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Somalia Water and Land Information Management

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Anticipated El Niño Impacts on Water Resources and Water Infrastructure in Somalia

Flood exposure of boreholes, dug wells, berkads and earth dams, and preparedness priorities for the 2026 Deyr

ISSUED BY

Food and Agriculture Organization of the United Nations · Somalia Water and Land Information Management (SWALIM) and the FGS Ministry of Energy and Water Resources (MoEWR)

PREPARED FOR

The Federal Government of Somalia, Federal Member State Ministries, Somalia WASH Cluster, Water Authorities, UN agencies, non-governmental organisations and development partners

7,517

strategic water
sources screened

71

classified Very high risk

524

classified High risk

10

districts hold 65% of the at-risk stock



Modelled potential inundation and flood susceptibility from the 30 m Copernicus DEM, with the 71 water sources classified Very high risk. A screening product; see Map 4 and Map 5.

Contents

SECTIONS

1	Executive summary	3
2	Purpose, scope and approach	5
3	The 2026 El Niño and the Deyr outlook	6
4	Water infrastructure baseline	9
5	Data and methods	13
6	Flood hazard: observed record and modelled susceptibility	18
7	Exposure, risk and priority locations	22
8	Anticipated humanitarian implications	34
9	Preparedness and early action	35
10	Monitoring and early warning	38
11	Limitations, conclusions and priority actions	40
—	References	44
—	Annexes	45

MAPS

Map 1	ICPAC October–December 2026 rainfall outlook	9
Map 2	National water infrastructure baseline, 2026	12
Map 3	Observed inundation 2013–2023 and the Deyr 2023 extent	20
Map 4	Modelled potential inundation and flood susceptibility	21
Map 5	Water infrastructure flood-risk classification	25
Map 6	Priority districts for El Niño preparedness	26
Map 7	Shabelle corridor, Beledweyne to Balcad	31
Map 8	Juba corridor, Baardheere to Jamaame	32

TABLES

1	ENSO and Deyr 2026 outlook by forecasting centre	7
2	National water-source inventory by region and type	10
3	Datasets used in the assessment	13
4	Evidence hierarchy and multi-criteria risk scoring	16
5	Flood exposure and risk by region and type	23
6	Priority districts: infrastructure and population	27
7	Monitored strategic boreholes at Very high or High risk	28
8	Sensitivity to alternative specifications	33
9	Impact mechanisms and protective measures by type	36
10	Priority actions, timing and responsible actor	37
11	Principal data gaps and recommended action	41

01 Executive summary

AT A GLANCE

El Niño is under way and strengthening: NOAA gives a greater than 90 percent chance of a very strong event, and ICPAC a 90 percent probability of above-normal October–December rainfall over central and southern Somalia. Against that outlook, all 7,517 strategic water sources in FAO-SWALIM's and MoEWR national inventory were screened for flood exposure. 507 lie in areas of confirmed historical inundation; a further 97 are supported as exposed by two or more independent lines of evidence. 71 sources are classified Very high risk and 524 High risk, including 68 of the strategic boreholes that SWALIM and FMS MoEWR monitors weekly. Ten districts hold 65 percent of the at-risk stock. Protective works cost roughly 7 percent of the corrective and emergency response they displace and must be financed in September to be delivered before the rains.

The forecast, and its confidence

El Niño is present and intensifying, and the forecasting centres agree to an unusual degree. NOAA's ENSO Diagnostic Discussion of 13 August 2026 maintains an El Niño Advisory on a July Niño-3.4 anomaly of +1.4 °C and gives a greater than 90 percent chance of a very strong event through the 2026-27 northern winter; IRI puts El Niño probability at 100 percent through early 2027; ICPAC gives a 90 percent probability of above-normal October–December rainfall over central and southern Somalia, with totals above 400 mm and a likely positive Indian Ocean Dipole. FEWS NET expects September–November rainfall above 120 percent of average with an early onset and carries an explicit risk of Famine (IPC Phase 5) in riverine and agropastoral areas should flooding be extreme. Table 1 records each position with its issue date.

The ENSO and seasonal rainfall signals are high confidence. The translation from a three-month regional rainfall anomaly to inundation at a specific water point is not, and is treated throughout this report as a scenario rather than a forecast. Above-normal seasonal rainfall does not by itself place a borehole under water.

What is at risk

Seven databases from FAO-SWAIM and MoEWR were merged and de-duplicated into a single analytical inventory of 7,517 strategic water sources. Removing 3,380 duplicate records was a precondition of quoting any total: the raw union of the contributing databases overstates the inventory total by roughly a third, and does so most severely in the densely inventoried riverine areas where exposure is highest. The inventory is the record FAO-SWALIM and MoEWR holds and maintains, not a census of every water point in Somalia: sources never surveyed, or never reported to SWALIM/MoEWR, are not in it, and every total in this report should be read on that basis.

Only 507 sources (6.7 percent) have confirmed historical exposure, because optical analysis of satellite imagery for flood mapping covers only Somalia's two main river corridors and is often prevented by cloud cover during the Deyr rainy season. Analysis of the 30-metre-resolution terrain dataset identifies a further 1,876 sources in flood-susceptible terrain with no observed record, predominantly in the Bay–Bakool agropastoral belt and the central rangelands. Combining hazard with physical vulnerability and with criticality to the population served gives 71 sources at Very high risk and 524 at High risk — 7.9 percent of the inventory, and 68 of the monitored strategic boreholes among them.

Where to concentrate

Exposure is concentrated. The ten first-priority districts — Jowhar (Middle Shabelle); Afgooye (Lower Shabelle); Belet Weyne (Hiraan); Luuq (Gedo); Balcad (Middle Shabelle); Xudur (Bakool); Bu'aale (Middle Juba); Rab Dhuure (Bakool); Bulo Burto (Hiraan); Qoryooley (Lower Shabelle) — hold 65 percent of all Very high and High risk sources in the country, and a further twelve form a second tier (Doolow, Cadaado, Cabudwaaq, Hobyo, Wanla Weyn, Garbahaarey, Marka, Gaalkacyo, Afmadow, Waajid, Baydhaba, Baardheere). Two riverine axes dominate: the Shabelle from Beledweyne through Bulo Burto, Jalalaqsi and Jowhar to Balcad, and the Juba from Baardheere through Bu'aale and Jilib to Jamaame, where inundation, active embankment breaches and dense settlement and irrigation infrastructure coincide. Away from the rivers, the Bay–Bakool–Gedo agropastoral belt carries a large stock of earth dams and shallow wells in flash-flood-prone terrain.

The five actions that matter most before the rains

- 1** Inspect and protect the 68 monitored strategic boreholes at Very high or High risk (Table 7): raise and seal wellheads, extend aprons, and elevate control panels, generators and solar inverters above the modelled inundation level. These are the assets whose failure removes supply from the most people with the fewest alternatives.

- 2** Undertake protective rehabilitation of Very high-risk shallow sources in the priority districts. Dug wells, berkads and earth dams make up 80 percent of the Very high-risk class and are the sources that fail first and contaminate fastest.

- 3** Close the active breach points on the Shabelle and Juba. 386 unique active breach locations are mapped in the two most recent FAO-SWALIM releases; Jowhar, Afgooye, Balcad, Beledweyne, Jalalaqsi and Bulo Burto account for most of them.

- 4** Pre-position chlorine, testing capacity, jerrycans and hand-pump spares at district level, and place water-trucking stand-by contracts before the season rather than after the first inundation.

- 5** Release the Juba river-breakage update, and fund its repetition before the Deyr. The August 2026 release covers the Shabelle only; the Juba assessment dates from March 2026 and was deferred for budgetary reasons. Breach proximity is among the strongest predictors of riverine inundation in this assessment.

The financing context is adverse. The WASH Cluster partner survey of May 2026 found 33 percent of partners with no confirmed 2026 funding, 73 percent judging their projects at risk of closure within three to six months, and 60 percent holding no emergency WASH supplies at all. Preparedness finance released now buys physical protection that will also reduce risks from future floods, making it a lasting investment rather than a one-off cost; the same money released in December would cover only a one-off emergency water-trucking response.

02 Purpose, scope and approach

This report was agreed with WASH Cluster partners as a joint assessment of anticipated El Niño impacts on Somalia's water resources and water infrastructure. It is a decision-support and anticipatory-action document: it identifies what is at risk, where, why, with what confidence, what the humanitarian consequences may be, which assets should be prioritized, what should be done before the rains, and what those actions cost.

Somalia's water supply rests on a small and fragile physical stock. Boreholes are the strategic backbone and carry the load whenever shallower sources fail. Dug wells are the most numerous source and the most exposed to contamination, being shallow, often unlined and frequently without a raised and sealed mouth. Berkads and earth dams store surface runoff for the dry season and are the mainstay of pastoral supply across the central rangelands and the north. Every one of these source types has been damaged, contaminated or put out of service by flooding in the recent record.

El Niño reaches Somali water infrastructure by two distinct pathways, and preparedness must address both. Riverine flooding follows above-normal rainfall over the Ethiopian highlands: the Juba and Shabelle rise and break their banks at breach points that have never been permanently closed, inundating the floodplain for weeks. Pluvial and flash flooding follows intense convective rainfall on hard, desiccated surfaces, generating rapid runoff into toggas and topographic depressions far from any perennial river; this is how Baidoa, Garowe, Qardho and Hargeisa flood. The first pathway is well monitored, the second is not, which is why this assessment does not rely on observed flood extents alone.

The assessment covers the whole country at national screening resolution. It is not an engineering flood study: the modelled inundation in Section 6 is a 30 m flood-susceptibility screening product, not a design flood extent, and field verification remains necessary before protective works are specified. Section 11 sets out where the evidence does not support a conclusion.

03 The 2026 El Niño and the Deyr outlook

Observed. The equatorial Pacific is in a warm, coupled state: July 2026 Niño-3.4 stood at +1.4 °C, the subsurface index rose through the month, and low-level westerly and upper-level easterly anomalies extended across the basin with enhanced convection from the central to eastern Pacific. Over Somalia itself, conditions are dry. The Gu 2026 season was poor and drought-related displacement reached 536,390 people between January and June 2026. The NOAA Global Forecast System (GFS) run of 1 September 2026 gives a seven-day area-mean total of about 2.5 mm over Jowhar district, and the Google Flood Hub gauge on the Juba near Bu'aale forecasts discharge well below its 317 m³/s warning threshold through 6 September. The hazard has not begun; that is why the preparedness window is open.

Antecedent dryness raises flash-flood risk rather than lowering it. Hard-set, desiccated soils and depleted vegetation reduce infiltration and shorten the time to peak runoff. The transition from drought to an intense wet season is a compounding sequence, not two independent events, and it is the sequence Somalia is entering.

Forecast. Table 1 records the current position of each authoritative centre with its issue date. On the ocean state there is no material disagreement. On the regional rainfall response there is also close agreement, because the physical mechanism — a warm Pacific coupled with a positive Indian Ocean Dipole, shifting convection and moisture flux towards the western Indian Ocean — is the mechanism that produced the 1997 and 2023 Deyr floods.

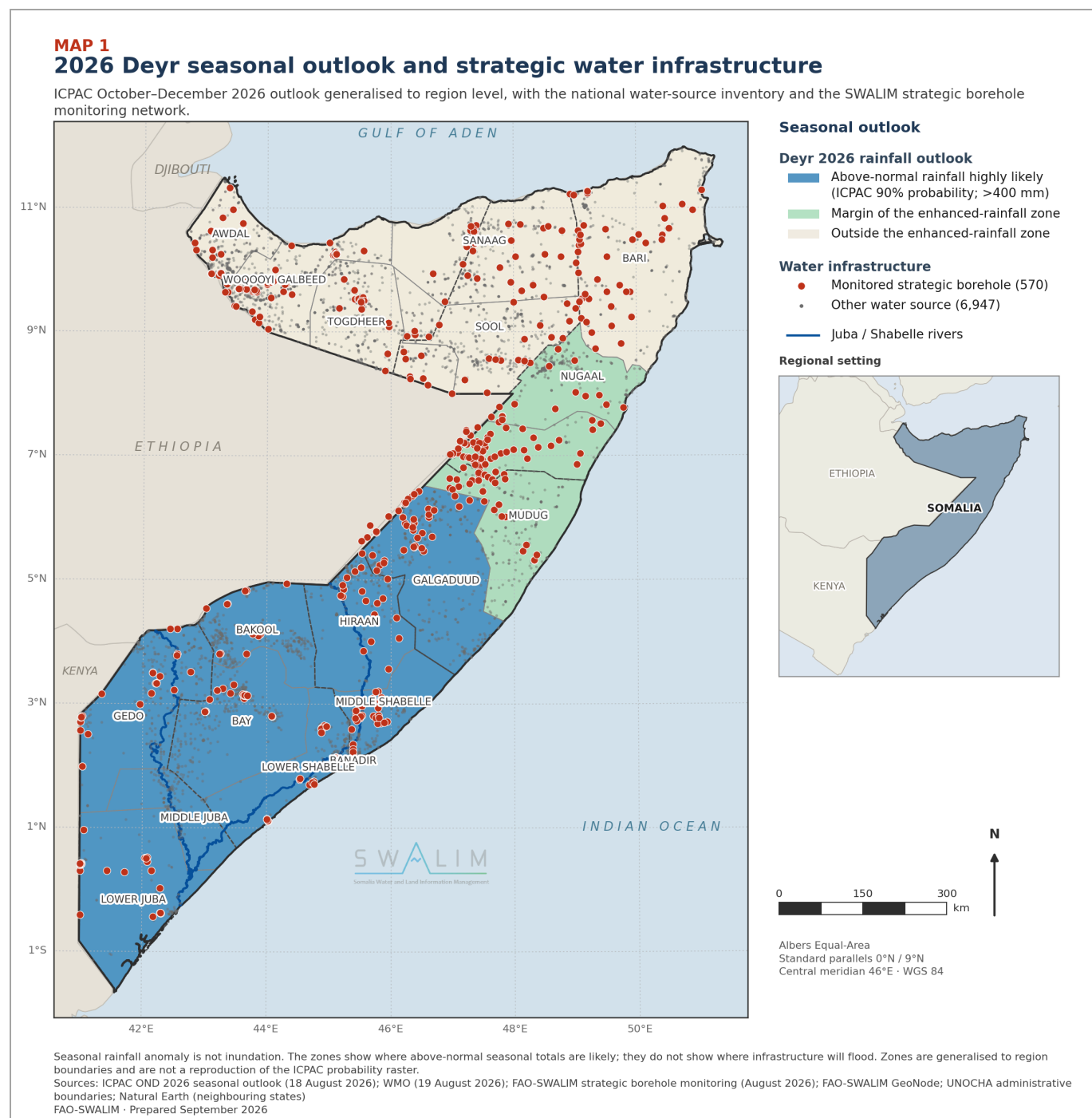
TABLE 1 ENSO and Deyr 2026 outlook by forecasting centre

CENTRE	PRODUCT AND ISSUE DATE	POSITION
NOAA Climate Prediction Center	ENSO Diagnostic Discussion, 13 August 2026	El Niño Advisory in force. July Niño-3.4 +1.4 °C, Niño-3 +1.7 °C, Niño-1+2 +2.9 °C. Greater than 90% chance of a very strong event in northern autumn–winter 2026-27; 69% chance of an October–December RONI above +2.5 °C, without precedent since 1950.
IRI / Columbia Climate School	ENSO Quick Look, 19 August 2026	El Niño probability 100% for every season from August–October 2026 to February–April 2027. Almost all models exceed +2.0 °C for August–October; fifteen of twenty-six reach +3.0 °C or above.
ICPAC	October–December 2026 outlook, 18 August 2026	90% probability of above-normal rainfall over southern Ethiopia, central to southern Somalia and north-eastern Kenya; seasonal totals above 400 mm. Positive Indian Ocean Dipole anticipated. 1997 and 2023 cited as analogues.
WMO	Greater Horn of Africa statement, 19 August 2026	Confirms the ICPAC position and notes that excessive rainfall substantially raises flood risk, with potential loss of life and damage to critical infrastructure.
FSNWG (FAO, IGAD, WFP, OCHA)	Special Report, 19 August 2026	95% chance the event is categorised strong or very strong by late 2026. States that this is the time for anticipatory action in the eastern sector.
FEWS NET	Somalia Food Security Outlook, June 2026	September–November precipitation likely to exceed 120% of the historical average, with an early onset in late September. Credible risk of Famine (IPC Phase 5) in riverine and agropastoral areas under an extreme scenario resembling 1997 or 2019.
FAO-SWALIM	Statement, 2 June 2026	Greater than 90% likelihood of El Niño during the Deyr; combined with a positive IOD, flood risk comparable to 1997 and 2023. Recommends updating preparedness plans, inspecting embankments, pre-positioning supplies and securing financing before the season.

Probabilistic statements are reproduced as issued. NOAA's next ENSO update was scheduled for 10 September 2026 and WMO's for 3 September 2026; the outlook should be re-checked before the report is acted upon.

Where the forecasts differ is in how strong the event may become and what it could mean for northern Somalia. IRI expects a stronger warming event than NOAA's central forecast, with more than half of its models showing temperatures above +3 °C. However, a stronger event does not automatically mean proportionally more rainfall in Somalia: past events show that the relationship is not consistent enough to make that assumption.

ICPAC's forecast shows a higher chance of above-normal rainfall in central and southern Somalia. Most northern regions — including Awdal, Woqooyi Galbeed, Togdheer, Sanaag, Sool and Bari — are outside this higher-risk area, and may even experience drier-than-normal seasonal conditions.



Map 1 ICPAC October–December 2026 rainfall outlook generalised to region level, with the national water-source inventory and the SWALIM strategic borehole monitoring network. The zones are a rainfall statement, not an inundation forecast.

04 Water infrastructure baseline

The national analytical inventory comprises 7,517 strategic water sources: 2,190 boreholes, 2,764 dug wells, 1,621 earth dams, 403 berkads, 393 springs and 146 other sources. Three features of that stock shape everything that follows.

- It is dominated by shallow, physically vulnerable sources. Dug wells and berkads together outnumber boreholes by roughly 1.4 to one, and it is these sources that fail first and contaminate fastest.
- A substantial part of it is already out of service. 863 sources are recorded non-functional and 112 abandoned, so the buffer available to absorb the loss of a flooded source is thinner than the raw asset count suggests.
- Its condition record is stale. Functionality comes from inspections spanning 2010 to 2025 and is absent altogether for 1,643 assets. This is the single largest data weakness in the assessment and is carried through to Table 11.

Table 2 gives the distribution by region. It is strongly asymmetric: Somaliland's regions hold the largest share of the recorded stock, Southwest and Jubaland hold large numbers of earth dams and dug wells serving the agropastoral belt; Hirshabelle and Banadir hold comparatively few recorded sources for their population. Coverage density is a reporting artefact as much as a physical one and should not be read as service adequacy.

TABLE 2 National water-source inventory by region, type and recorded functionality

REGION	BOREHOLES	DUG WELLS	EARTH DAMS	BERKADS	OTHER	ALL SOURCES	FUNCTIONAL (%)
Woqooyi Galbeed	326	311	144	38	65	884	84
Togdheer	226	178	79	129	62	674	71
Galgaduud	179	226	80	69	5	559	91
Bari	183	154	89	7	121	554	93
Sanaag	140	195	109	29	65	538	87
Mudug	259	174	48	31	8	520	90
Bakool	31	229	201	4	14	479	90
Bay	102	102	254	3	18	479	65
Awdal	109	219	24	26	72	450	84
Sool	99	222	57	4	24	406	87
Lower Shabelle	169	81	87	15	8	360	93
Gedo	42	174	118	8	11	353	85
Nugaal	107	130	45	5	53	340	87
Hiraan	83	74	111	34	5	307	78
Middle Shabelle	77	111	57	0	0	245	80
Banadir	10	140	0	0	2	152	44
Lower Juba	39	14	56	1	3	113	91
Middle Juba	9	30	62	0	3	104	91
Somalia	2,190	2,764	1,621	403	539	7,517	83

Source: harmonized FAO-SWALIM inventory (this study). "Other" combines springs, water catchments and togga sources. Regions are assigned by point-in-polygon overlay, not by the label recorded in the source database. Functionality is the share of assets with a recorded status that are functional; status is missing for 1,643 assets and inspection dates span 2010–2025.

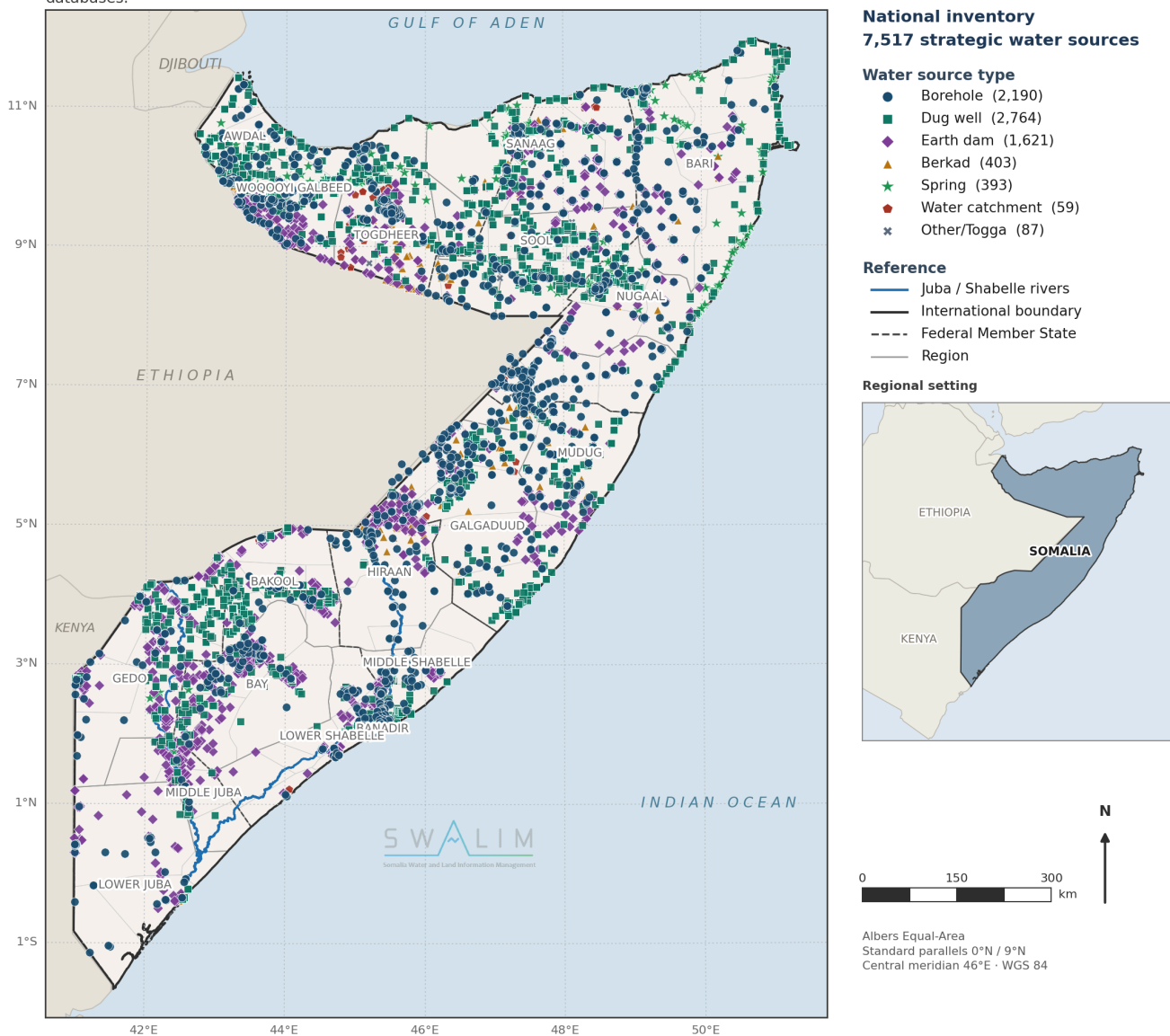
4.1 The strategic borehole monitoring network

FAO-SWALIM in collaboration with MoEWR/Water Authorities at state level monitors 612 strategic boreholes on a weekly cycle, combining mobile-phone reporting by operators with telemetric transmission at a small number of instrumented sites. Every borehole in the register is held with its coordinates, region, district and settlement, so the network can be mapped and screened directly. The August 2026 round, extracted on 1 September 2026, returned a status for 570 boreholes across 61 districts: 539 functional and 31 non-functional, a non-functionality rate of 5.4 percent. Those 570 boreholes are the strategic boreholes assessed in this report.

The monitoring form captures depth, static water level, pump setting, electrical conductivity, pH, tank capacity, households served, livestock, tanker movements, yield, pumping hours and water price. This is a richer operational record than exists for any other class of water source in Somalia, and it is why the strategic boreholes can be assessed for criticality on evidence rather than assumption. Current non-functionality is concentrated in Buhodle, Baligubadle, Eyl, Gabiley, Ceerigaabo, Qardho, Erigavo, Hargeisa and Burao — an almost entirely northern pattern. Flood risk and current non-functionality are therefore largely disjoint problems affecting different parts of the country. These functionality figures are those of the weekly monitoring round; the assessment does not establish why the northern pattern arises, which would need the maintenance and water-quality record.

MAP 2**Somalia water infrastructure baseline, 2026**

Harmonised and de-duplicated national inventory of groundwater and surface-water sources, compiled from seven FAO-SWALIM water-source databases.



Map 2 National water infrastructure baseline, 2026: the harmonised and de-duplicated inventory of groundwater and surface-water sources compiled from seven FAO-SWALIM databases.

05 Data and methods

Table 3 lists the datasets used and the role each plays in the analysis.

TABLE 3 Datasets used in the assessment

DATASET	PROVIDER AND VINTAGE	RECORDS	ROLE
Strategic Water Sources 2025, 2022, 2020 and 2018; Somalia Surface Water Sources; Functioning Boreholes 2010; Rehabilitated Water Catchments	FAO-SWALIM, 2010–2025	26,900	The seven databases merged and de-duplicated into the national analytical inventory
Strategic borehole monitoring, August 2026 round	FAO-SWALIM, monthly/weekly	570 of 612 boreholes	Functionality, households served, livestock, yield and water price; basis for criticality of strategic boreholes
Somalia Flood Plain Extent 2013–2023 (Sentinel-2, dissolved) and Flood Prone Areas merge	FAO-SWALIM	126,306 polygons	Primary observed historical inundation
Event flood extents: Deyr 2023 (El Niño), Gu 2024, Gu 2023, Gu 2021, Deyr 2019, Deyr 2018, Gu 2018	FAO-SWALIM	87,576 polygons	Inundation frequency at each asset
River breakages, Shabelle (August 2026) and Juba–Shabelle (March 2026)	FAO-SWALIM	3,548 points	Active breach locations; the physical mechanism of riverine inundation
Groundsource historical flood events, Somalia subset	Google Research, 2026 (DOI 10.5281/zenodo.18647054)	945 events, 2001–2025	Independent, news-derived record of flood occurrence, including flash floods away from the rivers
Google Flood Hub	Google, consulted 1 September 2026	—	Independent riverine forecast and gauge information; coverage assessed and reported
Copernicus DEM GLO-30	ESA / Copernicus	86 tiles at ~30 m	Depression filling, flow routing, drainage extraction, HAND, slope, distance to drainage, upstream contributing area
Somalia Rivers; Juba and Shabelle mainstems; OpenStreetMap drainage network	FAO-SWALIM; OSM	5,144 lines used	Mapped drainage network conditioning the HAND datum
Administrative boundaries, levels 0–3; harmonised settlements; population 2026 at 100 m	UNOCHA; FAO-SWALIM; WorldPop	101 units; 11,720; raster	Spatial assignment, aggregation and population within observed flood extents

All spatial data were retrieved from the FAO-SWALIM GeoNode between 31 August and 1 September 2026, except the Copernicus DEM (Copernicus open-data archive) and the Groundsource layer (supplied for this assessment).

5.1 Building the analytical inventory

No total can be quoted until duplicates are removed. The contributing databases overlap heavily, both internally and with one another, and the same physical water point frequently appears several times with different codes, slightly different coordinates and different inspection dates. Within the 2025 layer, 86 records fell outside the national boundary and were excluded; records were then treated as duplicates where they shared a source type and were either less than 10 m apart, bore an identical normalised name within 50 m, had one name missing within 50 m, or shared an identical SWALIM source code. That rule collapsed 3,380 records to 4,818 unique assets.

Each further database was tested against the accumulating inventory at a 100 m any-type or 150 m same-type threshold and only genuinely additional assets were merged: Somalia Surface Water Sources proved 88 percent co-located and contributed 347 assets, the 2022 vintage 879, the 2018 vintage 1,130 (predominantly earth dams absent from later inventories), the 2020 vintage 18, Functioning Boreholes 2010 75 and Rehabilitated Water Catchments 59. Every asset was assigned to a district by point-in-polygon overlay rather than by its recorded label; 1,156 assets carried a district label differing from the polygon they fall in, and the spatial assignment was used.

5.2 Terrain and hydrological analysis at 30 m

Observed flood extents are concentrated where SWALIM monitors routinely and are additionally constrained by cloud cover hindering the satellite images analysis during the Deyr, so outside those corridors their absence carries almost no information. A terrain screening was therefore run over the whole country on the Copernicus DEM GLO-30, in 76 one-degree tiles with a 0.12° halo. For each tile the sequence was pit filling; priority-flood depression filling, retaining the fill depth as a measure of topographic depression; flat resolution; D8 flow direction; flow accumulation converted to upstream contributing area; drainage extraction; Height Above Nearest Drainage; slope on metric cell spacing; Euclidean distance to the nearest channel; and, for every cell, the upstream contributing area of the channel to which it drains.

The channel network against which HAND is measured is the union of cells with at least 15 km² of upstream contributing area and the mapped perennial rivers and major watercourses. Conditioning the HAND datum on the mapped network is essential in Somalia: the Juba and

Shabelle rise in the Ethiopian highlands, so their true contributing area cannot be reproduced from a Somalia-only DEM, and a purely accumulation-derived network would not recognize the two most important rivers in the country as channels at all.

Susceptibility is classified from the joint terrain condition, never from elevation alone. A cell is Very high where HAND is at most 1.5 m, distance to channel at most 300 m, slope at most 1.5° and the receiving channel drains at least 50 km²; or where it sits in a closed depression at least 2.0 m deep with at least 2 km² upstream. High requires HAND at most 4 m, distance at most 1,000 m, slope at most 2.5° and at least 10 km² upstream; or a depression at least 1.0 m deep with at least 1 km² upstream. Moderate requires HAND at most 8 m, distance at most 2,000 m, slope at most 4° and at least 2 km² upstream; or a depression at least 0.5 m deep. Nationally this classifies 3.3 percent of land area Very high, 13.4 percent High and 12.5 percent Moderate.

Low elevation is not flooding. Every susceptibility class requires hydrological connectivity — either a defined route to a channel of stated size, or a closed depression with a stated contributing area. A low-lying cell with no upstream catchment and no connection to a drainage line is not classified as susceptible, because nothing would deliver water to it.

5.3 Limitations of a 30 m DEM

The mapped inundation layer represents Modelled Potential Inundation / Flood Susceptibility. It does not show observed flooding, and it should not be read as an engineering-grade flood extent. It is derived from the Copernicus GLO-30 elevation dataset, which has a horizontal resolution of 30 metres and a vertical accuracy of a few metres; in very flat terrain, where the difference between dry and potentially inundated ground may be around 0.3 metres, that vertical uncertainty is larger than the difference being assessed. Small but important drainage features — toggas, field drains and irrigation canals narrower than about 60 metres — cannot be represented reliably, so local conveyance routes and flood pathways may be missed. Road embankments, levees and canal bunds that govern where water actually goes may fall below the model resolution, or be represented as continuous where in fact they are breached. Very small ground features, such as raised wellheads, aprons and the protective bunds around berkads, are not captured at all. The model therefore indicates where water may accumulate under certain conditions; it does not estimate flood depth or predict the route water will take at a specific site, and it performs least well in the extremely flat Shabelle and lower Juba floodplains,

where small elevation errors produce large shifts in the mapped boundary and where the concentration of exposed infrastructure is highest. At 391 sites, almost all on the closed interior and coastal plateaux of northern and central Somalia, no downslope path to a mapped channel resolves at 30 metres; height above drainage is recorded as not determined for those, and they are classified on the depression and slope criteria alone. The analysis is intended for national and regional screening: a higher susceptibility class indicates that a site should be prioritised for field survey, not what should be built there.

5.4 Evidence hierarchy and risk scoring

Risk is not hazard. A borehole inside an area forecast to receive above-normal seasonal rainfall is not thereby at high flood risk, and one inside a modelled flood-susceptible polygon has not thereby failed. The assessment therefore places every asset in an evidence class, scores four distinct components, and combines them explicitly. Table 4 sets out both, with the justification for every scale used. Two rules constrain the outcome: no asset may be classified above the level its evidence class supports, and a Very high classification additionally requires either observed exposure or two independent lines of evidence.

TABLE 4 Evidence hierarchy and multi-criteria risk scoring

COMPONENT	CRITERION	SCALE	DEFINITION OR JUSTIFICATION	ASSETS
EVIDENCE HIERARCHY — THE STRENGTH OF EVIDENCE THAT A SOURCE IS EXPOSED				
Evidence	Confirmed / observed exposure	—	Intersects, or lies within 250 m of, a satellite-observed or documented historical flood extent	507
Evidence	High potential exposure	—	Not observed, but supported by two or more independent lines: terrain susceptibility High or Very high; a reported flood event; an active breach within 2 km; within 1 km of the Juba or Shabelle	97
Evidence	Moderate potential exposure	—	A single line of evidence, or Moderate terrain susceptibility, without independent confirmation	3,235
Evidence	Lower / uncertain exposure	—	No current indication of exposure. Not a finding of safety: it reflects the limits of the evidence	3,678
RISK SCORING — CRITERIA, SCALE AND JUSTIFICATION				
Hazard	Observed inundation frequency	0 – 1.00	Repeated observed inundation is the strongest evidence available; three or more events score 1.00, one event 0.60	—

COMPONENT	CRITERION	SCALE	DEFINITION OR JUSTIFICATION	ASSETS
Hazard	30 m terrain susceptibility	0 – 0.60	Scored below observed inundation because modelled susceptibility is weaker evidence than observation	—
Hazard	Reported flood events (Groundsource)	0 – 0.40	Independent occurrence record capturing flash flooding away from monitored rivers; spatially local events score higher	—
Hazard	Proximity to an active river breach	0 – 0.75	Breaches are the mechanism by which riverine flooding reaches the floodplain; graded at 2, 5 and 10 km	—
Hazard	Position in the perennial river corridor	0 – 0.60	Graded at 1, 5 and 10 km from the Juba or Shabelle mainstem	—
Seasonal	ICPAC OND 2026 outlook zone	0.6 – 1.0	A multiplier on latent hazard, not a hazard term. Regions inside the 90% zone take 1.0; Mudug and Nugaal 0.8; northern regions 0.6	—
Vulnerability	Source type	2 – 3	Dug wells, berkads, earth dams and catchments score 3 as open or embankment-dependent structures; boreholes and springs 2	—
Vulnerability	Recorded protection status	0 – 2	An unprotected source scores 2, a protected source 0, an unrecorded status 1	—
Vulnerability	Shallow depth	0 – 2	Sources at or below 15 m are the most rapidly contaminated by surface inflow	—
Vulnerability	Motorised or solar pumping present	0 – 1	Adds an electrical-damage pathway absent from hand-drawn sources	—
Criticality	Recorded users	0 – 3	Graded at 200, 1,000 and 5,000 recorded users	—
Criticality	Strategic borehole in the SWALIM network	0 or 3	Membership is an operational judgement already made about which sources carry the system	—
Criticality	Improved functional alternatives within 5 km	0 – 3	Computed from the inventory; a source with no functional improved alternative within 5 km scores 3	—
Criticality	Recorded as a permanent source	0 or 2	A permanent source carries dry-season load that a seasonal source does not	—

Hazard criteria are expressed on an evidential-strength scale: the strongest single line sets the hazard level and corroborating lines add a bounded increment of at most 0.35 of their mean. Vulnerability and criticality criteria are equally weighted within their component. Risk = 100 × Hazard × Seasonal factor × (0.5 + 0.5 × Vulnerability) × (0.5 + 0.5 × Criticality); class boundaries 14, 30 and 45. A Very high classification additionally requires observed exposure or two independent lines of evidence, and no class may exceed the level the evidence hierarchy supports.

06 Flood hazard: observed record and modelled susceptibility

6.1 The observed record

Seven event-specific inundation layers were analysed against the inventory, together with the dissolved 2013–2023 flood-plain extent. Deyr 2023 (El Niño) inundated 234 recorded water sources; Gu 2023 inundated 74; Deyr 2019 inundated 62; Gu 2018 inundated 53; Gu 2024 inundated 20; Gu 2021 inundated 16; Deyr 2018 inundated 4. 84 sources have been inside the mapped extent of two or more separate events and 55 inside three or more. Repeated exposure of the same asset is the strongest single indicator in this assessment: a water point inundated in 2018, 2019 and 2023 is not at risk because of a model but because it has already been under water three times.

The 2023 Deyr is the most instructive analogue because it occurred under El Niño with a positive Indian Ocean Dipole — the configuration now forecast. Between October and November 2023 flash flooding and river overflow affected approximately 2.5 million people, an estimated 1.2 million were displaced and 118 deaths were reported, with Southwest State, Jubaland and Hirshabelle worst affected. The WASH Cluster recorded hundreds of water points damaged or contaminated and several thousand latrines destroyed or inundated, forcing a significant part of the population onto unsafe sources or into open defecation, while stagnant water complicated disease control. Access was itself a primary operational constraint: functional boreholes were effectively lost to their users because operators, fuel, chlorine and repair teams could not reach them. Access is therefore treated in this assessment as an impact mechanism (Table 9).

6.2 River breaches: the mechanism that has never been closed

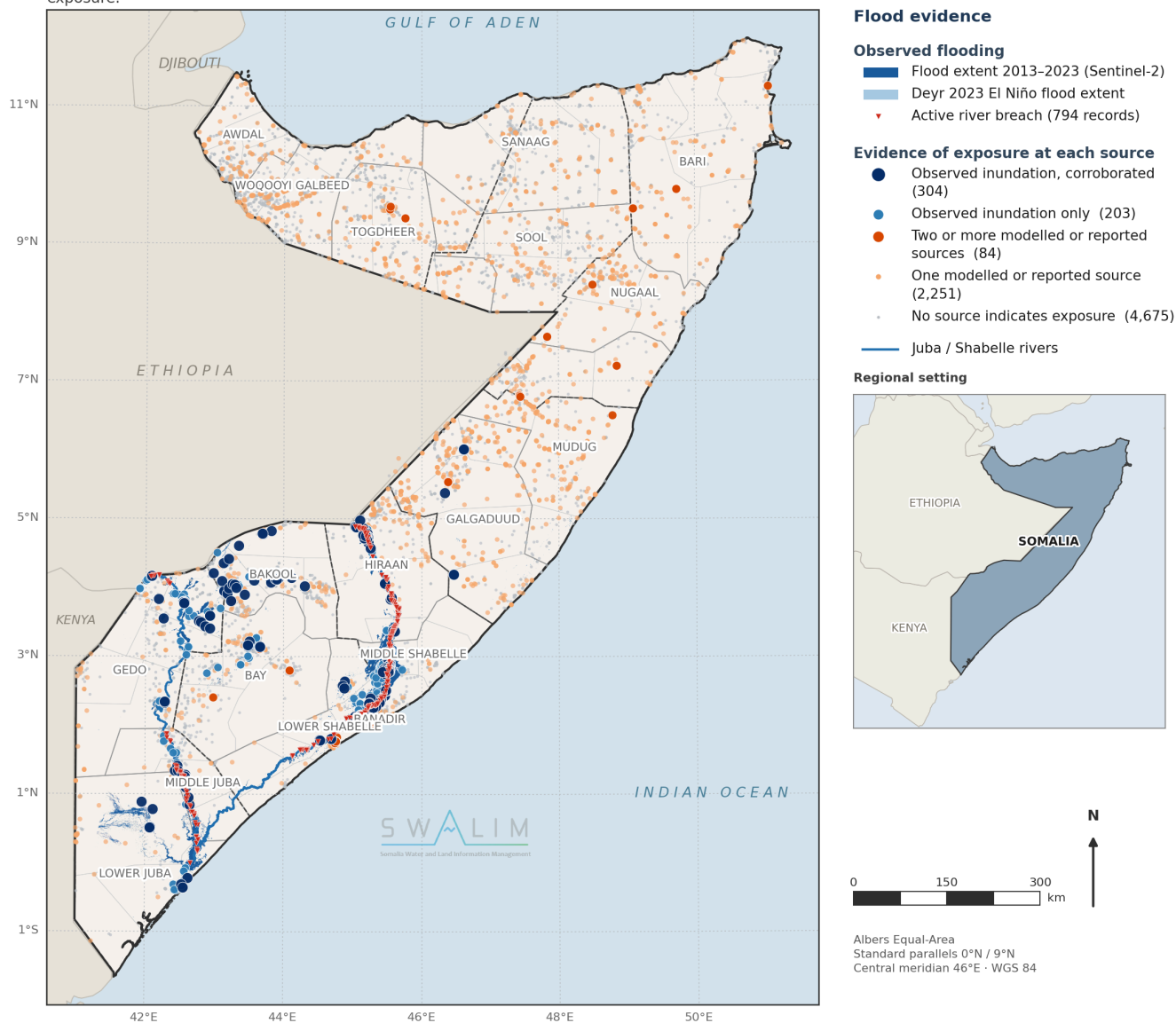
Riverine flooding in Somalia does not usually occur by uniform overtopping but at discrete breach points in the natural and artificial embankments of the Juba and Shabelle, most of which have been open for years and are closed, when at all, with sandbags. The August 2026 Shabelle assessment maps 1,427 points, of which 375 are in an active state — 147 open, 150 in overflow, 66 canal-intake flooding and 12 canal breaches — with a further 587 classified potential overflow. The March 2026 Juba and Shabelle assessment maps 2,121 points, of which 322 on the Shabelle and 96 on the Juba are active. The two releases are successive surveys of an overlapping point set rather than independent inventories: 306 of the 322 active Shabelle points in the March release lie within 250 m of an active point in the August release. Collapsing the

union at 250 m gives 386 unique active breach locations, concentrated in Jowhar, Afgooye, Balcad, Beledweyne, Jalalaqsi, Bullo Burto, Bu'aale and Kurtunwaarey. 167 water sources lie within 2 km of an active breach, 278 within 5 km and 426 within 10 km. These are the assets for which riverine inundation has a defined physical delivery mechanism rather than a modelled one.

The Juba evidence is out of date. FAO-SWALIM's August 2026 release maps 388 breakage points along the Shabelle from very high-resolution imagery. The equivalent Juba analysis was not released, for budgetary reasons, and the most recent Juba assessment dates from March 2026. Since breach proximity is among the strongest predictors of riverine inundation in this assessment, and the Juba corridor carries a substantial share of the exposed infrastructure, the update should be funded and released before the Deyr.

MAP 3 Flood evidence for water infrastructure

Observed inundation and active river breaches, with every water source classified by the number of independent lines of evidence indicating flood exposure.



Observed inundation is evidence of past flooding. Modelled and reported categories are potential exposure and carry lower confidence. 'No source indicates exposure' is not a finding of safety; the observational record is thinner outside the monitored riverine corridors.

Sources: FAO-SWALIM flood extents 2013–2023 and event layers; FAO-SWALIM river breakages (August 2026, March 2026); Copernicus DEM GLO-30 terrain analysis (this study); Groundsource flood events (Google Research, 2026); FAO-SWALIM GeoNode; UNOCHA administrative boundaries; Natural Earth (neighbouring states)

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Map 3 Observed inundation for 2013–2023 and the Deyr 2023 El Niño extent, with active river breaches and every water source classified by the number of independent lines of evidence indicating flood exposure.

6.3 Modelled susceptibility, and what it adds

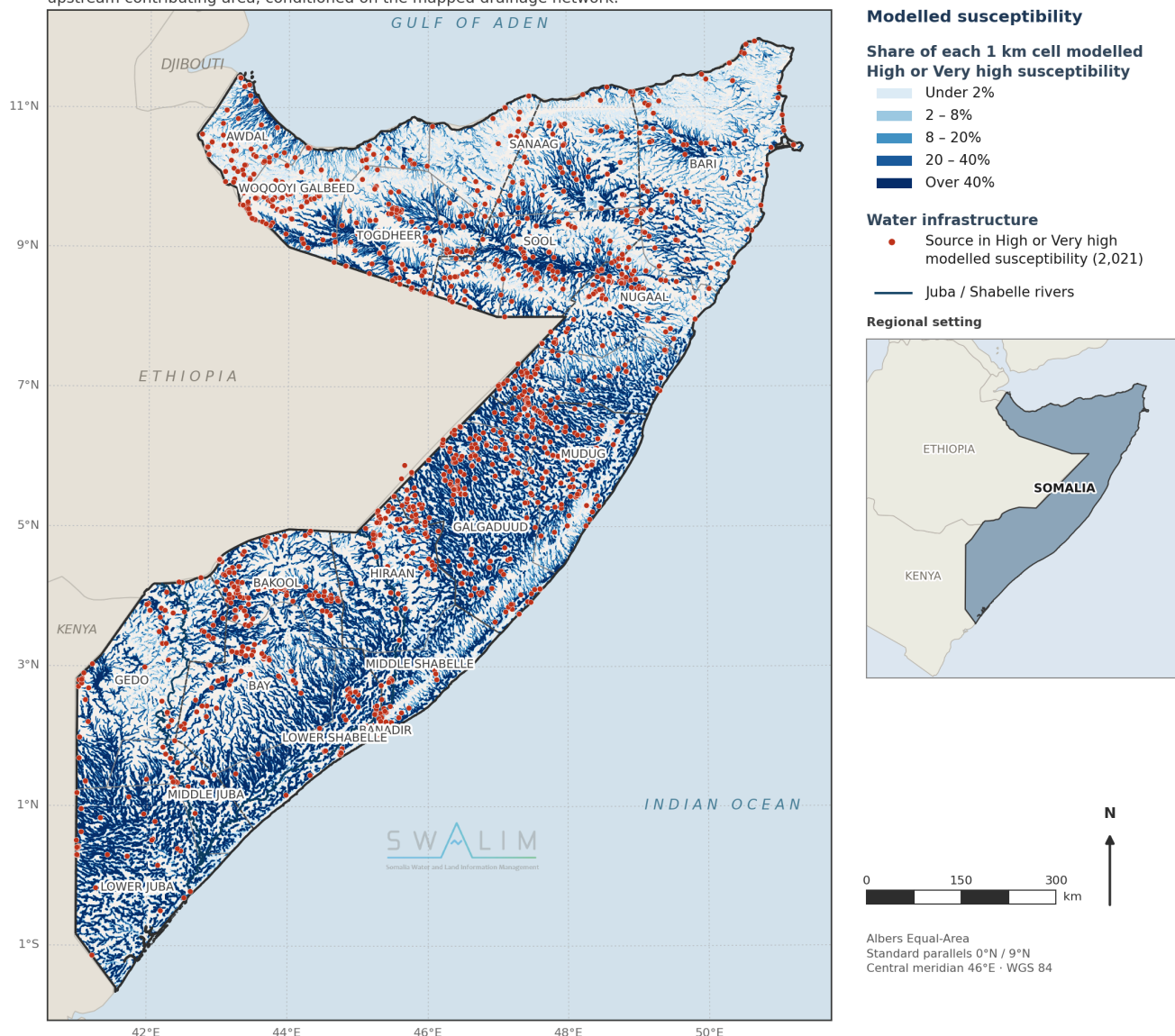
Terrain metrics were extracted for all 7,517 assets. 563 sources fall in Very high modelled susceptibility and 1,458 in High — 2,021 in total, 26.9 percent of the inventory — with a further 1,146 in Moderate. Expressed through the underlying variables, 2,955 sources sit no more than 2 m above the nearest drainage line, 3,460 lie within 500 m of a channel and 6,004 on slopes of

2 degrees or less. The value of the screening is that it reaches where the observed record does not: 1,876 of the sources in High or Very high susceptibility have no observed flood record at all, predominantly in the central rangelands, the Bay–Bakool agropastoral belt and the northern toggas, where optical analysis of satellite images for flood mapping has never been routine. Treating those assets as unexposed because no flood polygon covers them would be a reporting artefact, not a finding.

MAP 4

Modelled potential inundation and flood susceptibility

Derived from the 30 m Copernicus DEM by depression filling, D8 flow routing, drainage extraction, Height Above Nearest Drainage, slope and upstream contributing area, conditioned on the mapped drainage network.



MODELLED POTENTIAL INUNDATION — not observed flooding and not an engineering flood extent. Computed at 30 m and generalised to 1 km cells for national display; Maps 7 and 8 show the corridors at full resolution. A 30 m DEM cannot resolve small channels, embankments, culverts or shallow flood depths and performs least well in the flat terrain where most at-risk infrastructure lies.

Sources: Copernicus DEM GLO-30 (ESA/Copernicus); FAO-SWALIM Somalia Rivers; OpenStreetMap drainage network; FAO-SWALIM GeoNode; UNOCHA administrative boundaries; Natural Earth (neighbouring states)

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Map 4 Modelled potential inundation and flood susceptibility from the 30 m Copernicus DEM, generalised to 1 km cells for national display. A screening product: not observed flooding and not an engineering flood extent.

6.4 Independent corroboration

Google Flood Hub, consulted on 1 September 2026, has materially narrower Somali coverage than is often assumed. Fewer than ten higher-confidence riverine gauges are present nationally, all in the middle and lower Juba between Saakow and Jamaame; there is none on the Shabelle, and a query at Beledweyne — the most flood-prone urban centre on that river — returns 'area

not supported'. Where coverage exists the product is substantive: the gauge on the Webi Jubba at 1.0771 °N, 42.5854 °E (hybas_1121118960, upstream basin 211,617 km²) publishes a discharge forecast against thresholds of 317, 539 and 893 m³/s. Inundation footprints are published only while a gauge is alerting, so none was available for this assessment. Flood Hub therefore corroborates hazard along the Juba and offers a usable operational warning stream there; it cannot corroborate hazard on the Shabelle, in the central rangelands or in the north, and no asset outside the Juba basin has been classified on Flood Hub evidence.

The Groundsource dataset (Google Research, 2026) provides an independent, news-derived record of 945 Somali flood events between 2001 and 2025. Because it is not derived from satellite water detection it is not biased towards the monitored riverine corridors, and it records flash flooding in Baidoa, Garoowe, Hargeysa, Bossaso and smaller centres that the optical extents miss entirely. Event counts peak in 2020 (217), 2023 (197), 2024 (149), 2018 (91), 2019 (78) and 2025 (71), matching the known flood chronology. 608 water sources fall within a spatially local reported event and 997 within any reported event. Because footprints are geocoded from news reporting rather than surveyed, they are treated as evidence of flood occurrence in an area rather than of inundation at a point.

Taken together, 145 sources are supported by both observed inundation and High or Very high modelled susceptibility — the strongest evidential position available here, and the basis for the High confidence rating. 97 are supported by two or more independent lines without an observed record and are precisely the assets a purely observation-based assessment would have missed. 3,235 rest on a single line and are classified Moderate potential exposure with correspondingly lower confidence.

07 Exposure, risk and priority locations

Of the 7,517 strategic water sources, 507 (6.7 percent) fall in the Confirmed or observed exposure class, 97 in High potential exposure and 3,235 in Moderate potential exposure; 3,678 show no current indication of substantial exposure, which is a statement about the evidence rather than about safety. Applying the risk framework gives 71 sources at Very high risk and 524 at High risk — 7.9 percent of the inventory — with a further 1,667 at Moderate risk. Middle Shabelle, Hiraan, Lower Shabelle, Gedo and Bakool carry the largest at-risk shares; the

northern regions carry almost none, both because they lie outside the enhanced-rainfall zone and because their terrain is less hydrologically connected to large contributing areas. Table 5 gives the regional and type distributions.

TABLE 5 Flood exposure and risk classification by region and infrastructure type

REGION / TYPE	SOURCES	OBSERVED EXPOSURE	HIGH POTENTIAL EXPOSURE	VERY HIGH RISK	HIGH RISK	% VERY HIGH OR HIGH
BY REGION						
Middle Shabelle	245	119	2	25	87	45.7
Lower Shabelle	360	77	31	8	81	24.7
Hiraan	307	76	2	14	72	28.0
Gedo	353	80	3	10	75	24.1
Bakool	479	71	1	5	71	15.9
Galgaduud	559	11	12	1	59	10.7
Middle Juba	104	28	1	8	25	31.7
Lower Juba	113	26	0	0	20	17.7
Bay	479	19	5	0	18	3.8
Mudug	520	0	12	0	9	1.7
Nugaal	340	0	3	0	6	1.8
Banadir	152	0	10	0	1	0.7
Awdal	450	0	0	0	0	0.0
Bari	554	0	10	0	0	0.0
Sanaag	538	0	0	0	0	0.0
Sool	406	0	0	0	0	0.0
Togdheer	674	0	5	0	0	0.0

REGION / TYPE	SOURCES	OBSERVED EXPOSURE	HIGH POTENTIAL EXPOSURE	VERY HIGH RISK	HIGH RISK	% VERY HIGH OR HIGH
Woqooyi Galbeed	884	0	0	0	0	0.0
Somalia	7,517	507	97	71	524	7.9
BY INFRASTRUCTURE TYPE						
Borehole	2,190	108	41	14	86	4.6
Dug well	2,764	256	38	55	266	11.6
Earth dam	1,621	126	11	2	138	8.6
Berkad	403	11	3	0	25	6.2
Spring	393	2	3	0	4	1.0
Water catchment	59	3	0	0	4	6.8
Other / Togga	87	1	1	0	1	1.1

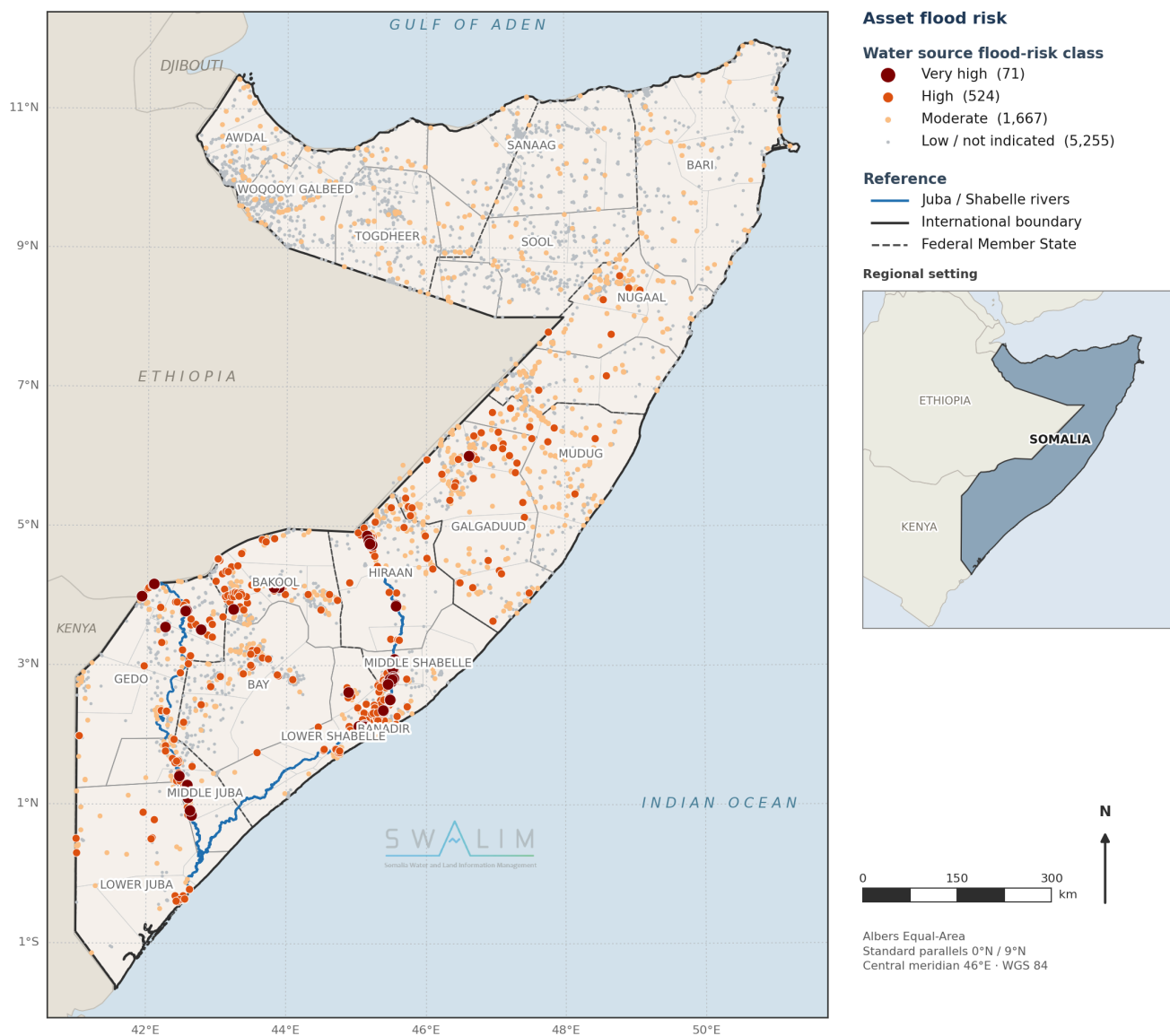
Source: this study. Evidence classes and risk classes are defined in Table 4. Regional rows sum to the national total; the type rows are the same 7,326 assets grouped differently.

The risk profile differs sharply between source types, and not because hazard differs. Dug wells account for 55 of the 71 Very high–risk sources and earth dams for 2: both are shallow or embankment-dependent structures with high physical vulnerability, and dug wells are concentrated in exactly the alluvial and depression terrain that floods. Boreholes account for 14. Boreholes are less vulnerable per asset — a cased, sealed borehole survives inundation that destroys a dug well — but far more critical, because they serve larger populations, carry the load when shallower sources fail, and lose their pumping equipment rather than the well itself. The two classes therefore require different interventions, which is the practical reason for separating them in Table 9.

MAP 5

Water infrastructure flood-risk classification

Risk combines hazard, seasonal amplification, physical vulnerability and criticality to the population each source serves.



Risk classes are screening classes for prioritisation. A Very high classification indicates that a source should be inspected and protected before the Deyr; it is not a prediction that the source will flood. A Low classification reflects the limits of the available evidence and is not a finding of safety.

Sources: This study, from FAO-SWALIM water-source inventories, flood extents and river breakages; Copernicus DEM GLO-30 terrain analysis; Groundsource flood events (Google Research, 2026); ICPAC OND 2026 outlook; FAO-SWALIM GeoNode; UNOCHA administrative boundaries; Natural Earth (neighbouring states)

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Map 5 Water infrastructure flood-risk classification, combining hazard, seasonal amplification, physical vulnerability and criticality to the population each source serves.

7.1 Priority districts

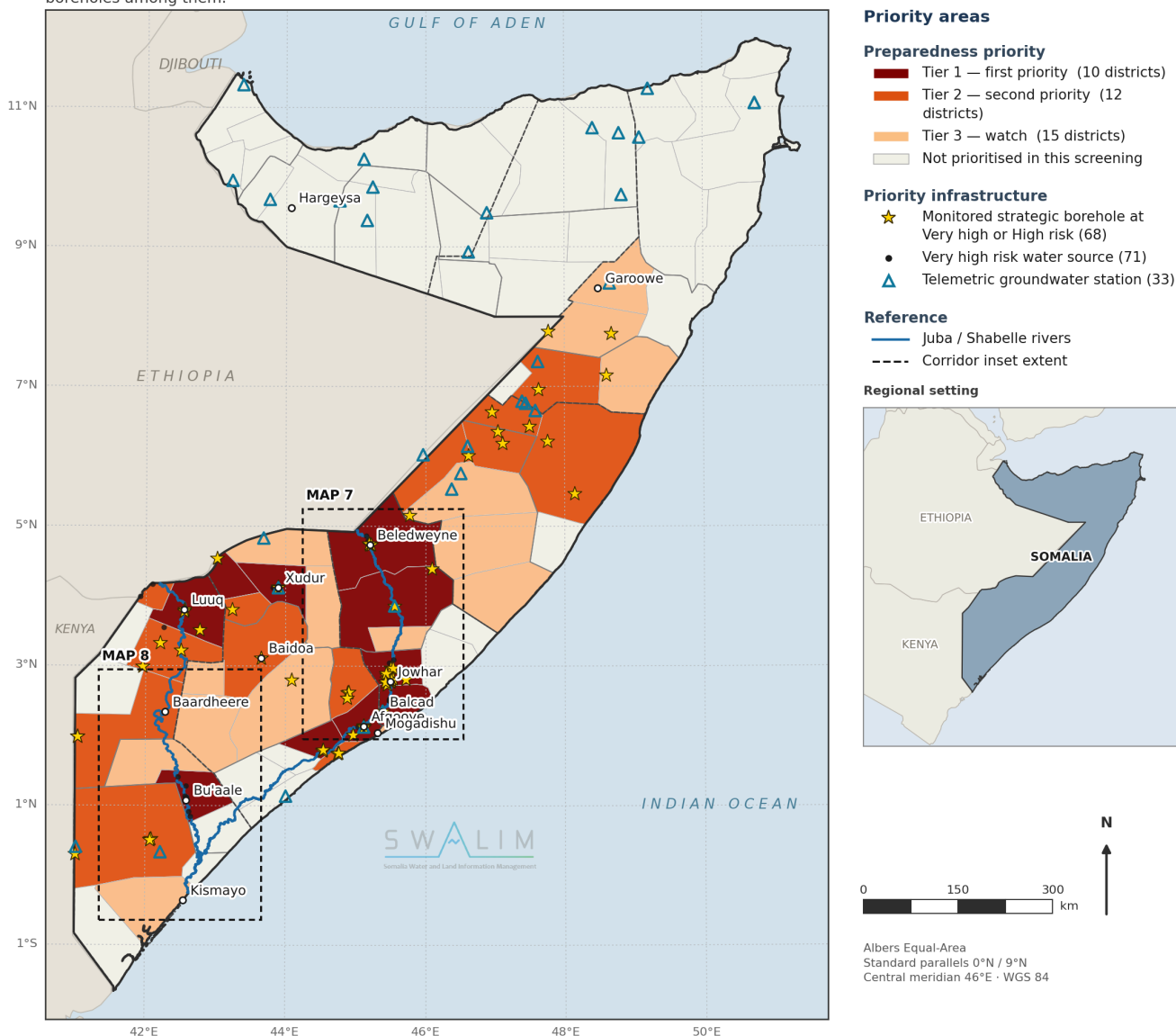
Preparedness resources are finite and exposure is concentrated, so targeting matters more than coverage. Districts were ranked on the combined count of Very high- and High-risk sources, the count of Very high sources alone, the monitored strategic boreholes among them, and the

population those sources are recorded as serving. The ranking gives ten first-priority districts, twelve second-priority and fifteen watch districts — 37 in all.

MAP 6

Priority areas for El Niño preparedness ahead of the 2026 Deyr

Districts ranked on the number of Very high and High risk water sources, the population those sources are recorded as serving, and the strategic boreholes among them.



Tiering prioritises preparedness effort; it does not imply that districts outside Tier 1 will not flood. The ranking is sensitive to the completeness of the underlying inventory, which is uneven between regions.

Sources: This study; FAO-SWALIM strategic borehole monitoring (August 2026); FAO-SWALIM telemetric groundwater station register (climseries.faoswalim.org, September 2026); FAO-SWALIM GeoNode; UNOCHA administrative boundaries; Natural Earth (neighbouring states)

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Map 6 Priority districts for El Niño preparedness ahead of the 2026 Deyr, with the Very high risk sources and the monitored strategic boreholes among them. Dashed frames show the extents of Maps 7 and 8.

TABLE 6 Priority districts: at-risk infrastructure and population indicators

TIER	DISTRICT	REGION	SOURCES	VERY HIGH	HIGH	% AT RISK	STRATEGIC BOREHOLES AT RISK	USERS AT AT- RISK SOURCES	POPULATION IN OBSERVED FLOOD EXTENT
1	Jowhar	Middle Shabelle	97	17	59	78.4	12	165,244	256,104
1	Afgooye	Lower Shabelle	230	7	50	24.8	8	145,084	75,932
1	Belet Weyne	Hiraan	267	10	52	23.2	4	52,510	195,684
1	Luuq	Gedo	130	7	40	36.2	3	175,701	13,651
1	Balcad	Middle Shabelle	124	8	28	29.0	2	95,250	100,599
1	Xudur	Bakool	105	4	22	24.8	3	82,218	1,991
1	Bu'aale	Middle Juba	54	8	16	44.4	0	—	54,991
1	Rab Dhuure	Bakool	124	0	29	23.4	1	23,618	887
1	Bulo Burto	Hiraan	31	4	12	51.6	2	14,350	6,566
1	Qoryooley	Lower Shabelle	18	0	11	61.1	3	65,250	517
2	Doolow	Gedo	39	2	17	48.7	0	11,178	703
2	Cadaado	Galgaduud	119	0	18	15.1	2	14,100	0
2	Cabudwaaq	Galgaduud	141	1	18	13.5	1	1,255	31
2	Hobyo	Mudug	207	0	4	1.9	2	106,402	not computed
2	Wanla Weyn	Lower Shabelle	43	1	7	18.6	3	46,470	6,383
2	Garbahaarey	Gedo	74	1	8	12.2	3	33,315	2,179
2	Marka	Lower Shabelle	50	0	12	24.0	2	42,690	3,553
2	Gaalkacyo	Mudug	185	0	4	2.2	3	67,800	no extent mapped

TIER	DISTRICT	REGION	SOURCES	VERY HIGH	HIGH	% AT RISK	STRATEGIC BOREHOLES AT RISK	USERS AT AT- RISK SOURCES	POPULATION IN OBSERVED FLOOD EXTENT
2	Afmadow	Lower Juba	65	0	8	12.3	4	25,320	not computed
2	Waajid	Bakool	85	1	11	14.1	1	21,390	103
2	Baydhaba	Bay	278	0	11	4.0	1	23,760	2,957
2	Baardheere	Gedo	55	0	10	18.2	3	—	not computed

Source: this study; population within the observed 2013–2023 flood extent computed from the WorldPop 2026 100 m raster. The last two columns measure different quantities and must not be added: the first counts people recorded as using particular at-risk sources (a lower bound, since user numbers exist for only a third of assets); the second counts people living inside a flood footprint irrespective of which source they use.

7.2 Priority strategic boreholes and communities without alternatives

68 monitored strategic boreholes are classified Very high or High risk. They are the highest-return assets for pre-season protection for three reasons: they serve the largest recorded populations; they must carry the load when shallow wells are contaminated; and, uniquely among Somali water infrastructure, they already sit inside a weekly reporting system, so protective works can be verified and post-flood damage reported through an existing channel rather than an improvised one.

TABLE 7 Monitored strategic boreholes at Very high or High flood risk (highest-scoring 24 of 68)

BOREHOLE	DISTRICT	REGION	COORDINATES (LAT, LON)	RISK CLASS	HOUSEHOLDS SERVED	HAND (M)	DISTANCE TO BREACH (KM)
Baareey	Jowhar	Middle Shabelle	2.820, 45.535	Very high	2,480	1.7	0.4
Doon Subugle	Belet Weyne	Hiraan	4.734, 45.222	Very high	1,800	0.0	0.1
Maleele water supply	Belet Weyne	Hiraan	4.739, 45.204	Very high	1,800	0.0	1.3

BOREHOLE	DISTRICT	REGION	COORDINATES (LAT, LON)	RISK CLASS	HOUSEHOLDS SERVED	HAND (M)	DISTANCE TO BREACH (KM)
Baani	Jowhar	Middle Shabelle	2.780, 45.505	Very high	7,360	0.0	2.4
Maxaadey	Jowhar	Middle Shabelle	2.799, 45.514	Very high	1,600	0.4	0.2
Lama galaay water supply	Belet Weyne	Hiraan	4.734, 45.203	Very high	1,200	1.7	0.7
Xaamud	Belet Weyne	Hiraan	4.750, 45.192	Very high	2,000	0.0	0.7
Qasaxley	Bulo Burto	Hiraan	3.859, 45.561	Very high	1,200	3.8	1.4
Ibnu Maxamed water supply	Afgooye	Lower Shabelle	2.147, 45.118	Very high	3,255	2.1	1.2
Towfiq water supply	Afgooye	Lower Shabelle	2.142, 45.115	Very high	3,435	0.0	0.5
Buurane BH	Jowhar	Middle Shabelle	2.968, 45.510	Very high	1,680	1.3	1.9
Yurkut	Luuq	Gedo	3.515, 42.767	Very high	2,000	2.4	—
Baloowkaa	Waajid	Bakool	3.807, 43.237	Very high	3,565	1.0	—
Hero Kacaan BH2	Afgooye	Lower Shabelle	2.143, 45.120	Very high	3,710	5.5	0.9
Farjanno BH1	Jowhar	Middle Shabelle	2.776, 45.499	Very high	9,600	3.2	2.0
Maraweine BH	Jowhar	Middle Shabelle	2.973, 45.535	Very high	5,200	2.4	0.6
Labiga	Jowhar	Middle Shabelle	2.811, 45.480	Very high	1,888	2.0	4.0

BOREHOLE	DISTRICT	REGION	COORDINATES (LAT, LON)	RISK CLASS	HOUSEHOLDS SERVED	HAND (M)	DISTANCE TO BREACH (KM)
Alkowthar Water Supply BH2	Balcad	Middle Shabelle	2.356, 45.391	Very high	9,200	0.0	1.2
Danab Water Supply	Afgooye	Lower Shabelle	2.140, 45.120	Very high	4,172	4.9	0.9
AL-NACIIM	Afgooye	Lower Shabelle	2.125, 45.121	Very high	3,425	1.8	1.7
Hashi weer	Garbahaarey	Gedo	3.331, 42.207	High	8,010	0.0	—
Sheikh Aways	Xudur	Bakool	4.120, 43.894	Very high	3,490	0.9	—
Gabon 2	Dhuusamarreeb	Galgaduud	5.158, 45.771	High	566	0.0	—
Qaradhi SH	Cabudwaaq	Galgaduud	6.010, 46.614	Very high	1,410	0.0	—

Households served are as reported by borehole operators to the FAO-SWALIM strategic borehole monitoring system, August 2026 round. HAND is the Height Above Nearest Drainage from the 30 m DEM (minimum of the 3 × 3 neighbourhood); an em dash indicates that no downslope path to a mapped channel resolves at 30 m and the height is therefore not determined. The full register of all 595 Very high and High risk sources is provided in Annex A.

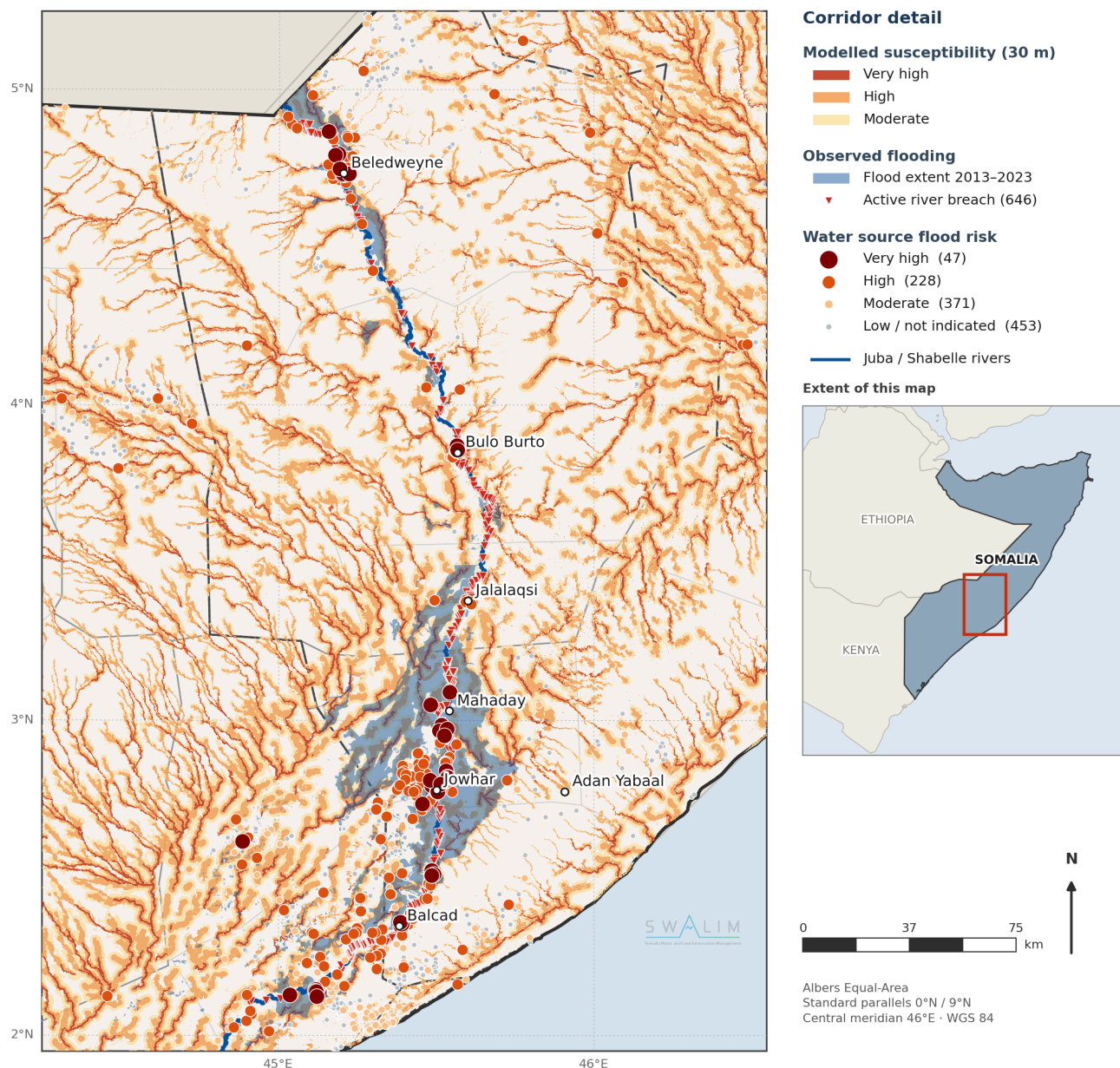
Criticality is not only how many people a source serves but what they would do if it failed. 299 at-risk sources have no functional borehole or protected spring within 5 km, of which 23 are Very high risk. For those communities, failure means a change of water source category rather than a longer walk, and these assets should be the first call on protective works and on water-trucking contingency planning irrespective of how many people any single one of them serves.

7.3 The two river corridors in detail

Two corridors dominate, and Maps 7 and 8 show both at the full 30 m resolution of the terrain analysis. The Shabelle from Beledweyne to Balcad carries the highest concentration of active breaches in the country, together with dense settlement, irrigation infrastructure and a large stock of shallow wells in a floodplain so flat that the modelled inundation boundary is inherently uncertain. Beledweyne is the pivotal town: it floods first, it floods repeatedly, and it has no higher-confidence Google Flood Hub gauge.

MAP 7 Shabelle corridor — Beledweyne to Balcad

Water infrastructure, observed inundation, 30 m modelled susceptibility and active river breaches along the middle and lower Shabelle.



Modelled susceptibility is shown at its native 30 m resolution and remains a screening product. Observed inundation is drawn over the modelled surface where both apply.
Sources: Copernicus DEM GLO-30 terrain analysis (this study); FAO-SWALIM flood extents 2013–2023 and river breakages (August 2026, March 2026); FAO-SWALIM GeoNode; UNOCHA administrative boundaries; Natural Earth (neighbouring states)
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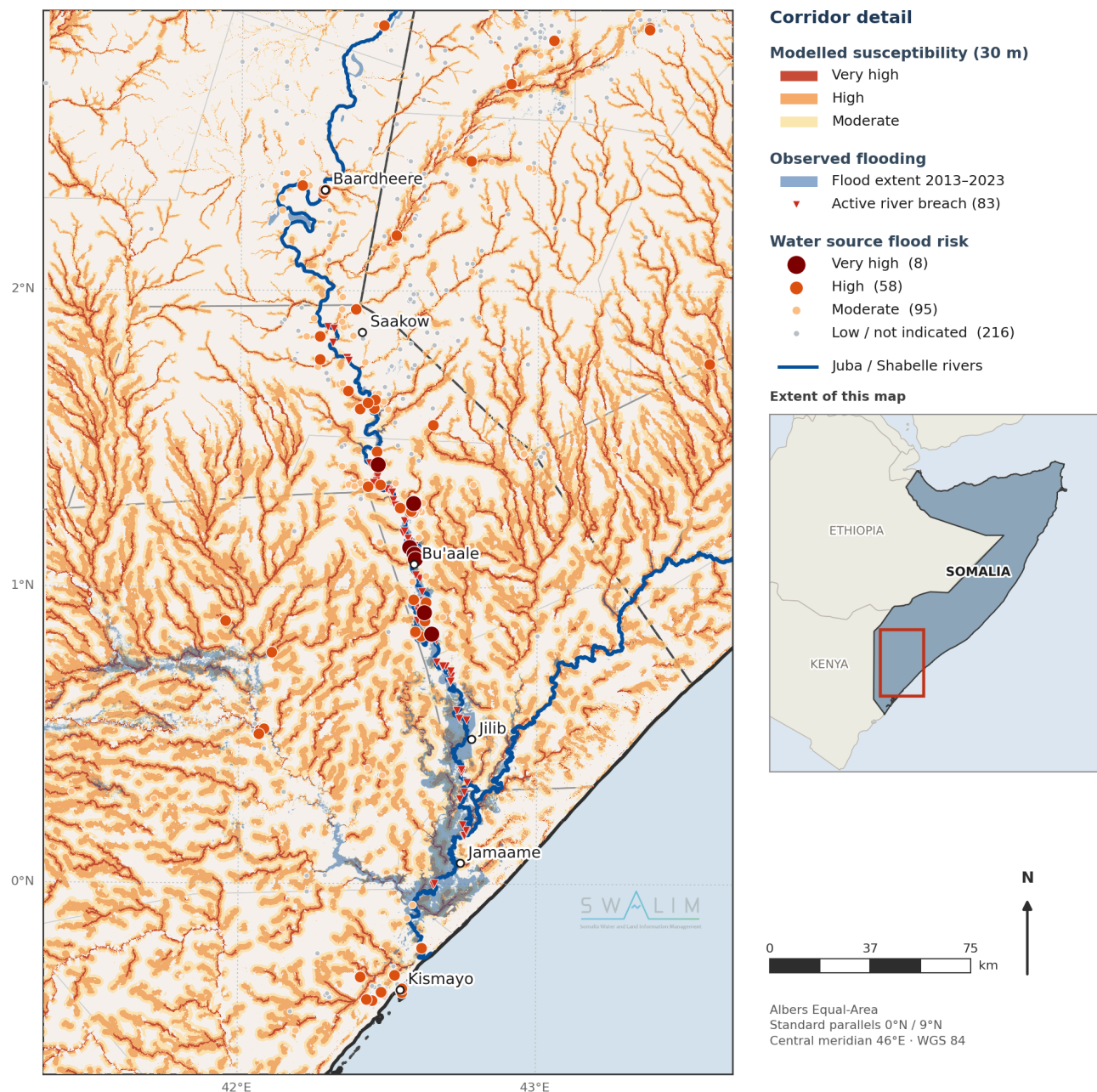
Map 7 Shabelle corridor, Beledweyne to Balcad: water infrastructure, observed inundation, 30 m modelled susceptibility at full resolution, and active river breaches.

The Juba from Baardheere to Jamaame carries fewer breaches but longer inundation once flooding begins, and is the only corridor where SWALIM gauging, Flood Hub forecasting and the terrain analysis are all available — which makes it the place an operational early-warning-to-

early-action chain could be demonstrated this season. Its weakness is that the breach mapping is six months old: the March 2026 Juba release predates a full Gu season, and the breach positions on which the corridor's hazard rests should be re-surveyed before the Deyr.

MAP 8 Juba corridor — Baardheere to Jamaame

Water infrastructure, observed inundation, 30 m modelled susceptibility and active river breaches along the middle and lower Juba.



Modelled susceptibility is shown at its native 30 m resolution and remains a screening product. Observed inundation is drawn over the modelled surface where both apply.
Sources: Copernicus DEM GLO-30 terrain analysis (this study); FAO-SWALIM flood extents 2013-2023 and river breakages (August 2026, March 2026); FAO-SWALIM GeoNode; UNOCHA administrative boundaries; Natural Earth (neighbouring states)
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Map 8 Juba corridor, Baardheere to Jamaame: water infrastructure, observed inundation, 30 m modelled susceptibility at full resolution, and active river breaches.

7.4 Sensitivity of the classification

To test whether the results depend on the scoring method, the classification was recalculated under six alternative approaches (Table 8): combining scores by addition rather than multiplication; using hazard alone; removing the seasonal factor; shifting class thresholds 25 percent up and down; and removing the evidence and corroboration limits. The reference method used here is the most conservative of those tested. Under every alternative except the deliberately stricter option that raises thresholds by 25 percent, all assets classified Very high or High in the reference analysis remain in those priority classes: the alternatives mainly add assets rather than remove them, so the assets prioritised for action are not an artefact of a particular set of scoring choices. Raising thresholds by 25 percent retains 45 percent of them, which would make the programme smaller and more selective rather than redirect it elsewhere. District results are similarly stable: 6 of the ten highest-priority districts (Afgooye, Balcad, Belet Weyne, Jowhar, Luuq, Xudur) appear in the first ten under every alternative that still considers hazard, vulnerability and criticality together, and at least 8 of the ten are common to any of those approaches. Two alternatives, the additive score and hazard alone, do reorder the ranking substantially, but they are fundamentally different models rather than adjustments to this one: both roughly triple the size of the High class, which captures more potentially exposed assets but makes the priority list too large to target and deliver realistically.

TABLE 8 Sensitivity of the risk classification to alternative specifications

SPECIFICATION	VERY HIGH	HIGH	% OF ASSETS IN THE SAME CLASS	% OF REFERENCE VERY HIGH + HIGH RETAINED
Reference specification used in this report	71	524	100	100
Additive rather than multiplicative combination	542	2,193	15	100
Hazard alone (vulnerability and criticality removed)	545	1,683	57	100
Seasonal amplification removed	71	766	89	100
Class boundaries lowered 25%	322	649	84	100
Class boundaries raised 25%	24	245	88	45
Evidence and corroboration caps removed	73	526	100	100

Source: this study. The test establishes whether the districts and assets identified for action would change materially under a different but equally defensible specification.

08 Anticipated humanitarian implications

Loss of access to safe water. Sources classified Very high or High risk are recorded as serving 1,297,200 people in the inventory entries where user numbers exist, and the monitored strategic boreholes among them report 210,994 dependent households — approximately 1,265,964 people. Both are lower bounds: user numbers exist for only 1,585 of 7,517 assets. Measuring something different, the WorldPop 2026 raster summed inside the observed 2013–2023 flood extent gives the flood-exposed population by district — 256,104 people in Jowhar district alone. Table 6 sets the two measures side by side for the priority districts; they must not be added, because the first counts people who use particular at-risk sources and the second counts people living inside a flood footprint regardless of which source they use.

Contamination and water-borne disease. The pathway from flooding to acute watery diarrhoea and cholera is short and well established: floodwater enters unraised dug wells and berkads directly, the shallow water table is contaminated, displaced households concentrate on

the remaining functional sources, and stagnant water sustains transmission for weeks after the peak. Cholera has been endemic with uninterrupted transmission in parts of the country since 2017, so the question in a flood year is not whether transmission occurs but how far it extends. 350 shallow sources are classified Very high or High risk; these are the assets through which contamination will propagate, and the reason chlorination supplies, pool testers and testing capacity must be pre-positioned at district level before the season rather than procured after the first outbreak signal.

Pressure on the sources that survive. The second-order effect is usually larger than the first. When shallow sources are contaminated or destroyed, demand transfers to the boreholes that remain functional and accessible; those boreholes then run longer pumping hours, draw down further, queue for longer, and become points of congregation where contamination at the collection point becomes a transmission route in its own right. The strategic borehole monitoring system already records pumping hours, yield, tanker movements and water price for each monitored borehole, so this transfer is observable in near-real time during the season. Rising pumping hours and rising water price at a functional borehole in a flood-affected district is an early indicator that the surrounding shallow sources have failed, and it arrives faster than a damage assessment does.

Communities without alternatives. 299 at-risk sources have no functional borehole or protected spring within 5 km, of which 23 are Very high risk. For the communities they serve, failure means a change of water source category — to an unimproved surface source, to purchased water, or to trucked supply — not simply a longer walk.

Livestock and pastoral supply. Berkads and earth dams are the principal pastoral water sources across the central rangelands. Their loss displaces herds towards the sources that remain, concentrating both animals and people on fewer points and raising contamination risk at each.

Collection burden. Where a source fails and the nearest functional improved alternative is more than 5 km away, collection time rises sharply and per-capita consumption falls below the emergency standard, with the burden falling disproportionately on women and girls.

Access disruption. Inundated and washed-out roads and bridges prevent operators, fuel, chlorine, spares and water-quality teams from reaching functional infrastructure, converting physically intact assets into unavailable ones.

An existing repair backlog. Somalia enters this season with 857 sources already recorded non-functional and 112 abandoned. New damage is added to that backlog, not to an empty one.

What this assessment does not claim. Population figures are derived from user numbers recorded in the inventory, from households reported by borehole operators, or from the WorldPop 2026 raster summed within observed flood extents. They are not estimates of the number of people who will be affected in the 2026 Deyr, and no beneficiary figure in this report has been generated by extrapolation from an assumed users-per-source ratio.

09 Preparedness and early action

Table 9 sets out the mechanism by which each source type fails and the protective measure that follows from it; Table 10 gives the full action list with timing and responsible actor. Four points govern sequencing.

- 1 Protection precedes response.** Every preventive measure can be executed now, on dry roads, with locally available labour. Every corrective measure can only be executed during or after a flood, when access is degraded, unit costs rise and lead times lengthen.
 - 2 Shallow sources and boreholes need different interventions.** Shallow sources need physical protection and disinfection capacity; boreholes need equipment elevation and rapid electromechanical repair capability. Treating them as one class produces the wrong procurement.
 - 3 The fallback must be identified before it is needed.** For every Very high–risk source, the nearest functional improved alternative and the access route to it should be recorded now, and water-trucking stand-by contracts placed before the season. Contracting during an emergency raises unit costs and lengthens response times.
 - 4 A baseline makes recovery prioritizable.** Without a pre-Deyr condition survey and a bacteriological baseline at strategic sources, post-flood contamination cannot be demonstrated, and rehabilitation cannot be prioritized on evidence.
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TABLE 9 Flood-impact mechanisms and priority protective measures by infrastructure type

INFRASTRUCTURE TYPE	VULNERABILITY	PRINCIPAL IMPACT MECHANISMS AND CONSEQUENCE	PRIORITY PROTECTIVE MEASURE BEFORE THE DEYR
Dug well (shallow)	Very high	Direct inflow over an unraised well mouth; collapse of unlined walls; siltation; contamination of the shallow water table. Immediate faecal contamination and loss of usable depth; the principal pathway from flooding to acute watery diarrhoea and cholera.	De-silt, raise and seal the well mouth at least 0.5 m above ground, fit or repair the hand pump
Berkad	High	Overtopping and embankment breach; inflow of contaminated runoff and livestock waste; sedimentation of storage volume. Loss of stored volume and of dry-season carry-over.	Repair and armour embankments, clear inlet channels, restore erosion protection
Earth dam / water catchment	High	Embankment overtopping and breach; spillway and outlet erosion; heavy sedimentation. Complete or partial loss of the structure and of the following dry season's storage.	Repair embankments and spillways, re-cut outlet drainage, prioritise structures already showing damage
Borehole (motorised or solar)	High	Submergence of control panels, generators, switchgear and inverters; scour around the casing; sediment ingress through a defective sanitary seal; access cut off. The borehole usually survives; the means of lifting water does not.	Elevate or relocate electrical and pumping equipment above the modelled inundation level; extend the apron; secure solar arrays
Spring	Moderate	Burial of the spring eye by sediment; turbidity surges; damage to collection chambers. Temporary loss of a protected source.	Clear and protect the catchment box and collection works
Distribution and ancillary works	Moderate	Washout of pipelines and kiosks; damage to tank foundations. Service interruption beyond the source itself.	Protect tank foundations and kiosk aprons; secure exposed pipe runs
Access roads and bridges	High	Inundation and washout of feeder roads and culverts. Operators, fuel, spares, chlorine and water-quality teams cannot reach the source, so functional infrastructure is effectively lost to users.	Identify and repair the access route to each priority source; agree contingency routing

Source: this study, drawing on FAO-SWALIM and WASH Cluster post-flood assessments for the 2018, 2019, 2020, 2023 and 2024 events. Vulnerability is the ordinal rating applied in Table 4.

TABLE 10 Priority actions, timing and responsible actor

#	ACTION	TIMING	RESPONSIBLE
1	Release dedicated anticipatory-action financing for the pre-Deyr protective programme	Immediate	Donors; OCHA; Somalia Humanitarian Fund
2	Inspect and physically protect the 68 monitored strategic boreholes at Very high or High risk: raise and seal wellheads, extend aprons, elevate control panels, generators and inverters	September – mid-October 2026	WASH Cluster partners; FGS MoEWR; FMS water authorities
3	Undertake protective rehabilitation of Very high-risk shallow sources in the priority districts: de-silt, raise and seal the well mouth, fit or repair hand pumps	September – mid-October 2026	WASH Cluster partners; district water authorities
4	Repair and close active breach points on the Shabelle and Juba, prioritising Jowhar, Afgooye, Balcad, Beledweyne, Jalalaqsi and Bulo Burto	September – mid-October 2026	FGS MoEWR; FMS authorities; partners with embankment capacity
5	Repair berkad and earth-dam embankments and re-cut spillways and outlet drainage in the priority districts	September – mid-October 2026	WASH Cluster partners; district authorities
6	Pre-position chlorine, pool testers, water-quality testing capacity, jerrycans and hand-pump spares at district level in the priority districts	By mid-October 2026	WASH Cluster; UNICEF supply hubs
7	Place water-trucking stand-by contracts and record the nearest functional alternative and access route for every Very high-risk source	By mid-October 2026	WASH Cluster partners
8	Establish the pre-Deyr baseline: condition survey and bacteriological water-quality baseline at strategic sources in the priority districts	By mid-October 2026	FAO-SWALIM; MoEWR; WASH Cluster partners
9	Release the Juba river-breakage dataset; the most recent Juba assessment dates from March 2026	September 2026	FAO-SWALIM
10	Fund the Juba river-breakage update so the assessment can be repeated before the Deyr	September 2026	Donors
11	Introduce routine Sentinel-1 SAR flood mapping for the Deyr, with a standing product for the WASH Cluster	By October 2026	FAO-SWALIM; partners
12	Agree the flood monitoring and assessment form, trigger and reporting line before the season	By mid-October 2026	WASH Cluster; FAO-SWALIM; MoEWR
13	Continue with weekly strategic borehole monitoring and reporting, and more frequently if resources are available, in districts under active flooding; regularly test free residual chlorine at operating sources; close and signpost contaminated sources	On flood onset	FAO-SWALIM; MoEWR; WASH Cluster partners

#	ACTION	TIMING	RESPONSIBLE
14	Conduct rapid damage assessment within 72 hours of water levels receding; test water quality before any inundated source is returned to use; de-silt and shock-chlorinate shallow sources; repair pumps and electrical systems; restore access routes	Early recovery	WASH Cluster partners; FGS and FMS water authorities
15	Add a structural-condition module to the strategic borehole monitoring form and extend a simplified cycle to dug wells, berkads and earth dams in the priority districts	Before the 2027 Gu	FAO-SWALIM; MoEWR

Source: this study. Timing assumes a Deyr onset in the second half of October 2026, consistent with FEWS NET's expectation of an early onset in late September in southern Somalia. Actions 1–12 are pre-season and cannot be deferred.

10 Monitoring and early warning

SWALIM and the MoEWR already operates most of the architecture that anticipatory action for this Deyr requires: weekly monitoring of 612 strategic boreholes; 33 telemetric groundwater stations transmitting water level, temperature, salinity and total dissolved solids daily by satellite; river gauging and seasonal flood advisories on the Juba and Shabelle; periodic breach mapping from very high resolution imagery; satellite-derived flood extent mapping; a national rainfall observer network of 143 trained observers; the monthly Combined Drought Index; and the GeoNode spatial catalogue that made this assessment possible. The gaps that remain are set out below, and two of them are inexpensive to close.

- **Groundwater monitoring is thin** relative to the country and to the flood-risk districts. SWALIM publishes 33 telemetric groundwater stations, installed between June and October 2024, transmitting water level, temperature, salinity and total dissolved solids — one station for roughly 19,000 km² of land. Four of the ten first-priority districts have a station inside their boundary: Afgooye, Balcad, Bulo Burto and Xudur. The other six do not, and the nearest station is 30 km from Rab Dhuure, 42 km from Jowhar, 50 km from Beledweyne, 65 km from Bu'aale, 89 km from Luuq and 159 km from Doolow — so the riverine reaches where flood-driven contamination and recharge signals would appear are largely unmonitored. Extending the network, and weighting the extension towards the Shabelle and Juba corridors, is the gap worth closing.
- **Flood extent mapping depends on optical imagery**, which is systematically obscured by cloud during the Deyr — precisely when it is most needed. Sentinel-1 synthetic aperture radar is unaffected by cloud, is freely available and requires no field deployment. Introducing routine

SAR flood mapping for the Deyr is the highest-value monitoring improvement available before the season.

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- **Monitoring of non-borehole sources is minimal.** Dug wells, berkads and earth dams are the most numerous, most vulnerable and least monitored assets in the country, with no reporting cycle equivalent to the strategic borehole system.
 - **The Juba breakage assessment is not current,** having been deferred for budgetary reasons.
 - **The monitoring register and the spatial inventory are not aligned** on a common identifier. The monitored boreholes are held in the inventory as assets, but the two systems are reconciled by position and name rather than by a shared asset code.
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Beyond closing those gaps (Table 10, actions 9, 10 and 14), two low-cost changes would materially improve the season's information base. Adding a short structural-condition module to the existing borehole reporting form — apron condition, wellhead elevation above ground, sanitary-seal condition, elevation of electrical equipment — would begin to close the physical-vulnerability gap through a cycle that already runs. And publishing a standing WASH Cluster product for the season — weekly borehole functionality by district, active breach status, current flood extent and a running register of reported damage — would convert monitoring into decisions.

11 Limitations, conclusions and priority actions

11.1 Limitations

This is a national screening built on the best datasets currently available for Somalia. Table 11 sets out the principal data gaps and whether each materially affects the result. Four uncertainties cannot be resolved with current data and should be read alongside every figure in this report.

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- **The translation from seasonal forecast to local inundation.** The ENSO and seasonal rainfall signals are strong and consistent; the mapping from a three-month regional anomaly to inundation at a specific water point in a specific week is not, and no dataset available for Somalia would close that gap. The seasonal outlook is used as a multiplier on latent hazard, not as a hazard in itself.
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- **No damage functions exist for Somali water infrastructure.** There is no empirical relationship in the record between flood depth or duration and the probability that a given source type fails, so vulnerability is scored ordinally from source type, protection status, depth and the presence of pumping equipment — defensible, but coarse.
- **The 30 m DEM cannot resolve the features that determine site-level outcomes.** A site classified Very high susceptibility may be protected by a road embankment invisible to the model; a site classified Low may flood through a culvert the model cannot see.
- **Functionality is stale and population dependency is partial.** All population figures in Section 8 are lower bounds.

The assessment does not establish that any specific source will flood in the 2026 Deyr; does not establish that sources classified Low or Uncertain are safe, since the observational record is systematically thinner outside the monitored corridors; does not provide flood depths or any basis for the structural design of protective works; and does not estimate the population that will be affected.

TABLE 11 Principal data gaps, their effect on the assessment, and recommended action

DATA GAP	EFFECT ON THIS ASSESSMENT	RECOMMENDED ACTION
Functionality is not current. Inspections span 2010–2025 and no status is recorded for 1,643 assets	High — an asset recorded functional in 2018 may already be out of service, so exposure counts and consequence estimates both carry error	Extend the weekly strategic borehole monitoring model to a sample of dug wells, berkads and earth dams; conduct a pre-Deyr condition survey in the priority districts
Construction characteristics are largely unrecorded: casing, apron and wellhead condition, elevation of pumping and electrical equipment, embankment condition	High — physical vulnerability had to be assigned from source type and protection status rather than as-built condition	Add a short structural-condition module to the borehole monitoring form and to routine partner assessments
Observed flood extents are riverine-biased and optical imagery is obscured by cloud during the Deyr	High — absence of an observed flood polygon outside the riverine corridors cannot be read as absence of hazard, which is why terrain screening was necessary	Introduce routine Sentinel-1 SAR flood mapping, which is unaffected by cloud, and extend flood mapping beyond the two river basins

DATA GAP	EFFECT ON THIS ASSESSMENT	RECOMMENDED ACTION
No national high-resolution DEM; the best available is approximately 30 m, with 1 m LIDAR in patches at country level	Moderate — 30 m terrain cannot resolve small channels, embankments, culverts or shallow inundation, so susceptibility is a screening product only	Acquire high-resolution terrain to fill existing gaps for the Beledweyne, Jowhar, Balcad, Afgooye and Baardheere corridors to support engineering-grade modelling
Population dependency is recorded for 1,585 of 7,517 assets; livestock dependency less often still	High — the consequence estimates are lower bounds and criticality scoring is weaker where user data are absent	Make recorded user numbers mandatory in inventory updates; triangulate with settlement population and the 100 m population raster
8 monitored boreholes are published at coordinates that fall outside the national boundary by 6 to 20 km	Low — they are assigned to the nearest district for reporting, but their terrain metrics are computed where the coordinates place them	Verify the coordinates of the affected boreholes in the monitoring register and correct them at source
Reporting coverage of the weekly borehole cycle is incomplete: 38 boreholes in the register returned no status in the August 2026 round (Sanaag 14, Bari 5, Togdheer 5, Awdal 4, Woqooyi Galbeed 3, Galgaduud 2, Nugaal 2, Sool 2, Lower Juba 1)	Moderate — those boreholes could not be screened on a current status, so the criticality ranking of the network is incomplete in the districts concerned. This is a reporting gap and not a georeferencing gap: the register holds coordinates for every borehole in it	Follow up the non-reporting boreholes with the responsible operators and agencies before the Deyr, and report reporting coverage alongside the functionality rate in each round
The monitoring register and the spatial inventory are reconciled by position and name, not by a shared asset code	Moderate — monitored boreholes are held in the inventory as assets, but joining the two systems depends on coordinates and spelling	Reconcile the monitoring register and the spatial inventory on a common asset identifier
No published unit costs for preventive protective works; water-quality baselines are thin	Moderate — the preventive investment case rests on a shallow-source analogue, and post-flood contamination cannot be measured against a baseline	Publish disaggregated unit costs for protective works in the 2027 planning round; undertake a pre-Deyr bacteriological baseline at strategic sources in the priority districts
The Juba river-breakage assessment dates from March 2026; the August 2026 release covers the Shabelle only	High — breach proximity is among the strongest predictors of riverine inundation, and the Juba evidence is six months old	Fund and release the Juba breakage update before the Deyr
Groundwater-level monitoring is thin for the size of the country: 33 telemetric stations, one per roughly 19,000 km ² , with six of the ten first-priority districts having none	Moderate — post-flood recharge, turbidity and contamination signals cannot be detected in most of the riverine south, where flood risk is greatest	Extend telemetric monitoring to the Shabelle and Juba corridors, prioritising Beledweyne, Jowhar and Baardheere

Source: this study.

11.2 Conclusions

- 1 The forecast is firm; the local consequence is not.** Every authoritative centre has El Niño present and strengthening, with a greater than 90 percent chance of a very strong event and a 90 percent probability of enhanced October–December rainfall over central and southern Somalia. What follows at any individual water point is a scenario, not a forecast, and is treated as one throughout.

- 2 The national inventory had to be rebuilt before anything could be counted.** Seven databases were merged and 3,380 duplicate records removed to give 7,517 unique assets. Percentages calculated on the un-de-duplicated union would overstate the stock by roughly a third, and would do so most severely in the riverine areas where exposure is highest.

- 3 Observed flood records alone would have missed most of the exposure.** Only 507 sources have confirmed historical exposure, because optical satellite flood mapping covers only the two main river corridors and is often prevented by cloud cover during the Deyr. Analysis of the 30-metre terrain dataset identifies 1,876 more in flood-susceptible terrain with no observed record.

- 4 71 sources are Very high risk and 524 High risk,** together 7.9 percent of the inventory, including 68 monitored strategic boreholes. The classification is the most conservative of the six specifications tested.

- 5 Ten districts hold 65 percent of the at-risk assets.** Targeting them, and within them the strategic boreholes and the 299 sources with no functional improved alternative within 5 km, is the difference between a programme that is deliverable before the Deyr and one that is not.

- 6 Prevention is an order of magnitude cheaper than response.** It must also be paid for in September rather than December, and the WASH Cluster's own May 2026 survey shows the sector cannot fund it from existing partner budgets.

- 7 Two monitoring gaps should be closed before the season:** routine Sentinel-1 SAR flood mapping, which is unaffected by cloud and requires no field deployment, and the Juba river-breakage update, now the weakest link in the evidence base for the corridor where forecasting capability is otherwise strongest.

The hazard has not yet begun. That is the point: the preparedness window is open now and closes with the first rains.

Table 10 sets out the fifteen actions that follow from this assessment, of which the first twelve are pre-season and cannot be deferred.

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Annexes

Annex A Asset-level register of Very high- and High-risk water sources

Annex A accompanies this report as a machine-readable register, one row for every water source classified Very high or High risk (595 assets). Each row carries the asset identifier, name, type, coordinates and administrative location; recorded functionality, protection status, users and livestock; the terrain metrics (Height Above Nearest Drainage, slope, distance to the nearest channel and its upstream contributing area, distance to the nearest active breach, modelled susceptibility class); every evidence flag; the hazard, vulnerability and criticality sub-scores with the composite score, risk class, evidence class and confidence rating; the number of functional improved alternatives within 5 km; and the recommended preparedness action.