency planning measures during this post monsoon and dry months.

13 GOLBAZAAR, SALHES TEMPLE — WARD 13

TW 14

WATER LEVEL CHART



OBSERVATIONS

Municipality	Ward	Location	Measurement date	Ground to Water	Op
Gobazaar	13	Salhes Temple	2026-04-30	2.73 m	

In Golbazar study area, this monitoring well at Salhes Temple is located at Ward 13 on the Gangetic Plain at the Southern belt from Highway.

The lowest water level (approx. 0.54 m) observed in this shallow aquifer was somewhere during the period of late Oct. 2025 whereas maximum water level (approx. 6.44 m BGL) occurred during the period of mid Jully 2025. The average water level (approx. 2.69 m) was observed somewhere in mid-Oct. 2025 and late April 2026. However, current live record shows the GW level of TW-14 is 3.19 m (as of 23/05/2026 @ 21.50 PM).

The water level remains consistently between ~3-7 m BGL making it a shallower aquifer. The data/chart shows that the water table (shallower depth) peaks at ~6-7 m around July 2025 then the water level drops sharply to ~3 m by Oct. 2025 and is then followed by the gradual recovery (i.e. rise in water level) through early 2026. The key point to note is that this aquifer demonstrates pronounced seasonal swings, with monsoon recharge and post monsoon depletion.

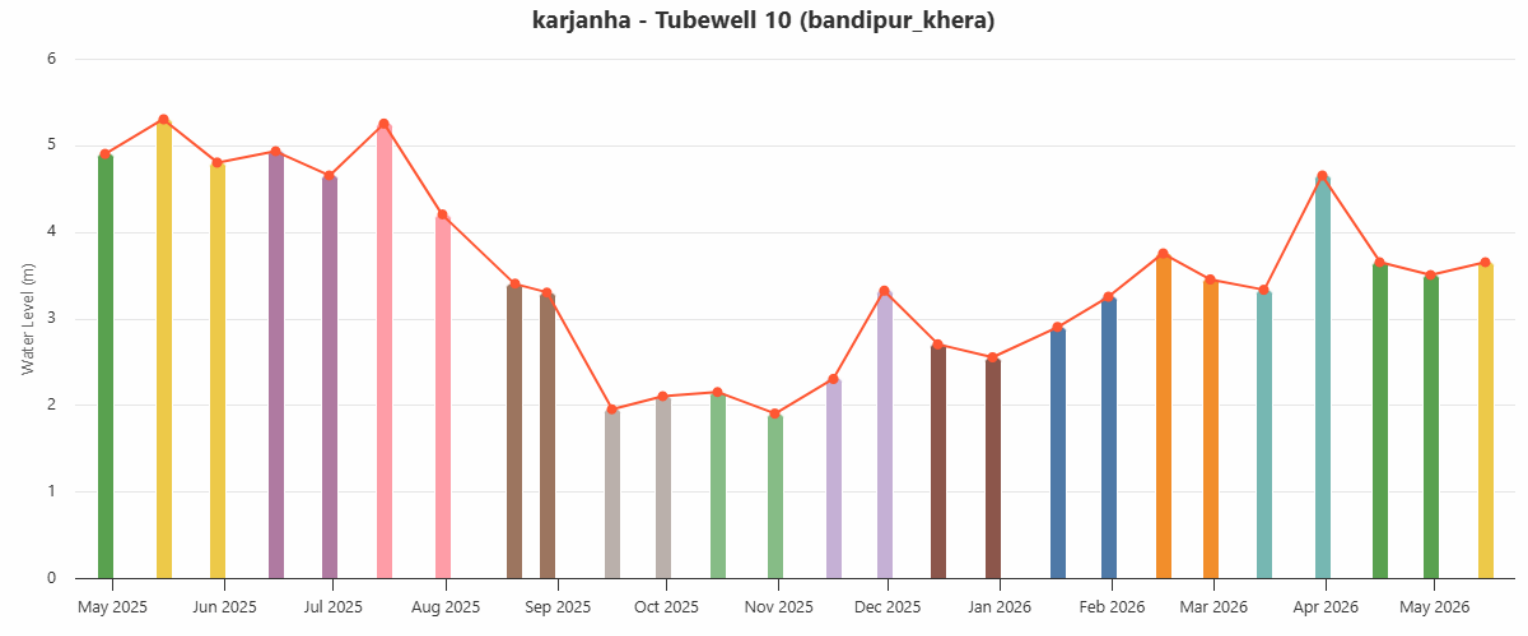
During Monsoon (June-July 2025), the data/chart shows the strong rise in water level (~6-7m) reflecting rainfall recharge. This is a typical characteristic of shallow aquifer that responds quickly to precipitations indicating strong surface-aquifer interactions. In Post monsoon (Sept. - Oct. 2025), the water level drops sharply ~3 m, suggesting heavy extraction and reduced recharge. This period marks the most critical stress point for this tubewell/aquifer with potential risk of wells running dry. The dry season (Dec. 2025 – May 2026), indicates that the water levels in this aquifer started to recover with gradual rise in water level (~5-6 m), showing aquifer resilience, slow recharge and extraction pressure compared to monsoon-driven rise.

Like other shallow aquifers, this tubewell also shows sharp water level fluctuations. Unlike deep aquifers, this site (tubewell) is highly sensitive and vulnerable to rainfall and extraction. Regarding this tubewell site, the site has quick recharge and depletion cycles and thus indicate strong dependence on surface recharge, but on higher contamination risks.

The data/chart indicates that Oct. 2025 is a high-risk period indicating water scarce situation possibly due to

complete drying of wells due to destabilization of aquifer resulted by over extraction. Therefore, during this dry period of the cycle, priority should be made for resilience planning measures to ensure contingency measures to ensure supply within this post monsoon season. However, this tubewell /aquifer having shallow depth increases the contamination vulnerability, requiring regular testing of the water quality. Similarly, this site exemplifies high seasonal vulnerability, reinforcing the need for targeted resilience planning measures during this post monsoon and dry months.

WATER LEVEL CHART



OBSERVATIONS

In Karjanha study area, the monitoring/observation well No 10 (TW-10), located at ward no 3, is in the Gangetic Plain at the Southern belt from Highway.

The water table shows a classic monsoon-driven seasonal cycle. Levels peak around May–July (pre-monsoon and monsoon onset), drop sharply through August–November (post-monsoon depletion), and partially recover through the dry winter months before the cycle repeats.

The key observations from this data/chart includes that in Monsoon Period (May – July 2025), the water levels sit between 4.5–5.4 m BGL, likely reflecting recharge from the spring snowmelt and early monsoon infiltration that has accumulated from the prior wet season. This period indicates water level has a peak zone. During Post Monsoon (August–Nov. 2025), a sharp and sustained drop from ~4.3 m down to about 1.9–2.1 m. This is the post-monsoon drawdown — despite heavy monsoon rainfall, surface runoff dominates and aquifer recharge lags behind extraction and evapotranspiration losses. This period indicates that water level is in declining phase. Whereas in Dry Season (December 2025–February 2026). Water Levels stabilize around 2.5–3.8 m. Reduced agricultural demand and cooler temperatures slow extraction, allowing some passive recharge. This period indicates that water level is at the low phase and is in recovery phase. Likewise, in pre-monsoon season (March–May 2026), A notable uptick back toward 4.6 m by April 2026, mirroring the prior year's peak — suggesting a fairly consistent annual recharge pattern. This period indicates that water level is at the speedy recovery phase.

In summary:

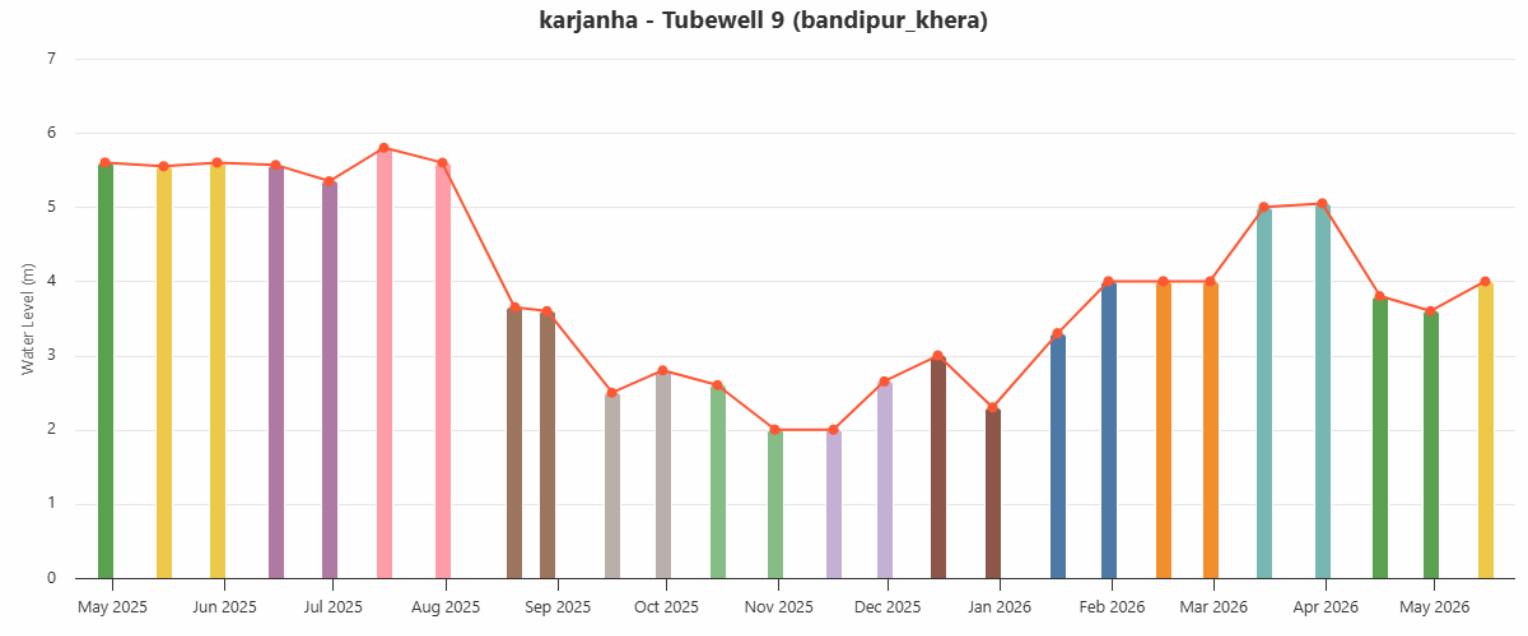
- Phase 1 (May–July 2025): Snowmelt plus prior monsoon recharge sustains high levels (~4.5–5.4 m). and reflect pre-monsoon peak.
- Phase 2 (Aug-Nov 2025): Sharp drawdown to 1.9 m as extraction outpaces infiltration and reflects post-monsoon decline (drop).
- Phase 3 (Dec 2025–Feb 2026): Low demand slows depletion and levels stabilize at ~2.5–3.8 m and reflect winter stabilization.
- Phase 4 (March-May 2026): Recharge pulse brings levels back to ~4.6 m, but below 2025 peak. This however reflects spring recovery/recharge.

The orange trend line in the chart dips to roughly 1.9 m in Oct.–Nov. 2025. This is a critically low level for a

tubewell, indicating the aquifer is being stressed during the dry season — likely a combination of high demand i.e. heavy extraction and insufficient recharge from that year's monsoon. This period marks the most significant drawdown reflecting the most critical stress point in the cycle and indicates a concerning signal.

While considering the current scenario of this aquifer site from the practical implications for water management, the ~3.5 m annual swing is quite large for a community tubewell. The critically low November levels (1.9 m) suggest the aquifer is under significant stress during peak dry-season demand. The slight year-on-year drop between May 2025, and May 2026 is worth watching. The year-on-year comparison reflects that May 2026 values (~3.5–3.6 m) appear slightly lower than May 2025 (~4.9–5 m), which could suggest a modest net depletion trend, though two data points aren't enough to confirm a long-term decline. If that pattern continues, it could indicate long-term groundwater depletion, possibly driven by over-extraction, reduced recharge from land-use change, or erratic monsoon patterns linked to climate variability.

WATER LEVEL CHART



OBSERVATIONS

In Karjanha study area, the monitoring/observation well no 09 (TW-09), located at Bandipur Khera-3, is in the Gangetic Plain at the Southern belt from Highway.

The water table shows that for most of the year (May 2025–Feb 2026, and Apr–May 2026), the water level remains consistently shallow at **~5–7 meters below ground surface**. In **March 2026**, the water level suddenly spikes to **~50 meters**, which is a dramatic departure from the otherwise stable pattern. This reflects a bit of anomaly. While analyzing the chart across the normal season cycle, unlike other tubewells that show monsoon-driven fluctuations, this site demonstrates remarkable stability across months. The shallow depth experienced by this aquifer suggests a highly responsive aquifer, likely recharged continuously by local rainfall and surface infiltration. Further observations can be made as below mentioned:

- Phase 1 (May–July 2025): Levels ~5–6 m, sustained by recharge from snowmelt and early monsoon and reflect high season.
- Phase 2 (Aug-Dec 2025): Gradual decline to ~1.5–2 m. Slower drop suggesting a deeper or more buffered aquifer and reflects dry drawdown.
- Phase 3 (Jan–March 2026): Levels stay low at ~1.5–4 m with little recovery indicating greater stress and prolonged low.
- Phase 4 (April-May 2026): Returns to ~4–5 m, consistent with prior year without any clear long-term depletion signal (anomaly aside) thereby indicating spring recharge.

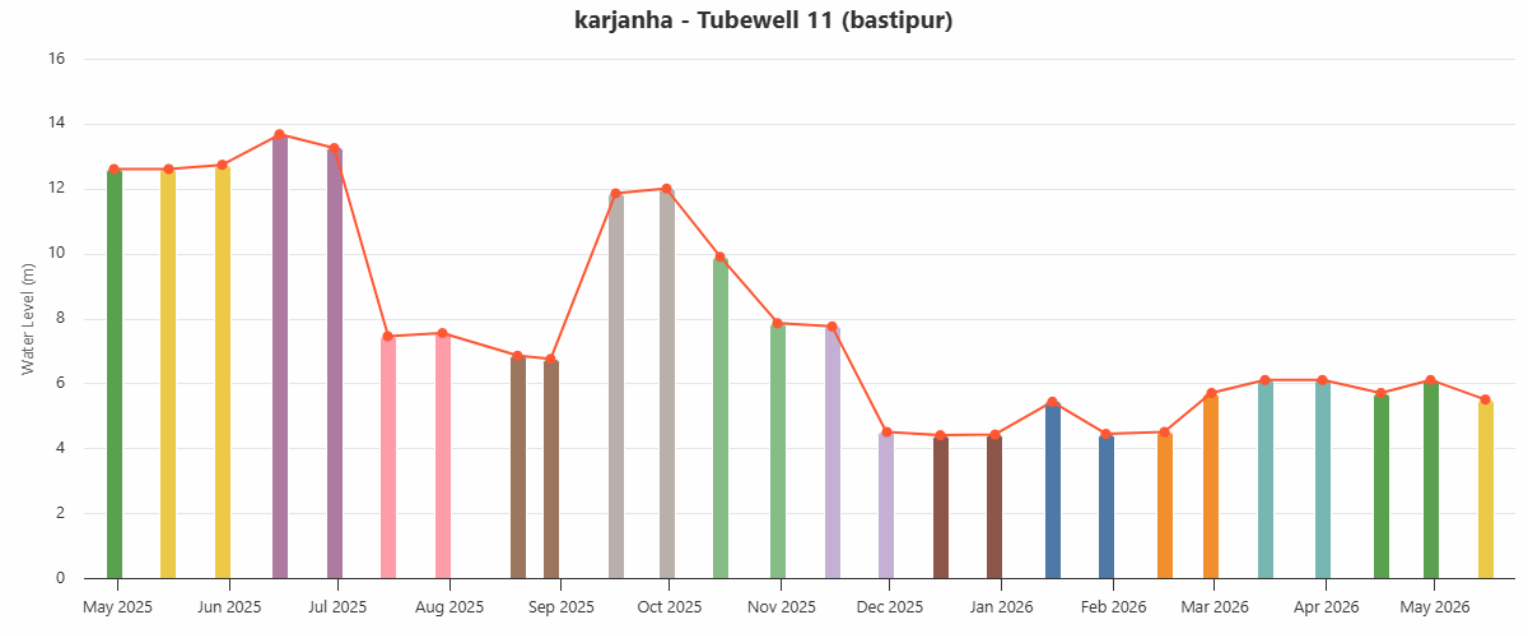
However, the chart also reflects a spike of ~49 m in March/April 2026. This is not a typical seasonal fluctuation physically and is in fact implausible for a shallow tubewell. It must be excluded from hydrological interpretation. The possible reason for this type of observation may be due to:

a. A faulty reading or equipment malfunction or maybe mislabeling or unit inconsistency (measurement error or data recording issue).
b. Pumping stress, cleaning, or maintenance affecting readings (operational change).
c. Sudden drawdown due to over-extraction nearby, or blockage in the tubewell (hydrogeological event).

The prevailing data of this tubewell side reflects that the aquifer of this tubewell site is shallow and stable, which is generally positive for community use. Therefore, March 2026 anomaly should be treated cautiously—it does not align with natural recharge/depletion cycles. Apart from this anomaly, this tubewell offers a steady water source

year-round. If anomalies are real, such a sharp drop could indicate critical aquifer stress or structural failure in the tubewell, or If anomalies recur, need to investigate aquifer connectivity and pumping practices. Lastly, one this clearly indicates that this tubewell (aquifer) site is stable but requires anomaly verification, contrasting it with more seasonally variable wells.

WATER LEVEL CHART



OBSERVATIONS

In Karjanha study area, the monitoring/observation well no 11 (TW-11), located at Bastipur-5, is in the Gangetic Plain at the Southern belt from Highway.

The water levels fluctuate between ~5 m and ~12 m BGL which is relatively deeper. The red line shows clear seasonal oscillations. This chart, therefore, reveals a distinctly different and more alarming groundwater story with Declining trend alert. Unlike most of the tubewells which recover toward prior-year peaks, Tubewell No 11 shows a persistent downward shift. May 2026 levels (~5.8 m) are less than half the May 2025 levels (~12.5 m). This is a strong indicator of long-term aquifer stress, not just seasonal variation.

- Phase 1 (May–Jun 2025): Levels at 12.5–13.9 m is significantly deeper aquifer awaiting the next monsoon recharge cycle suggesting a different geological unit.
- Phase 2 (Jul–Aug 2025): A peak (shallower water table) is visible around **July 2025**, consistent with monsoon rainfall recharge. This suggests the aquifer here is **rainfall-responsive**, with infiltration raising the water table. Suddenly, sharp monsoon drops i.e. sudden fall to ~7.5 m despite active monsoon. This is quite unusual and may indicate heavy extraction or poor local recharge connectivity.
- Phase 3 (Sep–Oct 2025): Recovery to ~12 m in September before collapsing again. This could reflect anomalous mid-season spikes due to late recharge pulse or a measurement irregularity.
- Phase 4 (Nov 2025–May 2026): Levels plateau at 4–6.5 m and fail to recover toward the 12+ m baseline. This is the critical concern as spring recharge is persistently low or no recovery in fact recharge is not restoring the aquifer.

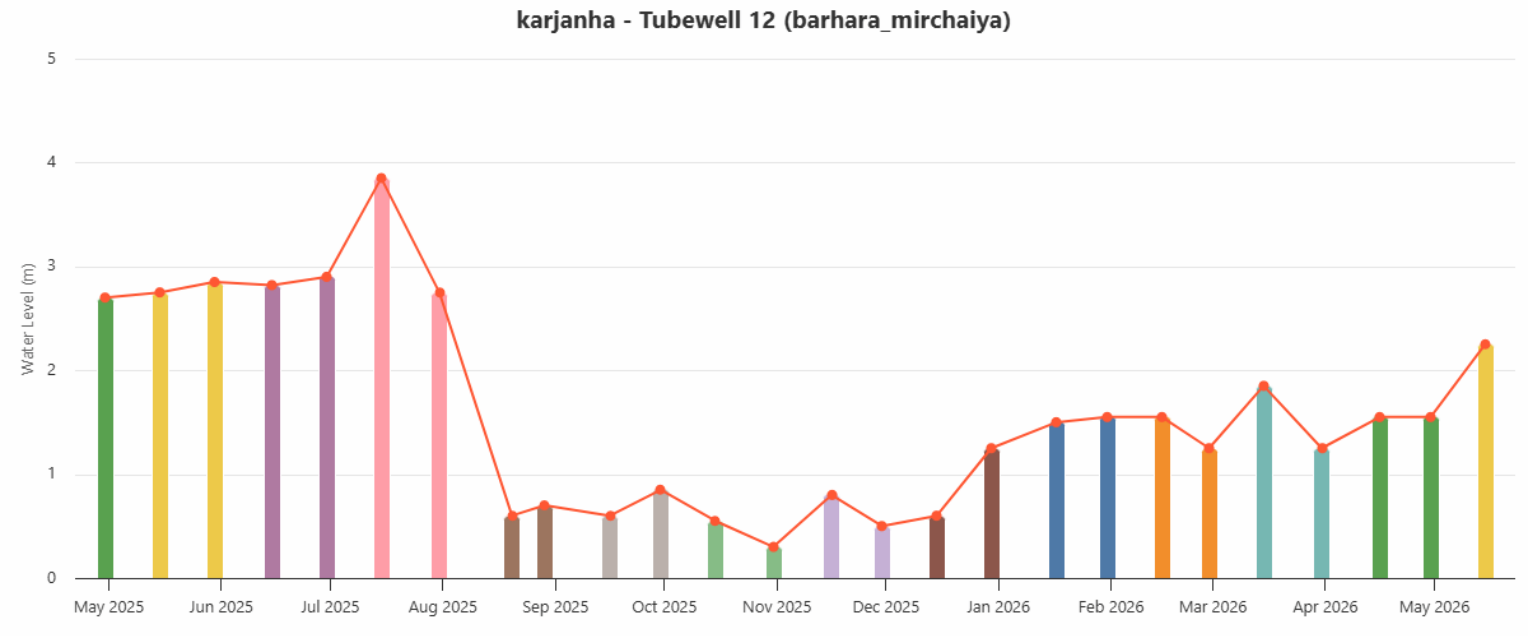
This Tubewell (aquifer) site operates at a much deeper level (4–14 m), has a far larger seasonal swing (~9.7 m vs ~3.5 m), and most critically such does not recover. The year-on-year drop of ~6.7 m between May 2025 and May 2026 points to either accelerating extraction, failed monsoon recharge into this aquifer layer, or structural changes in the local water table. This tubewell shows a classic seasonal cycle with shallow during monsoon, deep during dry season, thus reflecting natural aquifer dynamics more clearly. The November 2025 rise is interesting—it may point to local recharge sources (ponding, irrigation return flow, or lateral inflow).

The most worrying or concerning part of this tubewell/aquifer site is that in normal situation, the wells usually show seasonal breathing — they dip in the dry season and recover in spring. Tubewell No 11 does not recover. A ~6.7 m

year-on-year drop between the same month across two consecutive years is a serious signal, not noise. The September 2025 mid-season spike to ~12 m is also unusual — a near-full recovery in the middle of the monsoon followed by an immediate collapse suggests either an isolated recharge event (a heavy localized rainfall infiltrating directly into the aquifer) or a possible measurement irregularity/error that requires verification.

The aquifer feeding this well appears to be a deeper unit (operating at 4–14 m), which typically recharges more slowly and is more vulnerable to sustained over-extraction. Contributing factors could be increasing urban/peri-urban demand in Ward 5, reduced recharge from hardened surfaces, changes in land use upstream, or simply that this aquifer's natural replenishment rate is being outpaced by pumping. Giving due consideration to these aspects and suspected anomalies, immediate investigation and possibly a pumping rate assessment would be strongly suggested and warranted.

WATER LEVEL CHART



OBSERVATIONS

In Karjanha study area, the monitoring/observation well no 12 (TW-12), located at Baraha Mirchaiya-5, is in the Gangetic Plain at the Southern belt from Highway.

The water table fluctuates between <1 m and ~4 m BGL which in fact is very shallow. Unlike the steady profile of other Tubewells, this tubewell shows sharp fluctuations within a single year. In some ways, this chart presents the most stressed of all four tubewells analyzed. This tubewell operates at extremely low water levels (0.3–3.9 m). For most of Aug 2025–Apr 2026, levels sat below 1 m. At these depths, the risk of pump failure, dry-out, and contamination from surface infiltration is very high. This tubewell operates at critical shallow aquifer. Further observations can be made as mentioned below:

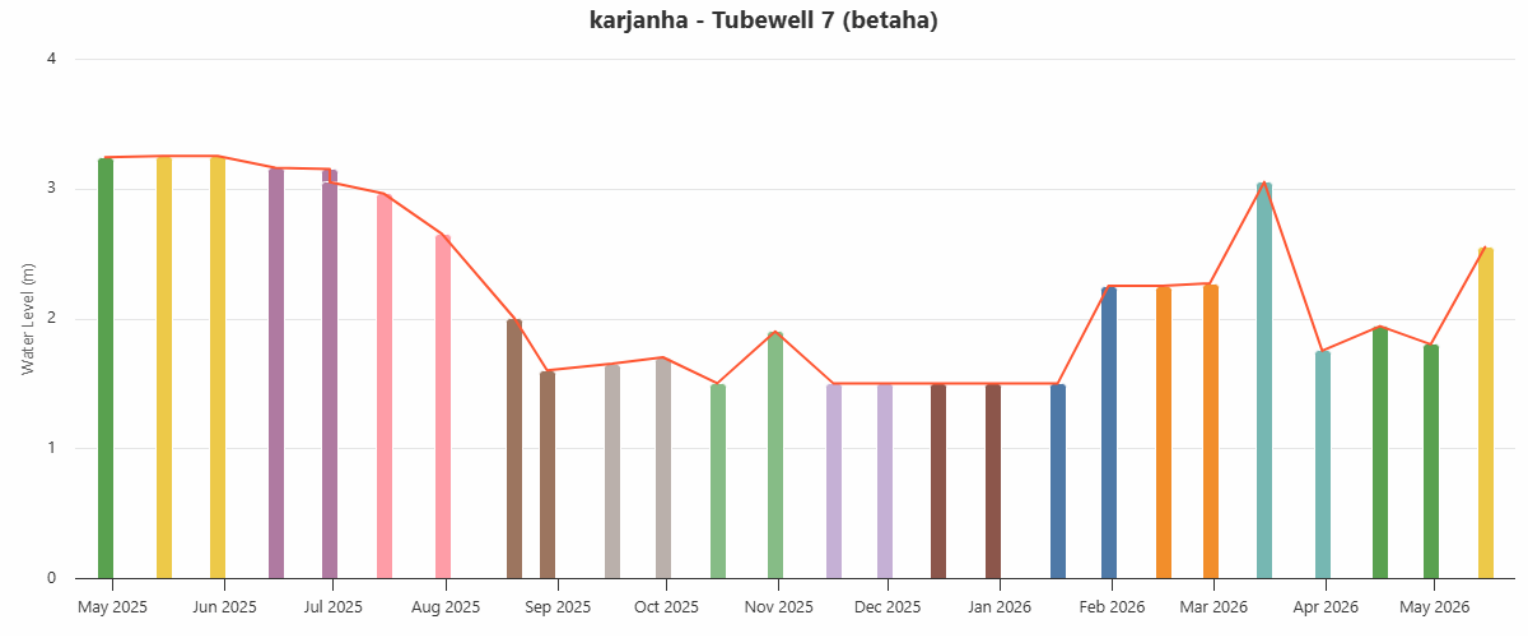
- Phase 1 (May–July 2025): Levels rise from ~2.7 m to a monsoon peak of 3.9 m in July — the only period of adequate water availability all year suggesting a monsoon peak indicating strong recharge during peak rainfall.
- Phase 2 (Aug-Dec 2025): A steep drop from 3.9 m to below 0.7 m within weeks of the monsoon peak — the fastest and most severe decline of all four wells studied suggesting a rapid collapse due to over extraction during harvest period, aquifer drawdown due to pumping stress, and or localized hydrogeological change (e.g. lateral flow away from the site).
- Phase 3 (Jan - April 2026): Six consecutive months below or near 1 m. Minor fluctuations suggest very limited recharge capacity — the aquifer is nearly exhausted seasonally suggesting a prolonged critical low.
- Phase 4 (May 2026): A recovery to ~2.3 m — but still well below the ~2.7 m May 2025 level, indicates a gradual rise back shows the aquifer's resilience and slow recharge through winter and pre-monsoon months thereby suggesting a modest year-on-year deficit with a partial recovery.

This is a very shallow, monsoon-dependent aquifer with virtually no dry-season buffer. The tubewell spends roughly half the year at critically low levels (below 1 m) which means the community it serves (Baraha Mirchaiya Tole) likely faces severe water scarcity for six months of the year. At 0.3 m (November 2025), the pump intake is essentially at the aquifer floor, risking sediment ingestion and pump burnout. This tubewell site is the most immediately precarious — extremely shallow, nearly exhausted for half the year, and with insufficient monsoon recharge to restore pre-dry-season levels. This tubewell is highly sensitive to both rainfall and extraction. The sharp September 2025 decline is unusual—it may reflect intensive irrigation demand or aquifer compartmentalization (*a small, shallow aquifer easily stressed*). Unlike other tubewells, this tubewell demonstrates abrupt stress events.

Therefore, a priority action for the municipality would be aquifer mapping across Ward 5 to understand whether the wells are drawing from the same unit, and whether demand-side management or alternative water sources are needed to reduce pressure during the October–April stress window.

While considering the current scenario of this aquifer site from the practical implications for water management, the Communities relying on this tubewell face greater vulnerability during post-monsoon months. This site should be flagged for close observation, especially around harvest seasons and be suggested to encourage rotation of pumping with deeper tubewells to avoid collapse of shallow aquifer zones. This is because, this tubewell exemplifies seasonal inequity in groundwater access—a strong narrative for grassroots advocacy.

WATER LEVEL CHART



OBSERVATIONS

In Karjanha study area, the monitoring/observation well no 07 (TW-07), located at Betaha-6, is in the Gangetic Plain at the Southern belt from Highway.

The water level in TW-07 fluctuates between ~1.5 m and ~3.5 m BGL. The water level fluctuating pattern shows a step-change depletion from Jul–Aug 2025 with no return to baseline. May 2026 (~2.6 m) is 19% below May 2025 (~3.2 m). The water level pattern has a clear cycle of decline through mid-2025, stabilization in late 2025, and recovery in early 2026. Therefore, the well now operates entirely within a stressed range (<2 m) for most of the year, with only a brief March 2026 spike breaking that pattern. This indicates that the tubewell operates with a structural drawdown without recovery. Further observations can be made as mentioned below:

- Phase 1 (May–July 2025): Consistent ~3.2 m across three months — an unusually flat monsoon-period baseline suggesting a well-buffered shallow aquifer indicating stable high plateau.
- Phase 2 (Aug-Sept 2025): A rapid drop from 3.1 m to 1.7 m in just one month, steeper and faster, and can possibly be linked to monsoon withdrawal and extraction surge, suggesting a step-change collapse due to over extraction during harvest period, aquifer drawdown due to pumping stress, and or localized hydrogeological change (e.g. lateral flow away from the site).
- Phase 3 (Oct 2025 - Feb 2026): Five months flat at ~1.5 m — a narrow band suggesting extraction and recharge are nearly balanced at a very low equilibrium. No meaningful recovery thus suggesting prolonged low plateau.
- Phase 4 (March - May 2026): A sharp rise to 3.0 m followed by an immediate return to ~2 m, showing resilience before the next monsoon cycle. Likely a strong localized recharge event or a measurement irregularity — suggests anomalous spike thus warranting verification.

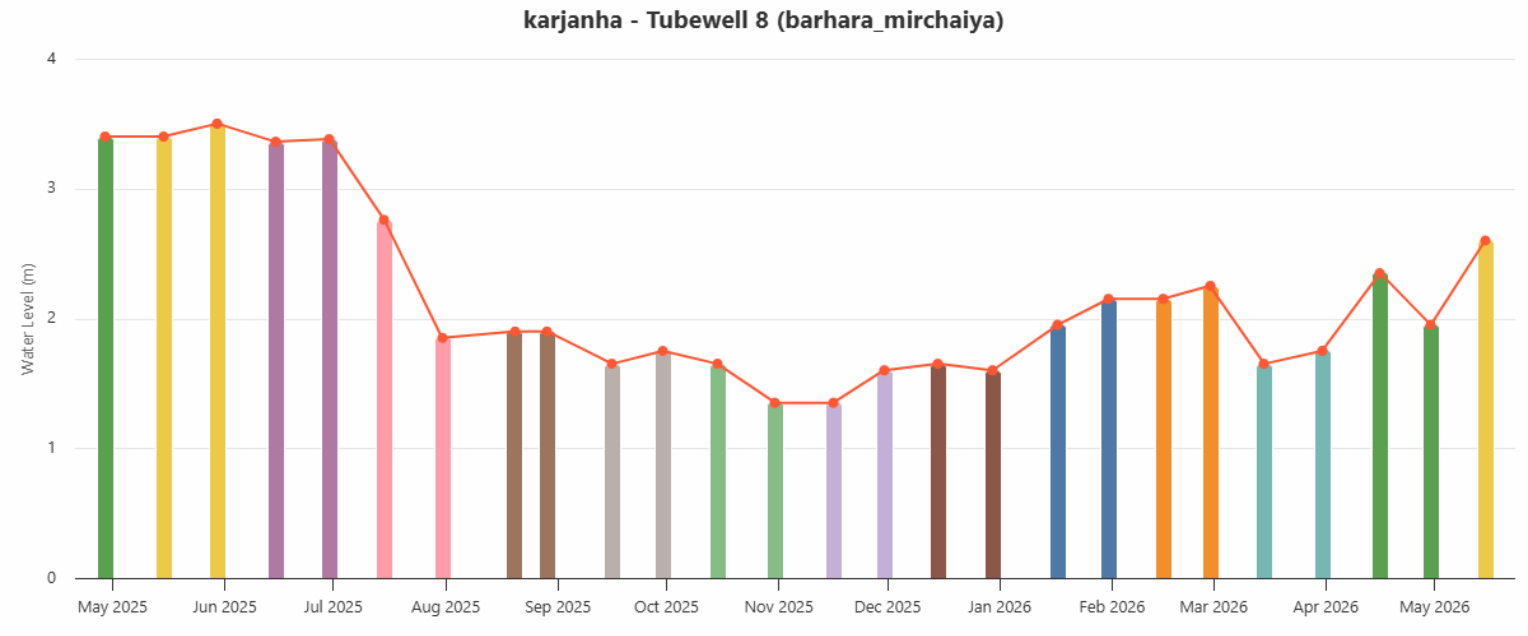
This tubewell spends the most months below 2 m — roughly 8 months of the year. While its absolute water levels are not the lowest (TW 12 dips to 0.3 m), the persistence of stress here is the longest. The flat 1.5 m plateau from Oct. 2025 through Jan. 2026 particularly suggests the aquifer has reached a low-level equilibrium where the little recharge trickling in is immediately consumed by extraction demand, leaving no buffer.

This tubewell demonstrates a classic seasonal cycle i.e. depletion during dry months, recovery with recharge. The March 2026 peak is notable—it suggests either exceptional recharge (rainfall or lateral inflow) or temporary reduction in demand. Comparatively, this aquifer is less volatile—its fluctuations are smoother and more

predictable. Here, the March 2026 spike to 3.0 m is puzzling and reflects an anomaly. The fact that this spike appears in wells across different wards and depths, followed immediately by a return to low levels, raises the possibility of either a regional heavy recharge event (intense late-winter rainfall or irrigation return flow) or a systematic data collection pattern worth auditing.

This tubewell is relatively stable, but still vulnerable during late dry season. Extraction should be moderated in Aug–Dec to prevent over-stress. The March 2026 rise should be cross-checked with rainfall records to confirm recharge dynamics. This site illustrates resilient aquifer behavior, contrasting with the stress-prone TW-12 in the same Ward.

WATER LEVEL CHART



OBSERVATIONS

In Karjanha study area, the monitoring/observation well no 08 (TW-08), located at Baraha Mirchaiya-6, is in the Gangetic Plain at the Southern belt from Highway.

The water level fluctuates between ~1.5 m and ~4 m BGL, thereby reflecting a shallower aquifer. The water level fluctuating pattern shows a cycle of high levels in early monsoon (May–Jul 2025), decline through late 2025, and recovery by May 2026. This TW-08 shows an irreversible mid-year step-down from its ~3.4 m baseline with no meaningful spring recovery. May 2026 (~2.6 m) remains 24% below May 2025 (~3.4 m). Eight consecutive months below 2 m confirms chronic aquifer stress in Ward 6. The water level fluctuation pattern indicates that the tubewell operates with a persistent structural drawdown. Further observations can be made as mentioned below:

- Phase 1 (May–July 2025): Flat ~3.3–3.5 m for three months suggesting both wells (TW-08 and TW-07) draw from the same aquifer unit in Ward 6 and indicate stable monsoon peak reflecting strong rainfall infiltration.
- Phase 2 (Aug 2025): A near-identical drop to TW 7 (~1.8 m in August), same timing, same magnitude. Strongly indicative of a shared aquifer responding to a common depletion trigger. The pattern reflects abrupt step down or sharp drawdown as post-monsoon decline as recharge slows and extraction continues.
- Phase 3 (Sept 2025–Feb 2026): Six months in the 1.3–2 m range, with a trough of 1.3 m in November suggests that TW 8 draws more heavily or sits in a less recharged zone. The pattern indicates the extended critically lower levels and stress during these dry months.
- Phase 4 (March-May 2026): A slow climb to 2.6 m by May 2026 and crash in March. No anomalous spike here, making TW 8 the cleaner signal of the two Ward 6 wells. This however reflects gradual partial recovery /recharge in the well suggesting aquifer resilience, likely aided by winter rainfall and reduced demand.

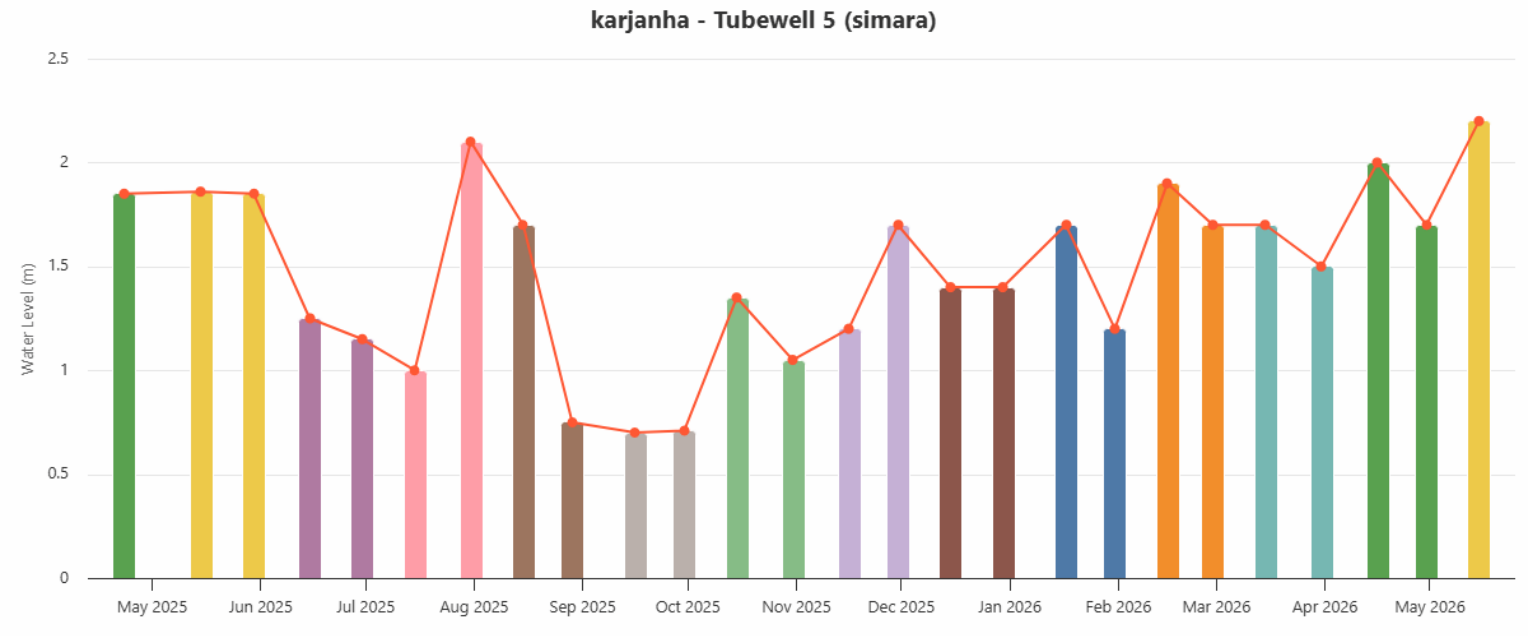
The water table shows a predictable monsoon-driven seasonal cycle with slightly deeper fluctuations. The aquifer is responsive to rainfall, but vulnerable to depletion in late dry season. However, this tubewell (TW-08) shows more stable and resilient.

This tubewell provides relatively consistent access, but communities should anticipate stress in Oct–Dec. Seasonal recharge patterns should be tracked against rainfall records to confirm aquifer responsiveness. This site

strengthens the narrative of hydro-social diversity—some aquifers are shallow and volatile, others resilient and predictable. However, Municipality-wide, a seasonal demand management strategy, particularly rationing pumping during October–February, combined with recharge augmentation measures (*rainwater harvesting, managed aquifer recharge pits*) would address the root cause rather than just monitoring the symptoms of decline.

Interesting Fact: The Ward 6 shared-aquifer finding is the most actionable insight from this well. The near-perfect synchrony between TW 7 and TW 8 — same baseline (~3.2–3.4 m), same August collapse timing, same prolonged low, similar May 2026 recovery level — is a strong hydrogeological signal. These two wells almost certainly tap the same shallow aquifer body. This means interventions or stresses affecting one well directly affect the other, and combined extraction from both is accelerating depletion of a single shared resource.

WATER LEVEL CHART



OBSERVATIONS

In Karjanha study area, the monitoring/observation well no 05 (TW-05), located at Simara Tole -7, is in the Gangetic Plain at the Southern belt from Highway.

This chart shows the water level fluctuates between ~0.5 m and ~2 m BGL. This tubewell reveals an extremely shallow aquifer, with water levels ranging only between ~0.65 m and ~2.1 m across the full annual cycle. The water table sits less than 2 m below the surface for most of the year, which has profound implications for both water security and contamination risk. The water level fluctuating pattern shows a short-term variability with multiple peaks and troughs across the year showing a short-term variability rather than smooth seasonal cycle. Further observations can be made as mentioned below:

- Phase 1 (May–Aug 2025): Water levels drop significantly from ~1.85 m in May down to a low of 0.7 m in Aug-Sept 2025 with declining water levels during early monsoon. This reflects aquifer depletion due to dry season demand and reduced recharge and the period August–September marks the critical stress period for groundwater.

- Phase 2 (Sept – Oct. 2025): A sharp rebound to ~2.1m in Aug/Sep (the pink bar spike) suggests strong monsoon infiltration recharging the aquifer. This is typical of the Terai/valley geology where monsoon rains rapidly recharging the shallow aquifers. This suggests localized recharge events

- Phase 3 (Nov 2025 – Feb 2026): Levels stabilize then gradually decline from ~1.35m (Nov) toward 1.2–1.7m range. Winter abstraction and reduced recharge drive a slow drawdown. This reflects gradual decline in post-monsoon. The levels dip toward ~0.5 m, reflecting aquifer stress during the dry months.

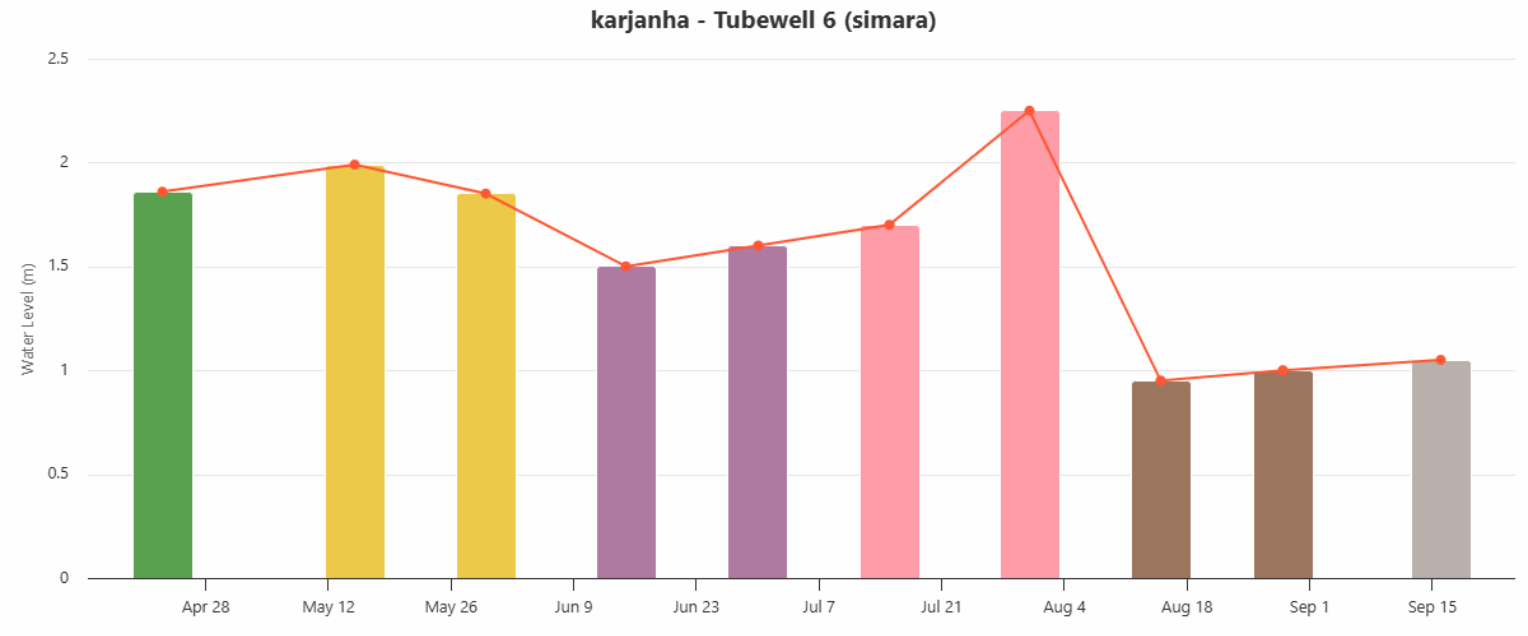
- Phase 4 (March – May 2026): By May 2026, levels are rising again toward ~2.2m, suggesting another monsoon recharge cycle beginning. May 2026 values are notably higher than May 2025, which could indicate slightly better recharge or lower abstraction. This however reflects gradual partial recovery /recharge in the well suggesting aquifer resilience, likely aided by winter rainfall and reduced demand.

During Aug-Sept 2025, lowest water table is experienced with a peak groundwater stress and this prevailed with a risk of tubewell running dry. The highest water table: Aug 2025 spiking and May 2026 reflecting the monsoon recharge is effective. When year on year comparison is made, May 2026 is slightly higher than May 2025 stable or improving aquifer. The TW-07 also experiences moderate seasonal variability. The tubewell is highly sensitive to both rainfall and human activity. The multiple peaks (Jul, Sep, Nov, Mar, May) suggest episodic recharge rather than a single monsoon-driven cycle. Comparatively, this aquifer is shallower and more volatile, making it more

vulnerable to stress but also quicker to recover.

The groundwater system here shows a classic monsoon-driven recharge pattern consistent with Nepal's seasonal hydrology. The aquifer is most vulnerable during late summer (Aug–Sep) before monsoon recharge kicks in. The overall trend appears stable, with no alarming long-term depletion visible within this one-year window. Communities here benefit from quick recharge, but risk short-term scarcity during dry months. Peaks outside monsoon should be investigated, likely linked to local water management practices. This tubewell illustrates hydro-social fragility—a shallow aquifer that responds quickly but is easily stressed.

WATER LEVEL CHART



OBSERVATIONS

In Karjanha study area, the monitoring/observation well no 06 (TW-06), located at Simara Tole -7, is in the Gangetic Plain at the Southern belt from Highway.

Unlike all other wells (12 months of data), Tubewell No 6 shows only ~5 months of readings: late April through mid-September 2025. This is either a newly commissioned well, a recently installed sensor, or data collection began mid-year. No year-on-year comparison is possible, and seasonal recovery cannot be assessed due to limited data window. However, this chart shows that this tubewell reveals an extremely shallow aquifer, with water levels ranging only between ~0.95 m and ~2.25 m BGL across the full annual cycle. A short-term cycle (Apr–Sep 2025) with a gradual rise until late July/early August, followed by a sharp decline.

The entire operating range is 1.0–2.3 m. By mid-August 2025, levels have dropped to ~1.0 m and appear to be still falling. This is also one of the shallowest wells, and the trajectory at the data cutoff is downward with no sign of stabilization, thus reflecting critically shallow and declining water levels.

- Phase 1 (April – May 2025): Levels fluctuate between 1.4–2.0 m over ~3 months with no clear trend, neither building up nor depleting. This suggests a very thin, quickly saturating aquifer reflecting narrow oscillation. In this period, the water level remains moderate, reflecting limited recharge before monsoon precipitations.

- Phase 2 (June – July 2025): A sharp rise to 2.3 m, the only notable recharge event in the record. The water levels peak consistently with the rainfall infiltration and aquifer recharge. Likely a concentrated monsoon infiltration, but the aquifer cannot retain it, and the water levels collapse within days. This reflects an observation of a brief monsoon pulse.

- Phase 3 (Aug - Sept 2025): A 1.3 m drop in roughly 6 weeks, the steepest rate of decline. At this rate, the well risks reaching pump intake depth before October 2025 and reflect rapid post-pulse collapse. This sharp decline suggests intensive extraction or rapid aquifer drawdown. Stabilization in September indicates the aquifer reached a new equilibrium under stress.

- Phase 4 (Post Sept 2025): No data available beyond mid-September. Given the trajectory, the Oct–Jan period (historically the driest) likely pushed this well to critical or dry conditions.

The narrow pre-monsoon oscillation (1.4–2.0 m over three months) also tells us this aquifer has extremely low storage capacity. It neither builds reserves during the pre-monsoon nor holds recharge for long. The sharp August decline, i.e. the monsoon pulse on August 4 drained away almost immediately, leaving nothing for the dry season.

This reflects high demand/ heavy extraction or limited aquifer storage capacity.

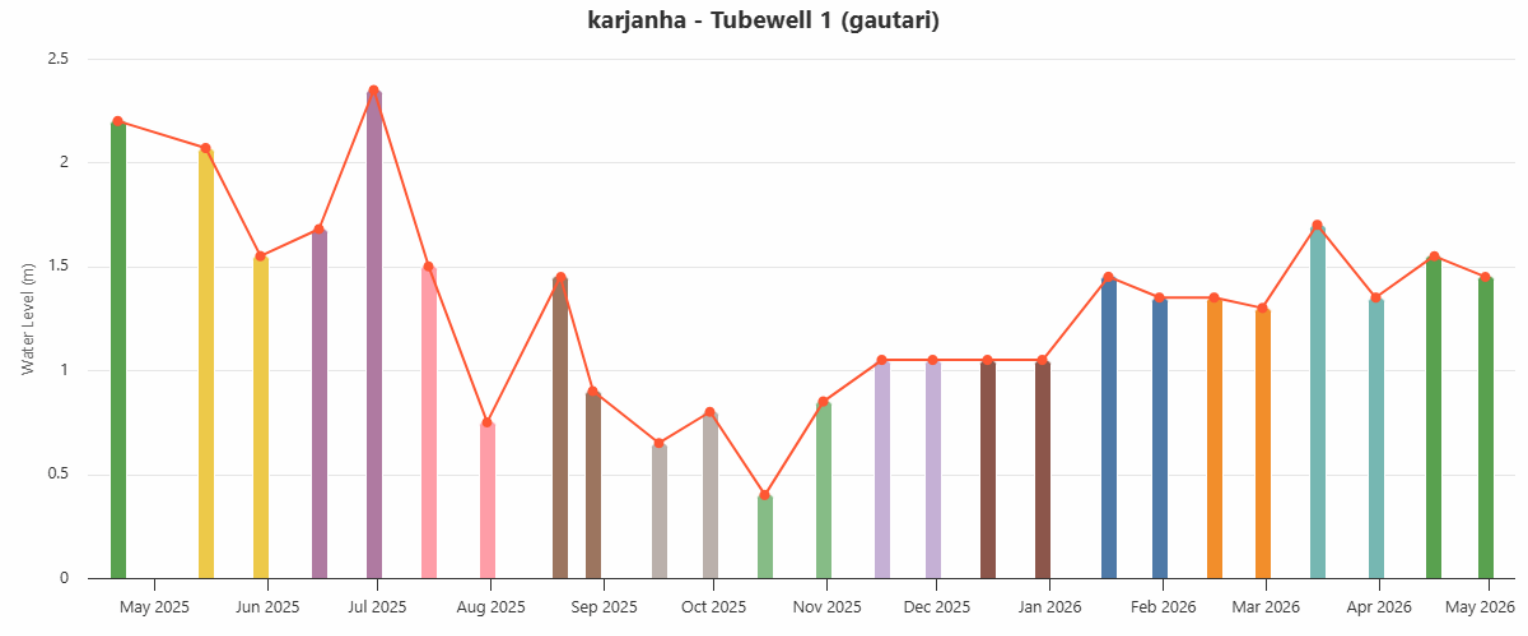
The TW-06 took only weeks to reach its trough; that is, this tubewell shows a short-term monsoon-driven cycle but with abrupt depletion after recharge and demonstrates a single recharge–depletion cycle within the monsoon season. This tubewell is vulnerable to rapid depletion after monsoon, making it less reliable for sustained use. Extraction should be carefully managed in Aug–Sep to avoid aquifer stress. This site highlights the fragility of shallow aquifers under seasonal demand pressure, reinforcing the need for equitable water-sharing mechanisms.

Unique concerns of TW-06 despite its short data record: Two things stand out, i.e.;

- First, the entire observed range, even at its best, never exceeds 2.3 m. This well has essentially no headroom; and
- Second, the rate of post-peak decline is the fastest in the dataset: 1.3 m lost in just six weeks after the August 4 pulse.

The data gap after September 2025 itself is a red flag. Monitoring appears to have stopped or failed at precisely the moment the well was entering its most critical period. Cross-check rainfall and pumping records to confirm whether the August decline is demand-driven or structural. Whether the sensor failed, the well went dry, or data collection was interrupted, the municipality should treat the absence of data as a reason for urgent field verification, not reassurance.

WATER LEVEL CHART



OBSERVATIONS

In Karjanha study area, the monitoring/observation well no 01 (TW-01), located at Gautari Tole - 8, is in the Gangetic Plain at the Southern belt from Highway.

This chart shows the fluctuation of water level between ~0.5 m and ~2.5 m BGL. This well aquifer reveals a cycle of peaks in July 2025 and March 2026, with troughs in September and November 2025. This tubewell reveals that it operates with an extremely shallow aquifer, with water levels ranging only between ~0.3 m and ~2.4 m – the narrowest absolute range of any well with full-year data; yet it shows one of the more resilient recovery patterns. At Oct. 2025 trough of ~0.3 m, the pump is essentially at the sediment floor. Contamination risk from surface infiltration is very high at these depths. Despite being the shallowest well, May 2026 (~1.5 m) is only modestly below May 2025 (~2.1 m), a Year-on-Year (Y0Y) decline of ~0.6 m. The aquifer recovers partially each year, suggesting some local recharge connectivity and relative resilience. Further observations can be made as mentioned below:

- Phase 1 (May–July 2025): Starts high at ~2.1 m in consistent with rainfall infiltration, dips briefly to ~1.5 m in June, then surges to 2.4 m in July from monsoon infiltration. The June dip suggests active extraction during early summer demand. This suggests pre-monsoon peak.

- Phase 2 (Aug-Oct 2025): A steep drop from 2.4 m to 0.3 m in just ~10 weeks, comparable to TW 6's post-pulse collapse rate showing aquifer depletion as recharge slows and extraction continues. This aquifer sheds water extremely quickly once the monsoon recharge pulse passes. The pattern reflects abrupt step down or sharp drawdown as post-monsoon decline as recharge slows and extraction continues thus reflecting rapid post-monsoon crash.

- Phase 3 (Nov 2025–Jan 2026): Recovery begins slowly from the October floor. Levels stay below 1.1 m through January, four months near pump-intake depth. Any further extraction stress could dry this well temporarily. Sustained low levels indicate vulnerability during the dry months.

- Phase 4 (Feb-May 2026): A steady climb back to ~1.5 m by May 2026. Unlike TW 11 and TW 6, this well does recover — but not to its prior-year level, indicating a modest but real annual depletion trend. This reflects the condition of gradual spring recovery and suggests aquifer resilience and responsiveness to recharge.

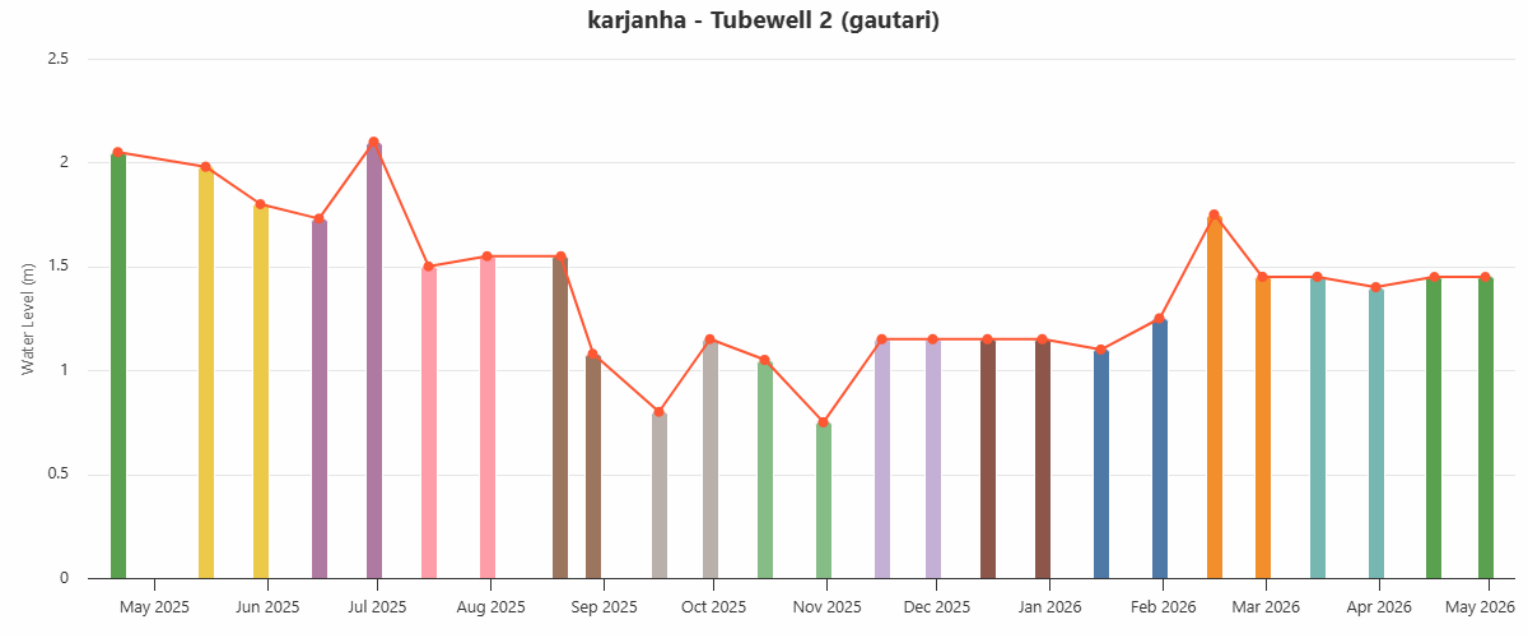
The water level of TW01 in June dip to ~1.5 m, sandwiched between two higher readings in May and July, is telling

a behavioral signature. It points to peak early-summer extraction demand pulling the water table down just before the monsoon arrives to recharge it. This kind of extraction-recharge interplay is healthy in principle, but with only 2.4 m of headroom at best, the margin for error is razor thin.

The October trough of 0.3 m is alarming in absolute terms — the lowest confirmed reading, yet the subsequent recovery to 1.5 m by May 2026, while incomplete, demonstrates this aquifer does have some recharge pathway. It is a fragile system that still functions, as opposed to structurally broken. However, this well/aquifer is more stable with smoother transitions between peaks and troughs.

Lastly, this tubewell shows a dual-peak cycle: one during monsoon (Jul 2025) and another during late winter/early spring (Mar 2026). The March peak is unusual—it may reflect winter rainfall recharge or reduced pumping demand. This tubewell is relatively resilient, but communities should anticipate stress in Sep–Nov. The March 2026 peak should be cross-checked with rainfall and pumping records to confirm recharge dynamics. This site illustrates hydro-social resilience, contrasting with more volatile shallow aquifers in other wards.

WATER LEVEL CHART



OBSERVATIONS

In Karjanha study area, the monitoring/observation well no 02 (TW-02), located at Gautari Tole - 8, is in the Gangetic Plain at the Southern belt from Highway.

This chart shows the fluctuation of water level between ~1.0 m and ~2.0 m BGL. This well aquifer reveals a relatively stable aquifer with modes seasonal variation with Jan 2026 showing dry season depletion and Mid 2025 reflecting monsoon recharge. The TW-02 operates almost entirely below 2 m for its entire recorded history. It begins declining immediately in May 2025 with no monsoon recovery. By late 2025 it plateaus at ~1.1–1.5 m with no meaningful seasonal swing. This aquifer appears to have lost its recharge responsiveness entirely and reflects Permanent depletion threshold crossed.

Unlike other wells measured monthly or bi-weekly, TW 02 appears to have sub-weekly readings (tooltip shows Jan 15, 2026 = 1.1 m). The rapid oscillations visible throughout the chart are likely real pump-cycle or diurnal draw-down and recovery signals, not noise. This is valuable data showing High-frequency data insight revealing extraction demand at the aquifer level. Further observations can be made as mentioned below:

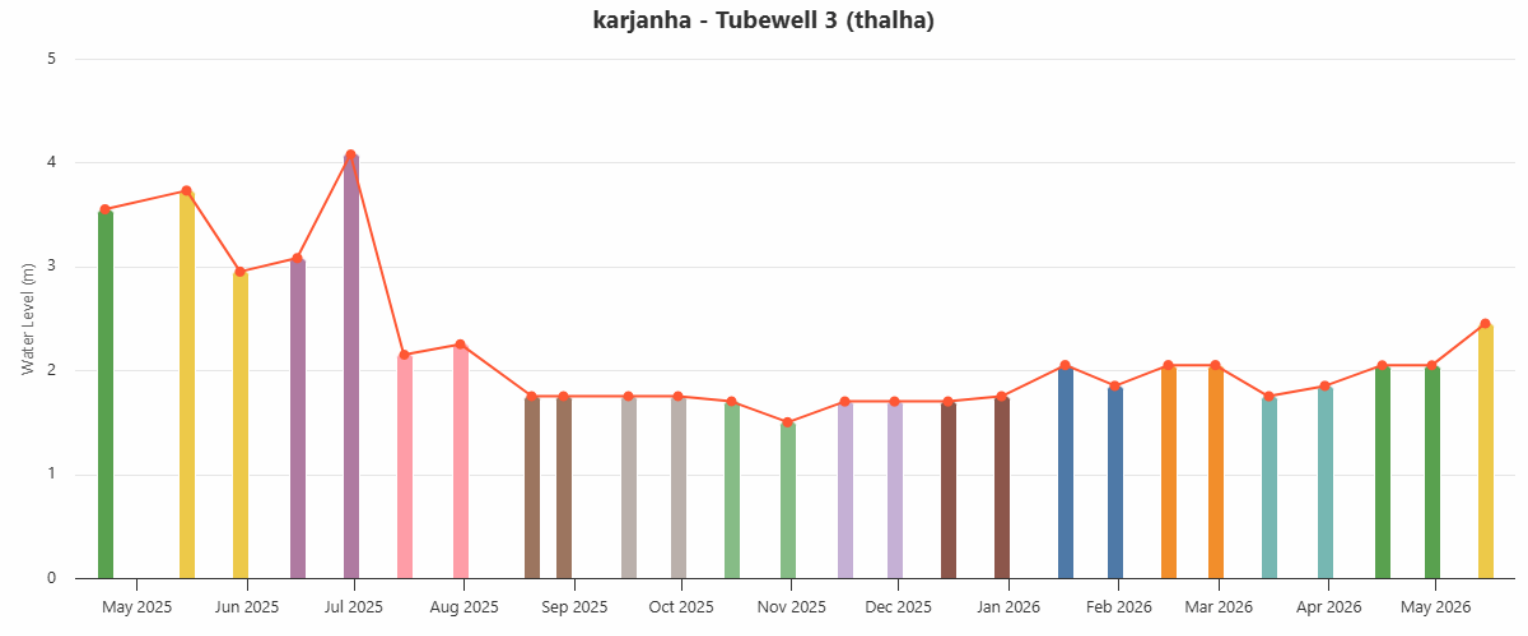
- Phase 1 (May–July 2025): Every other well shows a monsoon peak in June–July. TW 2 declines continuously from day one, reaching ~1.55 m by July. The aquifer is not receiving monsoon recharge — a structural disconnection from surface infiltration reflecting immediate decline but no peak.
- Phase 2 (Aug-Oct 2025): Two separate dips to ~0.75 m in late August and late November. Rapid oscillations suggest intensive pumping against near-exhausted storage. Levels gradually drop showing aquifer drawdown as recharge slows.
- Phase 3 (Nov 2025–Jan 2026): Levels stabilize at ~1.1–1.5 m. Crucially, there is no spring recovery trend visible — unlike TW 1 which climbs back toward 1.5 m. Lowest water levels occur, reflecting extraction pressure and minimal recharge. TW 02 ends the record at roughly the same level it entered the dry season.
- Phase 4 (Feb-May 2026): The rapid up-down oscillations (visible across all seasons) indicate the sensor captures each pump start-stop cycle. This is a rare and valuable operational signal — the aquifer recovers partially between pumping events, suggesting it is not yet completely dry but has minimal storage buffer. This reflects the visibility of extraction frequency, aquifer resilience, and responsiveness to seasonal recharge.

This tubewell is **less volatile** than TW-01 in the same ward, which showed dual peaks. The aquifer here demonstrates **predictable monsoon-driven cycles** with modest dry-season stress. The January 2026 low point is typical of shallow aquifers under extraction pressure, but recovery indicates resilience.

The absence of any monsoon peak is the single most diagnostic feature here. Every other well, regardless of ward, depth, or aquifer type, shows some response to the monsoon season, even if modest. TW-02 declines from the very first reading in May 2025 and never looks back. This points to a physical disconnection between this aquifer and the local surface recharge system, likely caused by overlying impervious surfaces, a clay aquitard blocking vertical infiltration, or the aquifer having already been drawn below the zone that seasonal recharge can reach.

The pump-cycle oscillations are a silver lining analytically. The fact that levels bounce back partially between pumping events tells us the aquifer still has some hydraulic conductivity and is not completely sealed off. But the overall trend envelope is flat-to-declining, meaning incoming recharge equals or is less than ongoing extraction. This is a system in equilibrium at a dangerously low level.

WATER LEVEL CHART



OBSERVATIONS

In Karjanha study area, the monitoring/observation well no 03 (TW-03), located at Thalhai Tole - 8, is in the Gangetic Plain at the Southern belt from Highway.

This chart shows the water level fluctuates between ~1.5 m and ~4 m BGL. This tubewell reveals a pattern of a clear monsoon recharge peak in July 2025 (~4 m) followed by a decline and stabilization around 1.5-2.5 m until early 2026, with a modest recovery by May 2026. After a sharp post-monsoon crash, TW 03 finds a stable floor at ~1.75–1.8 m and holds it remarkably consistently for 8+ months (Sep 2025–Apr 2026) thereby reflecting a sustained equilibrium. It suggests the aquifer has reached a dynamic balance between recharge and extraction at this level. However, the pre-monsoon level of 3.5–3.7 m (May–Jun 2025) is never recovered. May 2026 at ~2.5 m represents a ~1.0 m year-on-year deficit. The aquifer stabilized, but at a permanently lower level than where it started. Further observations can be made as mentioned below:

- Phase 1 (May–July 2025): Rises from 3.6 m to 4.1 m — This strong peak indicates a robust rainfall infiltration and aquifer recharge - a clear monsoon response. The June dip to ~3.0 m (likely extraction) is quickly overcome, showing a healthy recharge flux at this time of year. This reflects the monsoon recharge peak.
- Phase 2 (Aug - Sept 2025): A steep drop from 4.1 m to ~1.75 m in ~6 weeks — one of the sharpest post-monsoon declines in the dataset. The aquifer drains quickly once monsoon recharge ceases, indicating limited storage capacity. This indicates the rapid post monsoon crash (decline).
- Phase 3 (Sept 2025 – April 2026): Eight months of near-perfectly flat levels at 1.75–1.80 m. This is unique in the dataset. It implies the aquifer has reached an equilibrium point where slow lateral or deep recharge exactly balances extraction — a fragile but functioning state. At this period, water levels remain relatively stable, showing aquifer resilience despite reduced recharge. This suggests a remarkable stable plateau during the dry season.
- Phase 4 (May 2026): A rise to ~2.5 m by May 2026 — the first upward movement since the monsoon. Encouraging, but ~1.1 m below the May 2025 starting point. Gradual rise to ~2.5–3 m suggests aquifer responsiveness to late winter/early spring recharge. The question for year 2 is whether the 2026 monsoon can recover more of this deficit. This suggests modest spring uplift / recovery.

The plateau behavior is hydro-geologically significant because of the following arguments:

- An 8-month flat line at exactly ~1.75–1.80 m is not accidental — it is a system finding its equilibrium point. In aquifer science this is called the "dynamic equilibrium level" — the depth at which inflow (lateral seepage, slow percolation) precisely matches outflow (pumping, evapotranspiration).

- The fact that TW 03 found this equilibrium rather than continuing to decline (as TW 02 does) suggests this aquifer has some residual recharge connectivity, probably through slow lateral flow from an adjacent formation rather than direct surface infiltration.

- This tubewell demonstrates a classic monsoon-driven cycle with a strong recharge peak and gradual depletion. This TW-03 shows greater amplitude of fluctuation, meaning it is more sensitive to rainfall but also more vulnerable to depletion. The stability in late 2025 suggests moderate extraction pressure and aquifer resilience.

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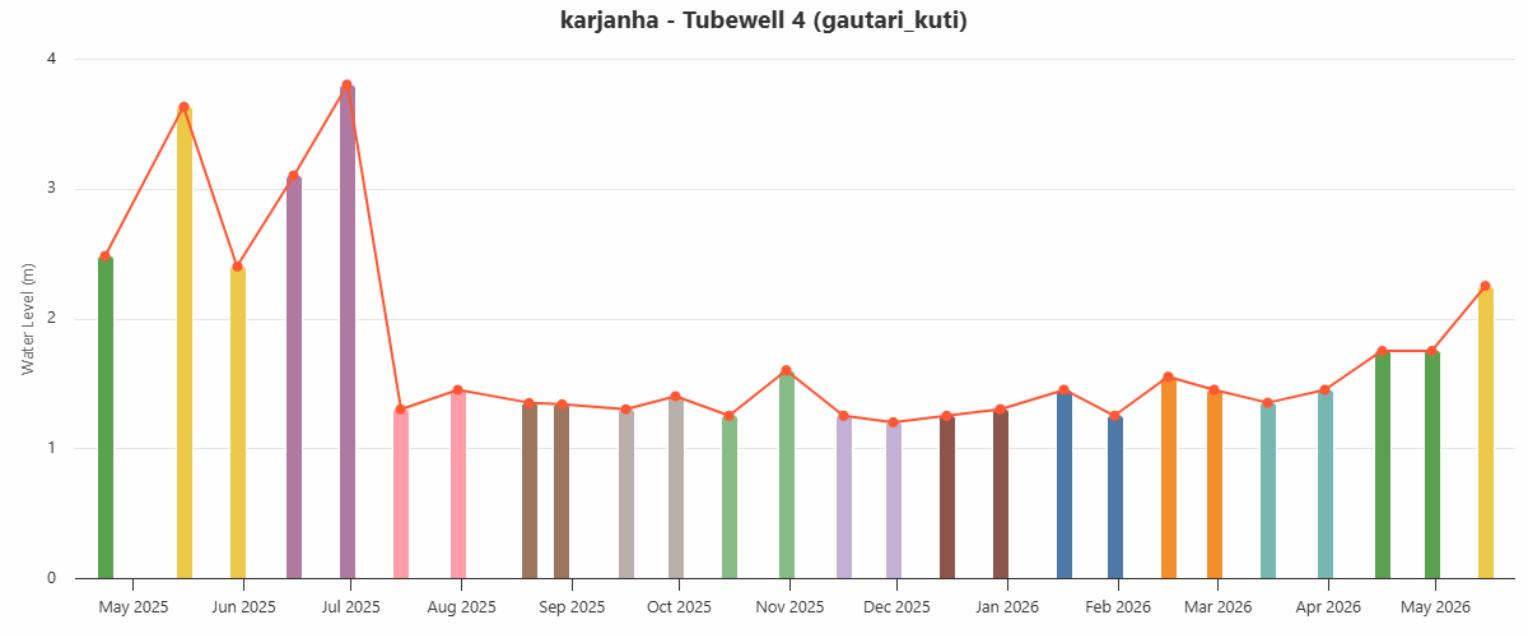
TW 4

WATER LEVEL CHART



OBSERVATIONS

In Karjanha study area, the monitoring/observation well no 04 (TW-04), located at Gautari Kuti - 8, is in the Gangetic Plain at the Southern belt from Highway.

TW-04 swings wildly between 1.4 m and 3.8 m in the May–July 2025 window, then collapses to a near-flat ~1.3–1.5 m plateau for 10 months. The TW-04 thus finds a low equilibrium — but at a lower absolute level and with less spring recovery. This reflects the behavior of TW-04 as high early volatility, then structural low plateau. The large May–June swings (2.6 ? 3.6 ? 2.4 ? 3.0 ? 3.8 m) across just 6–8 weeks are too large and rapid for natural aquifer fluctuation alone. They almost certainly reflect alternating heavy pumping and recovery events — possibly irrigation cycles — in a well with very limited storage volume. This indicates that pre-monsoon oscillations are diagnostically unusual, This chart shows the water level fluctuation revealing a pattern of high levels in May - July 2025 followed by a decline and stabilization through late 2025 until early 2026, with a modest recovery by May 2026. Further observations can be made as mentioned below:

- Phase 1 (May–July 2025): Rapid swings of up to 2.4 m within weeks — physically consistent with a low-storage aquifer being repeatedly drawn down and allowed to recover between pumping sessions. Irrigation demand likely driver. This reflects the pump-cycle volatility with Strong peak indicating robust rainfall infiltration and aquifer recharge.
- Phase 2 (Aug - Sept 2025): Despite a July peak of 3.8 m (the highest reading in record), the well collapses to ~1.4 m within weeks. Classic "fast drain" behavior — the aquifer accepts recharge rapidly but cannot retain it once pumping resumes. This indicates the monsoon crash (decline) with levels drop reflecting aquifer depletion as recharge slows and extraction continues.
- Phase 3 (Sept 2025 – April 2026): Ten months at ~1.3–1.5 m with almost no variation — an even flatter and longer plateau than TW 03's 8-month stabilization. At this depth the well is under chronic stress but not yet failing. Margin is very thin. This suggests a low stable plateau during the dry season with water levels remaining relatively stable, showing aquifer resilience despite reduced recharge.
- Phase 4 (May 2026): A rise to ~1.8 m in April and 2.3 m in May 2026. The recovery is proportionally similar to TW 3, and the YoY deficit (~0.3 m) is the smallest of any Ward 8 well — suggesting this aquifer has better recharge access than TW 1 or TW 2. This suggests a modest spring uplift / recovery with gradual rise of water level to ~3 m reflecting aquifer responsiveness to late winter/early spring recharge.

This tubewell demonstrates a classic monsoon-driven cycle, but with slightly less amplitude. The aquifer here is resilient, maintaining stability through dry months and recovering predictably with seasonal recharge. TW-04 shows a balanced pattern i.e. strong recharge, moderate depletion, and reliable recovery. This tubewell is therefore dependable, with predictable seasonal variation, and anticipates stress in **Sep–Dec**, but otherwise reliable year-round. This site illustrates hydro-social resilience with seasonal vulnerability, reinforcing the need for adaptive water-use strategies.