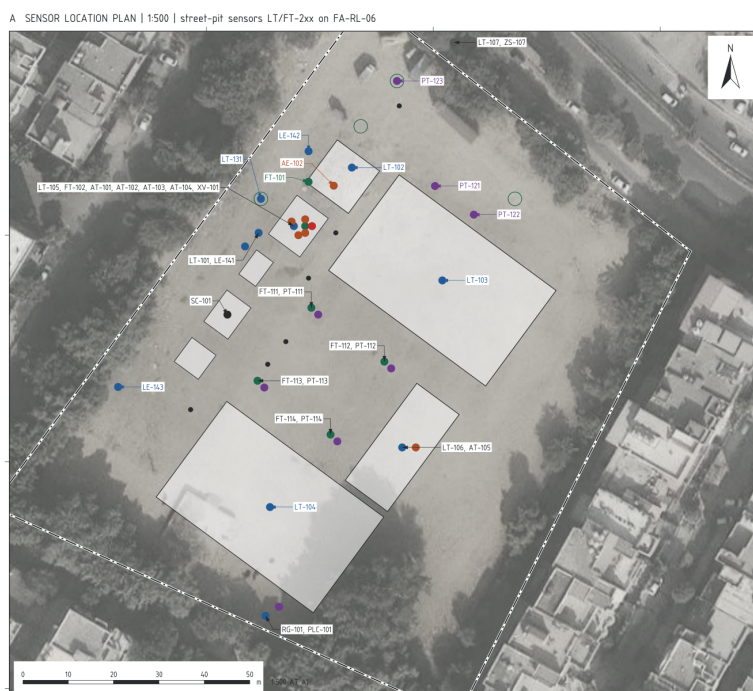


FloodAstra | Gurugram

Ram Lila Ground

Instrumentation and Monitoring Plan

Flood capture, storage, treatment and aquifer recharge scheme



Sensor location plan, drawing FA-RL-07

Site	Ram Lila Ground, Sheetla Mata Mandir Road, Gurugram, Haryana
Client	Municipal Corporation of Gurugram
Prepared by	IIT Gandhinagar with AIReSQ
Document	FA-RL-RPT-02 Revision P3 18 Oct 2026
Related documents	FA-RL-RPT-01 Engineering summary report; drawings FA-RL-01 to FA-RL-07
Status	PROPOSED DESIGN – PRELIMINARY – NOT FOR CONSTRUCTION

Positions, setpoints and costs are preliminary. Setpoints are indicative and will be fixed from the baseline groundwater survey, the injection test, filter trials and the approval of the Central Ground Water Authority.

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1 Summary

The scheme captures flood water from Ram Lila Ground and nearby streets, stores it underground, treats it and injects it into the deep aquifer. Instruments are needed for three reasons: to run the pumps and valves automatically during a storm, to protect the aquifer by allowing injection only when the water is clean enough, and to measure what the scheme actually achieves so that the design can be checked against the simulation. Table 1 summarises the monitoring network shown on drawing FA-RL-07.

Table 1. Monitoring network at a glance

Element	Provision
Rainfall	1 rain gauge at the edge kiosk
Water level and depth	8 level transmitters in the plant, 7 in the street pits, 3 surface flood-depth sensors on the ground
Flow	2 plant flow meters, 4 well meters with flow-control valves, 7 on the street rising mains
Water quality (injection permissive)	5 analysers: turbidity in and out of the filter, EC and pH, oil-in-water, UV254 organics
Groundwater and wells	7 pressure loggers: 4 injection wells, 2 deep and 1 shallow observation piezometers
Gate, silt and control	flap-gate position and levels both sides; forebay silt sensor; 3-way diversion valve; booster VFD; PLC with telemetry; 8 cameras
Cost (concept)	INR 184.1 lakh capital; INR 25.8 lakh per year to operate; INR 4.74 crore over 25 years at 8 %

Source: Drawing FA-RL-07; costs are concept estimates excluding GST

2 Objectives

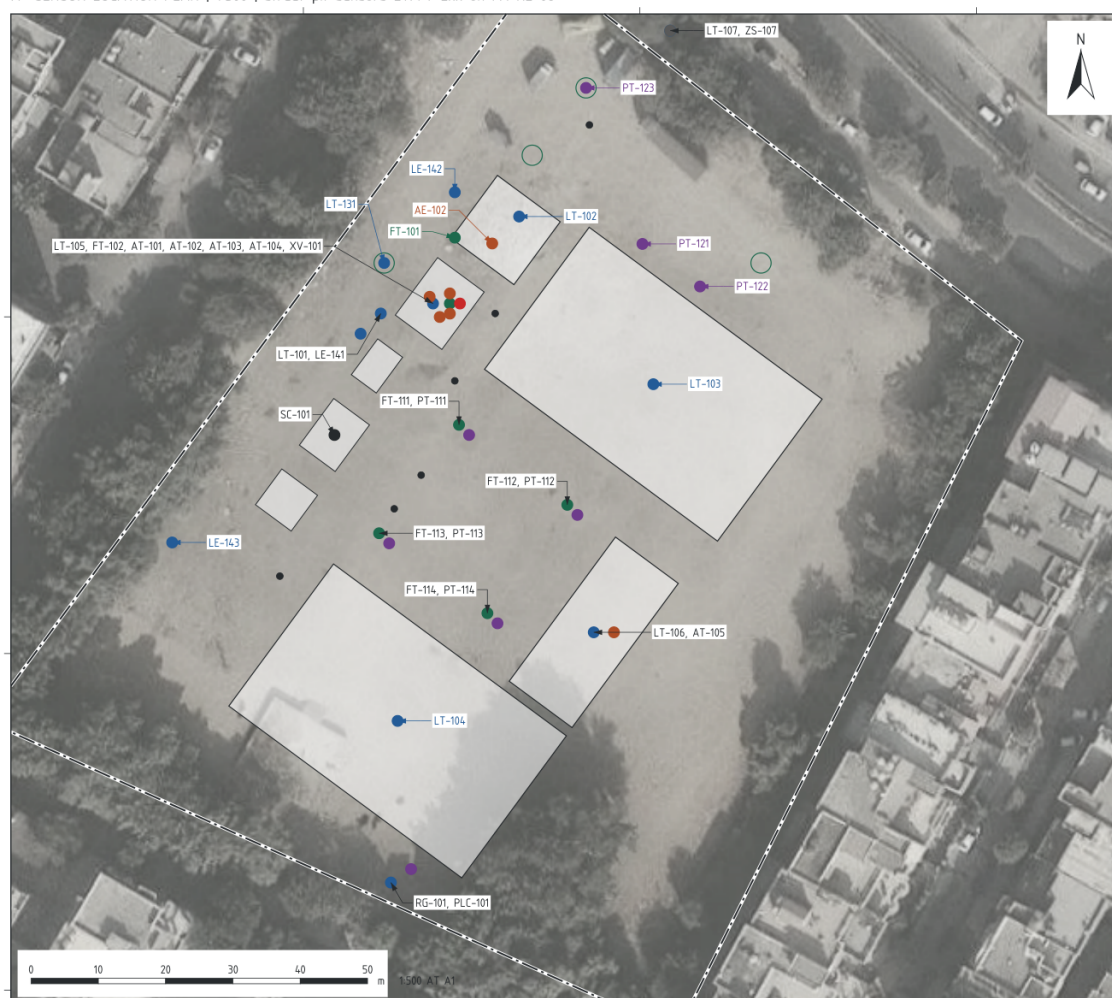
1. Run the scheme safely: start and stop the street-pit, intake, treatment and injection pumps from water levels, and stop intake when the storage fields are full.
2. Protect the aquifer: inject only water that passes turbidity, pH, conductivity and oil checks, and divert anything else back to storage automatically.
3. Protect the wells: watch injection head and flow in every well so that clogging is caught early and the well is rested or backflushed.
4. Prove the benefit: measure flood depth on the ground and in the street pockets, the volume captured and the volume recharged, storm by storm.
5. Support approval and learning: build the groundwater-quality record required by the Central Ground Water Authority and calibrate the model with measured data.

3 Where the model says to measure

The simulation of the 107 mm, 3-hour design storm identifies where the information is most valuable:

- **Flood depth:** the three deepest points of the pond without works (simulated. peak 0.91 m, simulated. peak 0.80 m, simulated. peak 0.77 m) carry surface depth sensors LE-141 to LE-143. They show directly how much the scheme lowers the flood.
- **Street pockets:** the seven street pits supplied 4,207 m³ in the simulation, more than half of the water captured; each pit has a level and a flow measurement.
- **Capacity limits:** intake reached the DN700 main limit of about 1.04 m³/s and the storage fields were about 88% full at 3.3 h, so the main flow (FT-101) and storage levels (LT-103, LT-104) are the key operating measurements.
- **Injection:** water stored after the storm is injected over about 1.5 days at the 50 L/s treatment rate. The quality analysers, well heads and observation piezometers govern this phase.

A SENSOR LOCATION PLAN | 1:500 | street-pit sensors LT/FT-2xx on FA-RL-06

**Figure 1.** Sensor location plan (drawing FA-RL-07, panel A)

Source: Drawing FA-RL-07; positions from the design geometry and the simulated flood depths

4 Sensor schedule

Every instrument has a tag, a position, a purpose and an alarm or setpoint. The register below is the same as on drawing FA-RL-07.

4.1 Rain gauge and weather

Table 2. Sensor schedule: rain gauge and weather

Tag	Instrument	Location	E / N (UTM 43N)	Setpoint / alarm
RG-101	Tipping-bucket rain gauge	Edge kiosk KI-1 roof	697913 / 3152166	> 10 mm/h: pumps to standby

4.2 Water level, flow, gate and silt

Table 3. Sensor schedule: water level, flow, gate and silt

Tag	Instrument	Location	E / N (UTM 43N)	Setpoint / alarm
LT-101	Radar level transmitter	Collector sump SU-1	697912 / 3152250	start 215.94, stop 215.84, high 217.0
LT-102	Radar level transmitter	Forebay FB-1	697932 / 3152265	high 215.80
LT-103	Radar level transmitter	Storage field SF-1	697952 / 3152240	full 215.94: stop PM-1 and SP pumps
LT-104	Radar level transmitter	Storage field SF-2	697914 / 3152190	full 215.94: stop PM-1 and SP pumps
LT-105	Radar level transmitter	Filter feed chamber	697919 / 3152252	low-low: pumps off
LT-106	Radar level transmitter	Clean tank CT-1	697943 / 3152203	low: IB-1 off
LT-107	Level transmitter (pair)	Overflow OC-1, each side of FG-1	697954 / 3152292	downstream > upstream: gate closed
ZS-107	Gate position switch	Flap gate FG-1	697954 / 3152292	alarm if open while drain full
AE-102	Sludge-blanket (silt) sensor	Forebay FB-1 sump	697928 / 3152261	silt > 0.5 m: desilt
FT-101	Electromagnetic flow meter	DN700 main GM-1	697923 / 3152262	record
FT-102	Electromagnetic flow meter	Filter outlet	697922 / 3152252	record
FT-111	Flow meter + FCV-111	Well IW-1 feed	697923 / 3152234	drop > 20 %: backflush
FT-112	Flow meter + FCV-112	Well IW-2 feed	697939 / 3152222	drop > 20 %: backflush
FT-113	Flow meter + FCV-113	Well IW-3 feed	697911 / 3152218	drop > 20 %: backflush
FT-114	Flow meter + FCV-114	Well IW-4 feed	697927 / 3152206	drop > 20 %: backflush
LT-131	Level logger	Recharge trench RT-1 shaft	697912 / 3152258	record
LE-141	Surface flood-depth sensor	Ground low point 1 (simulated, peak 0.91 m)	697908 / 3152248	alert 0.15 m, 0.30 m
LE-142	Surface flood-depth sensor	Ground low point 2 (simulated, peak 0.80 m)	697922 / 3152268	alert 0.15 m, 0.30 m
LE-143	Surface flood-depth sensor	Ground low point 3 (simulated, peak 0.77 m)	697880 / 3152216	alert 0.15 m, 0.30 m
LT/FT-2xx	Level + flow per street pit	SP-1–7 and rising mains	see FA-RL-06	pit high/low

4.3 Water quality and injection control

Table 4. Sensor schedule: water quality and injection control

Tag	Instrument	Location	E / N (UTM 43N)	Setpoint / alarm
AT-101	Turbidity analyser	Filter inlet	697919 / 3152253	record
AT-102	Turbidity analyser	Filter outlet (before XV-101)	697922 / 3152253	< 2 normal; 5–10 hold; > 10 stop
AT-103	EC + pH analyser	Filter outlet	697922 / 3152250	pH 6.5–8.5; EC step > 20 %: stop
AT-104	Oil-in-water detector	Filter outlet	697920 / 3152250	oil detected: stop
AT-105	UV254 organics probe	Clean tank CT-1 outlet	697946 / 3152203	trend alarm
XV-101	Automatic 3-way diversion valve	After filter: to CT-1 or back to SF	697923 / 3152252	driven by AT-102–104
SF-101	VFD speed control	Injection booster IB-1	697905 / 3152232	by PT and storage level

4.4 Groundwater and wells

Table 5. Sensor schedule: groundwater and wells

Tag	Instrument	Location	E / N (UTM 43N)	Setpoint / alarm
PT-111	Pressure transducer	Injection well IW-1	697925 / 3152232	head limit: reduce/stop
PT-112	Pressure transducer	Injection well IW-2	697941 / 3152221	head limit: reduce/stop
PT-113	Pressure transducer	Injection well IW-3	697913 / 3152216	head limit: reduce/stop
PT-114	Pressure transducer	Injection well IW-4	697929 / 3152204	head limit: reduce/stop
PT-121	Piezometer logger (deep)	Observation well OW-1	697950 / 3152261	mound limit: reduce rate
PT-122	Piezometer logger (deep)	Observation well OW-2	697959 / 3152255	mound limit: reduce rate
PT-123	Piezometer logger (shallow)	Near RT-2	697942 / 3152284	record

4.5 Instrument specification

Table 6. Minimum instrument specification

Instrument	Range	Accuracy	Output	Notes
Radar level transmitter	0-6 m	± 3 mm	4-20 mA / HART	IP68, non-contact, above water
Electromagnetic flow meter	to 2.5 m/s	± 0.5 %	4-20 mA + pulse	full-bore, buried flanged, grounding rings
Turbidity analyser	0-100 NTU	± 2 % or 0.1 NTU	Modbus / 4-20 mA	self-cleaning wiper, flow-through cell
EC + pH analyser	pH 0-14; EC 0-5 mS/cm	± 0.1 pH; ± 1 %	Modbus	auto-compensated
Oil-in-water detector	0-50 mg/L	± 5 %	relay + 4-20 mA	UV fluorescence
UV254 organics probe	0-50 1/m	± 3 %	Modbus	proxy for organic load
Pressure transducer (well)	0-30 m H ₂ O	± 0.1 % FS	SDI-12 / 4-20 mA	vented, stainless
Piezometer logger	0-20 m	± 0.05 % FS	internal logger + telemetry	barometric compensation
Surface flood-depth sensor	0-1.5 m	± 5 mm	LoRa / 4G	ultrasonic on pole, solar
Rain gauge	0.2 mm tip	± 2 %	pulse	tipping bucket, 200 mm orifice
Silt (sludge-blanket) sensor	0-2 m	± 2 cm	4-20 mA	ultrasonic, in forebay

Source: Indicative performance specification for tender

5 Control points: need, trigger and action

Each control point links a reason, a measurement, a trigger and an action. Automatic actions run in PLC-101; operator actions are taken from the MCG dashboard or on site. Every control point has a fail-safe, so that a fault never makes flooding or groundwater quality worse than without the scheme. Control points CP-7 to CP-9 govern injection and are the most important for protecting the aquifer.

Table 7. Control point CP-1 Street-pit pumps

CP-1	Street-pit pumps
Why it is needed	Lift water from the seven flooded street pockets only while they are ponded, without running pumps dry.
Measured by	LT-201–207 (pit level)
Trigger	Start when water stands 0.3 m over the pit floor; stop at 0.1 m
Automatic action	Duty pump on/off; standby starts on duty fault
Operator action	Clear a blocked grate or pit screen on alarm
Fail-safe	Check valve on each main; if a pump fails the street ponds as it does today

Table 8. Control point CP-2 Intake booster PM-1

CP-2	Intake booster PM-1
Why it is needed	Keep the pond grates draining so the ground empties as fast as the main allows.
Measured by	LT-101 (sump level), FT-101 (main flow)
Trigger	Start at 215.94; stop at 215.84; alarm at 217.00
Automatic action	Duty/standby booster on/off
Operator action	Inspect grates if the sump alarms while flow is low
Fail-safe	Grates surcharge back to the ground: no worse than without the scheme

Table 9. Control point CP-3 Storage full

CP-3	Storage full
Why it is needed	Stop feeding the buried storage when it is full so the forebay and fields are never over-pressured.
Measured by	LT-103, LT-104 (field levels); independent high-level float
Trigger	Both fields at 215.94
Automatic action	Stop PM-1 and all street-pit pumps
Operator action	Confirm on dashboard; plan treatment to empty storage
Fail-safe	Hard-wired float trips the pumps even if the PLC fails

Table 10. Control point CP-4 Overflow and flap gate

CP-4	Overflow and flap gate
Why it is needed	Stop water from the full city drain backing into the plant, and release only after the drain recedes.
Measured by	LT-107 (both sides of FG-1), ZS-107 (gate position)
Trigger	Downstream level above upstream: gate must be closed
Automatic action	Alarm if the gate reads open while the drain is full
Operator action	Release stored water through OF-1 only after the drain has receded
Fail-safe	Flap gate closes by water pressure without power

Table 11. Control point CP-5 Forebay silt

CP-5	Forebay silt
Why it is needed	Keep silt out of the storage fields and the filter.
Measured by	AE-102 (silt depth)
Trigger	Silt more than 0.5 m
Automatic action	Desilting work order on the dashboard
Operator action	Desilt within 7 days
Fail-safe	Separator baffle keeps settled silt in the forebay

Table 12. Control point CP-6 Treatment start

CP-6	Treatment start
Why it is needed	Treat stored water steadily after the storm without drawing the fields dry.
Measured by	LT-103/104, LT-105
Trigger	Fields above 50 m ³ retained volume and filter feed below high
Automatic action	Start TP-1/2; stop at low-low
Operator action	Backwash filter when pressure drop is high
Fail-safe	Pumps stop at low-low level (dry-run protection)

Table 13. Control point CP-7 Injection permissive

CP-7	Injection permissive
Why it is needed	Protect the aquifer: only clean water may enter the wells.
Measured by	AT-102 turbidity, AT-103 pH and EC, AT-104 oil
Trigger	Turbidity above 10 NTU, oil present, pH outside 6.5–8.5 or EC step above 20 %
Automatic action	XV-101 returns water to storage; well valves close
Operator action	Find the cause (filter, first flush, spill); take a lab sample
Fail-safe	XV-101 fails to the divert position on loss of power or signal

Table 14. Control point CP-8 Injection rate

CP-8	Injection rate
Why it is needed	Inject as fast as the wells and aquifer safely accept, so storage is empty before the next storm.
Measured by	PT-111–114, FT-111–114, PT-121/122, LT-103/104, RG-101
Trigger	States 3–5: head rising, mound near limit, storage above 60 % or rain forecast
Automatic action	Booster speed (SC-101) and well valves (FCV-111–114) set the rate
Operator action	Bring wells 3 and 4 in when accepted
Fail-safe	High head stops the affected well

Table 15. Control point CP-9 Well health

CP-9	Well health
Why it is needed	Catch clogging early; a clogged well is costly to restore.
Measured by	FT-11x and PT-11x (specific capacity)
Trigger	Specific capacity 20 % below commissioning value
Automatic action	Flag the well; reduce its rate
Operator action	Backflush or redevelop the well
Fail-safe	Well rested automatically at head limit

Table 16. Control point CP-10 Flood-depth alert

CP-10	Flood-depth alert
Why it is needed	Tell MCG and event organisers when the ground is unsafe or unusable.
Measured by	LE-141–143 (surface depth)
Trigger	0.15 m advisory; 0.30 m alert; 0.50 m emergency
Automatic action	Dashboard and SMS alerts
Operator action	Ward team and organisers act on Table 10
Fail-safe	Solar-powered sensors keep reporting in a power cut

Table 17. Control point CP-11 Storm start

CP-11	Storm start
Why it is needed	Have pumps ready before ponding begins.
Measured by	RG-101 (rain intensity) and forecast
Trigger	More than 10 mm/h, or heavy rain forecast
Automatic action	Pumps to standby; dashboard to storm mode; 1-minute logging
Operator action	Operator on call
Fail-safe	Level-based starts still work without the rain gauge

6 Telemetry, monitoring platform and control room

All plant instruments are wired to PLC-101 in the edge kiosk, which has an uninterruptible power supply for at least four hours. Street pits and the surface flood-depth sensors report by 4G or LoRa; the plant uses fibre where available with 4G as back-up. Data are logged every minute during storms and every 15 minutes otherwise, and are sent to the MCG flood dashboard. The PLC runs all safety interlocks locally, so the scheme keeps operating safely if communication is lost. Operators can switch any unit to manual from the kiosk or remotely; every manual action and every change of state is written to an event log for audit. The telemetry gateway is isolated from other networks and uses encrypted, authenticated connections.

7 Decision support: alert levels and responses

7.1 Three layers

1. **Local interlocks** in the PLC act within seconds: pump starts and stops, the storage-full stop, and the injection permissive.
2. **Operating states** decide the injection rate from water quality, well heads and storage level (Table 18).
3. **Operator decisions** at the MCG control room use the dashboard, rainfall forecasts and alerts (Tables 19 to 21).

7.2 Injection control

Water that goes wrong at the surface can be dealt with; water that goes wrong in the aquifer cannot be taken back, and a clogged well is expensive to restore. Injection is therefore allowed only when the quality analysers are all within range, and the rate is set by the state of the wells and the aquifer. The diversion valve XV-101 returns water to storage by default if power or signal is lost.

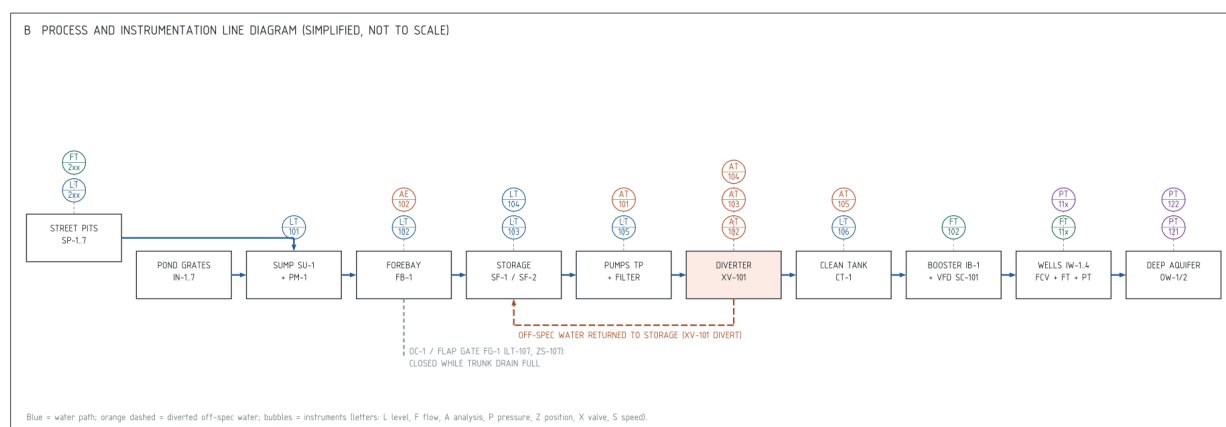
Table 18. Injection control states (indicative setpoints)

State	Trigger	Action
1 Stop and divert	AT-102 > 10 NTU, oil detected (AT-104), pH outside 6.5–8.5 or EC step > 20% (AT-103), or a well head at its limit (PT-111..114)	Close FCV-111..114; XV-101 returns water to storage; alarm to the MCG control room
2 Hold and recirculate	AT-102 5–10 NTU, or the first 20–30 min of street runoff	No injection; water settles in SF-1/SF-2 or is refiltered
3 Reduced rate	Quality acceptable, but a well head is rising fast or the aquifer mound (PT-121/122) is near its limit	Lower booster speed (SC-101); rest the affected well
4 Normal	AT-102 below 2–5 NTU, all parameters normal, head margin available	Inject at the design rate through the active wells
5 Accelerate	Quality good, head margin, storage above 60% (LT-103/104) or more rain forecast (RG-101)	Both treatment trains; wells 3 and 4 on; higher booster speed

Source: Setpoints to be fixed from the injection test, filter trials and CGWA approval

7.3 Alert levels at the main level sensors

7.4 Flood-depth levels on the ground

**Figure 2.** Process and instrumentation line diagram (drawing FA-RL-07, panel B)

Source: Drawing FA-RL-07

Table 19. Alert levels (levels in m, model datum)

Sensor	Watch	Warning	Alarm	Response
LT-101 sump	216.30	216.80	217.00 (grates surcharge)	Check PM-1 duty/standby; inspect grates
LT-103/104 storage fields	214.94 (75 %)	215.70 (95 %)	215.94 (full)	At full: stop PM-1 and SP pumps; grates pass water to the street
LT-107 overflow chamber	drain level rising	drain above weir	water against closed FG-1	Confirm FG-1 closed (ZS-107); no release
LT-2xx street pits	pit 50 % full	pit 80 % full	pit full	Check pump; standby starts on fault
PT-111..114 well heads	60 % of limit	80 % of limit	limit	Reduce rate, then stop that well; plan backflush

Table 20. Flood-depth levels and responses

Depth at LE-141..143	Meaning	Response
Below 0.15 m	Normal ponding	None
0.15–0.30 m	Nuisance flooding	Dashboard advisory; confirm pumps running
0.30–0.50 m	Ground unusable; road access affected	Alert to MCG ward team and event organisers
Above 0.50 m	Severe; above simulated design performance	Emergency response; check grates, pumps and power

7.5 Responses to instrument alerts

Table 21. Responses to instrument alerts

Alert	Response
Turbidity high (AT-102)	Divert (XV-101); check filter differential pressure; backwash
Oil detected (AT-104)	Stop injection; inspect street pits and forebay; skim oil; lab sample
Well head high (PT-11x)	Reduce rate; if repeated, backflush or redevelop the well
Mound high (PT-121/122)	Reduce total injection; review aquifer response with hydrogeologist
Silt above 0.5 m (AE-102)	Schedule forebay desilting within 7 days
Power failure	UPS keeps PLC and alarms alive; XV-101 fails to divert; pumps restart in sequence

8 Operation and maintenance

Table 22. Operation and maintenance schedule for the instruments

When	Task	By
Every storm	Check dashboard states, pump runs and any diversion; download event log	Operator
Weekly (monsoon)	Clean analyser windows; check wipers; clear grates and pit screens	Technician
Monthly	Verify turbidity, pH and EC against hand-held meters; test XV-101 and FG-1 position	Technician
Quarterly	Calibrate analysers; check flow meters against pump curves; test UPS	Technician
Before monsoon	Full function test of all interlocks; desilt forebay if needed; well specific-capacity test	Engineer
Annually	Third-party calibration of flow meters and transducers; review of setpoints with data	Engineer
As triggered	Backflush or redevelop a well when specific capacity falls by 20 %	Hydrogeologist

9 Data plan

- **Logging:** 1-minute values during storms and injection, 15-minute values otherwise; raw and quality-checked data kept separately.
- **Quality control:** automatic range and rate-of-change checks; flags for maintenance periods; monthly review by the engineer.
- **Storage:** the MCG dashboard database with an off-site back-up; data kept for the life of the scheme.
- **Reporting:** a storm report after each event (rain, flood depths, volume captured, diverted and injected); a seasonal groundwater-quality report for the Central Ground Water Authority; an annual performance report comparing measured and simulated results.
- **Model update:** measured depths, levels and flows are used to recalibrate the flood model after the first monsoon.

10 Phasing with construction

Table 23. Monitoring phasing

Phase	Monitoring work
Before construction (one monsoon ahead)	Rain gauge, surface flood-depth sensors, observation wells OW-1/2 drilled and logged; baseline groundwater quality
During construction	Instruments installed with each unit; cables in the gallery corridor and road ducts; PLC panel in the kiosk
Commissioning	Dry and wet tests of every loop; interlock tests; trial injection at low rate with full sampling
First monsoon	Operation under supervision; setpoints reviewed after each storm; first annual report
Later phases	Wells IW-3/4 and their instruments added if the injection test confirms acceptance

11 Cost

Costs are concept estimates in INR lakh, excluding GST, at 2026 prices, with an accuracy of about $\pm 30\%$. They will be replaced by vendor quotes.

Table 24. Capital cost of instrumentation and control (INR lakh)

Item	Qty	Rate	Amount
Radar level transmitters (sump, forebay, SF-1, SF-2, filter feed, clean tank, OC-1 pair)	8	1.5	12.0
Street-pit level transmitters LT-201–207	7	1.5	10.5
Electromagnetic flow meter DN700 (FT-101)	1	6.0	6.0
Electromagnetic flow meters, rising mains FT-201–207 and filter outlet FT-102	8	3.5	28.0
Well flow meters with flow-control valves FT/FCV-111–114	4	4.5	18.0
Turbidity analysers AT-101, AT-102	2	3.5	7.0
EC + pH analyser AT-103	1	2.5	2.5
Oil-in-water detector AT-104	1	6.0	6.0
UV254 organics probe AT-105	1	5.0	5.0
Automatic 3-way diversion valve XV-101 (fail to divert) and backflush valve	1	8.0	8.0
VFD for injection booster SC-101	1	3.0	3.0
Pressure transducers in injection wells PT-111–114	4	0.8	3.2
Piezometer loggers OW-1, OW-2 (deep) and shallow PT-123 incl. 1 shallow borehole	3	2.0	6.0
Trench shaft level logger LT-131	1	0.6	0.6
Surface flood-depth sensors LE-141–143 (pole-mounted, solar)	3	1.2	3.6
Flap-gate position switch ZS-107	1	0.5	0.5
Sludge-blanket silt sensor AE-102	1	3.0	3.0
Tipping-bucket rain gauge RG-101	1	0.8	0.8
PLC-101 panel with UPS, I/O, HMI	1	18.0	18.0
Telemetry (4G/fibre), cybersecurity gateway, MCG dashboard integration	1	12.0	12.0
CCTV cameras (8) with recorder	8	0.8	6.4
Equipment			160.1
Installation, cabling and commissioning (15 %)			24.0
Capital cost			184.1

Table 25. Annual operating cost of the monitoring (INR lakh)

Item	INR lakh per year
Calibration, analyser consumables and spares	4.0
Laboratory sampling: about 12 storm events per year	6.0
Seasonal groundwater-quality sampling at OW-1/2 (4 rounds)	3.0
Telemetry, data hosting and software	2.0
Part-time instrumentation technician	6.0
Sensor replacement allowance (3 % of equipment)	4.8
Annual operating cost	25.8

Over 25 years at a 8% discount rate (present-value factor 10.67), with analyser and drive replacement in years 10 and 20, the whole-life cost of the monitoring is about INR 474 lakh (INR 4.74 crore): capital 184.1, operation 275.4 and replacements 14.9.

Reconciliation with the scheme budget. The engineering report carries a lump sum of INR 55 lakh for instrumentation, PLC, telemetry and CCTV in the street-capture add-on. This detailed estimate of INR 184.1 lakh replaces that lump sum; the difference of about INR 129.1 lakh is mainly the water-quality analysers, the diversion and flow-control valves and the street-pit flow meters, which are essential for safe injection.

12 Limits and next steps

- Sensor positions are from the design geometry and the simulation; they must be confirmed on site with access, power and utility checks.
- All setpoints are indicative and depend on the baseline groundwater survey, the injection test, filter trials and CGWA approval.
- The trunk-drain position and level at the overflow are assumed; LT-107 and ZS-107 will confirm the closed-gate assumption in practice.
- Costs are concept estimates and exclude GST; vendor quotes are needed.
- Next steps: site survey of sensor positions; baseline monitoring for one monsoon before construction; tender specification; control narrative for the PLC.