عمادة المهندسين التونسيين
TUNISIAN ENGINEERS ORDER

Summary of the decision support document:

Water stress in Tunisia: A major threat to national security. What solutions?

Group of multidisciplinary experts from the Engineering Sciences Council

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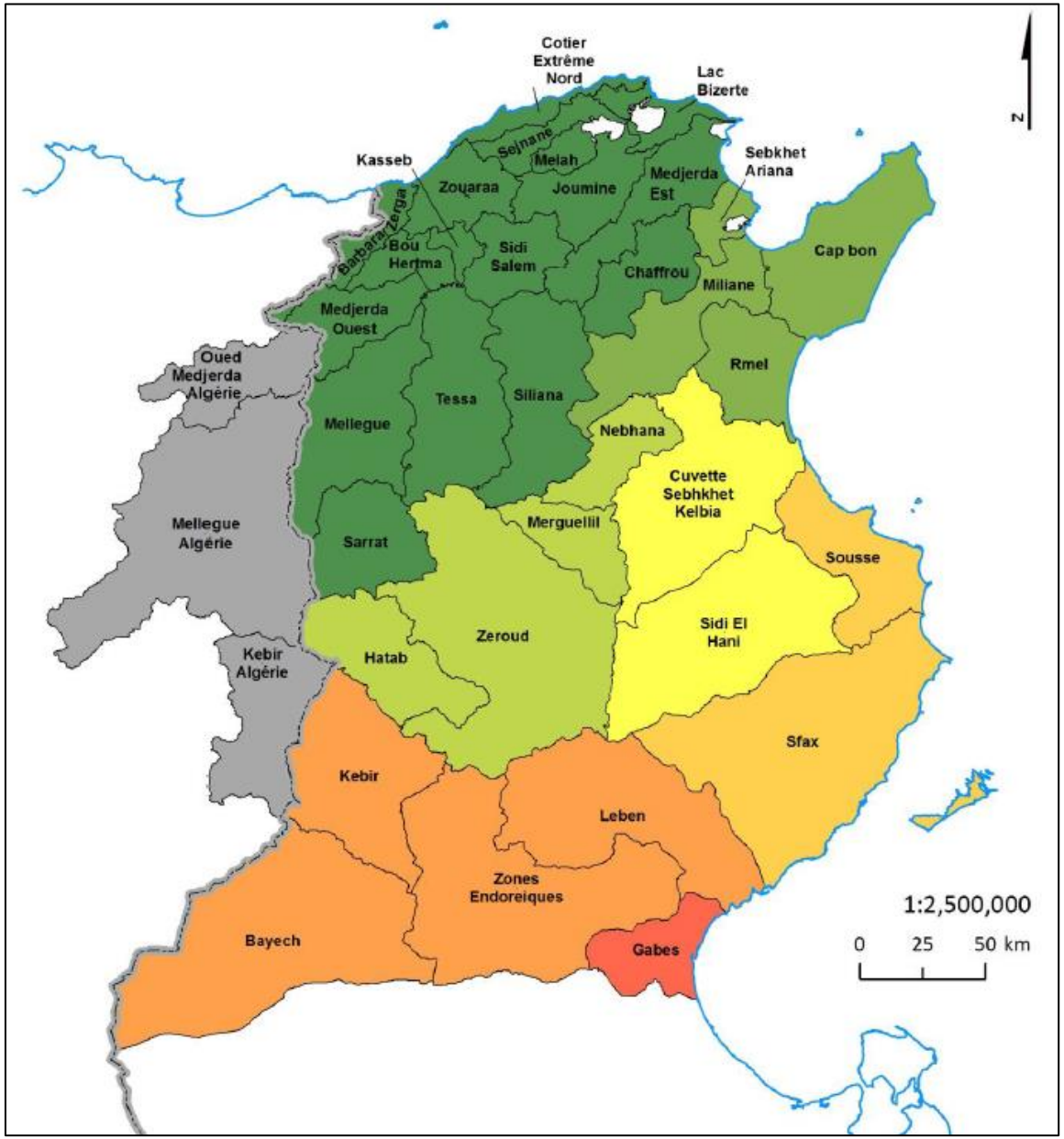
Outline

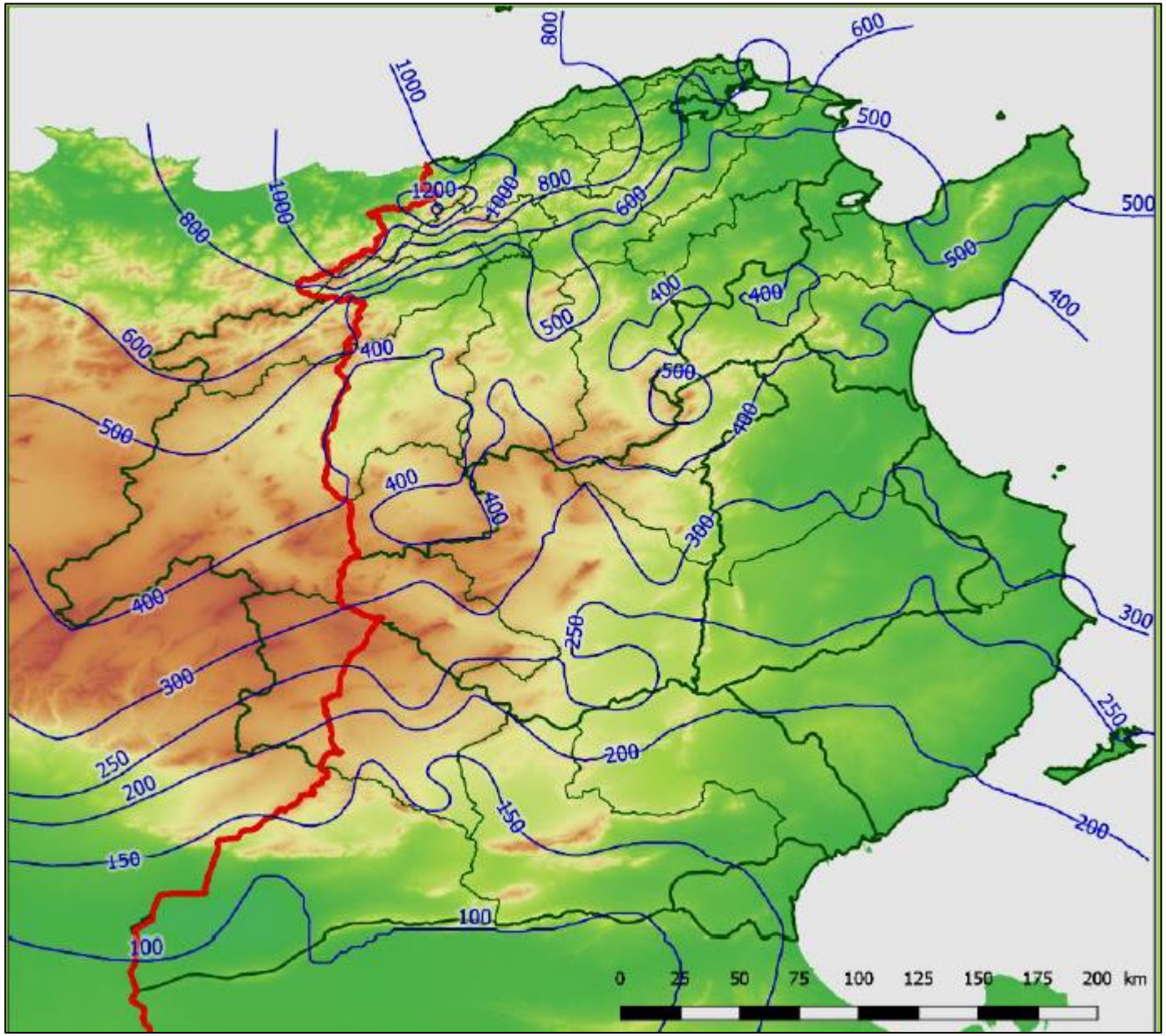
- **Introduction: Status of the Tunisian water sector.**
- **Main challenges.**
- **Towards a new paradigm of water management.**

Introduction

Tunisian water sector status

Water sheds and annual isohyets : 1981 - 2014



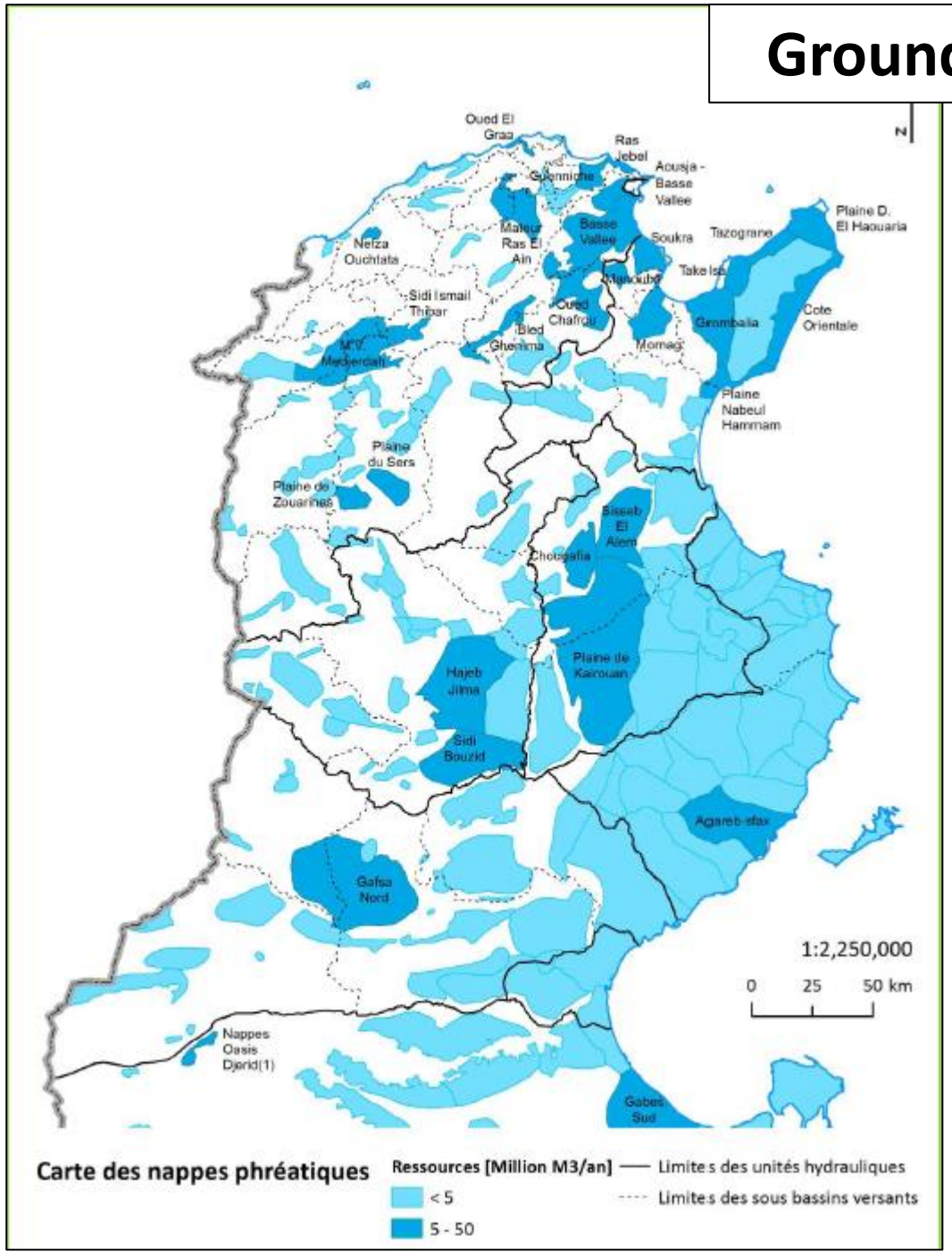


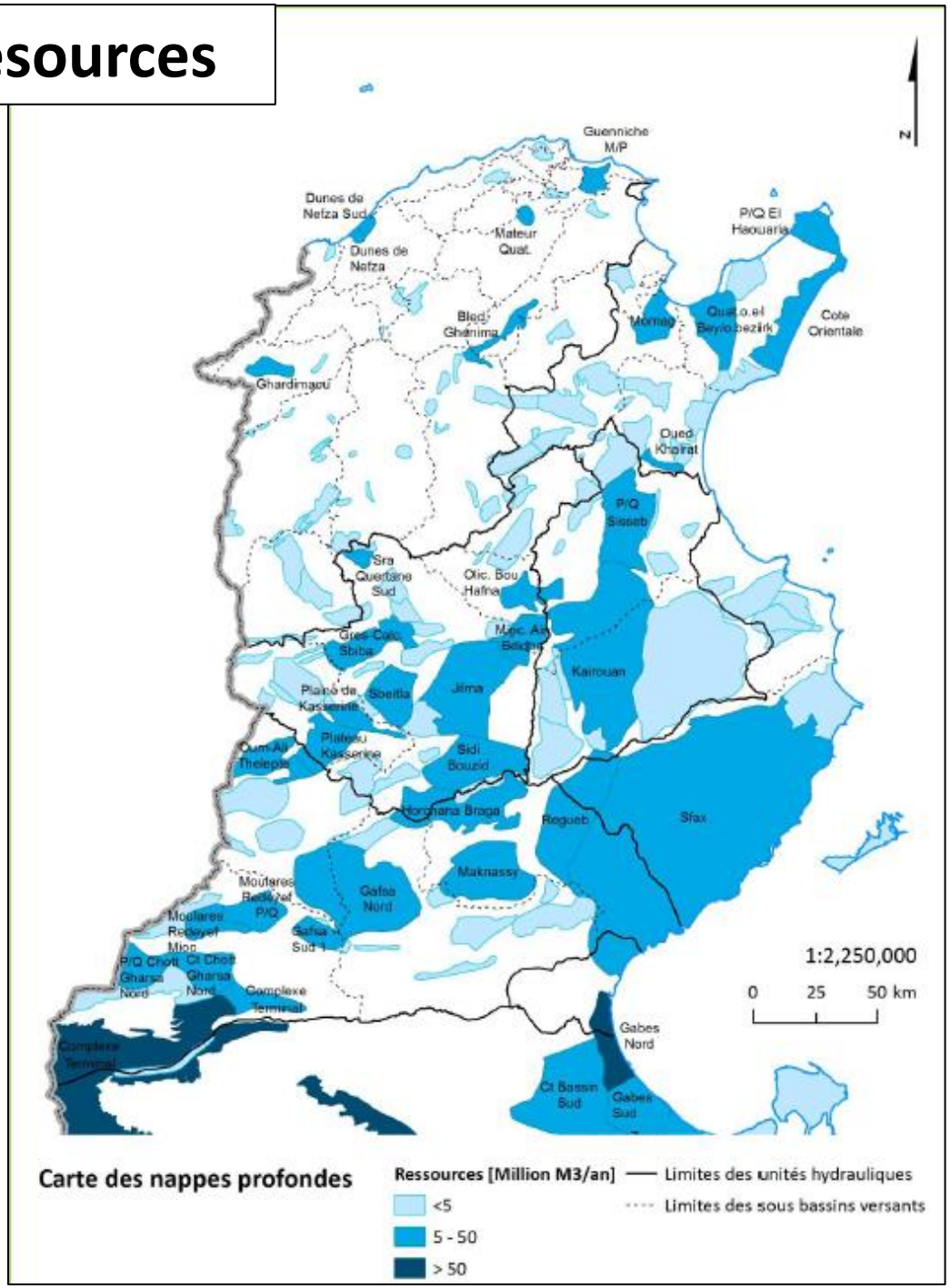
Annual flows to dam sites according to different probabilities [Mm3/year]

Nom	Moyenne	Médiane	9/10	4/5	2/3	1/3	1/5	1/10	1/50
Sidi el Barrak	324	303	519	448	373	237	182	162	105
Sejnane	120	103	191	165	133	89	77	66	53
Joumine	95	89	181	131	109	70	47	28	13
Beni M'tir	48	42	73	61	47	38	33	32	28
Kasseb	45	39	69	60	46	35	29	25	23
Bou Heurtma	142	124	229	188	154	110	101	86	72
Mellegue	464	382	826	610	456	313	261	222	169
Sidi Salem	1 352	1 162	2 110	1 723	1 407	1 012	893	740	563
Siliana 1	90	64	147	118	90	53	43	30	26
Nebhana	24	19	41	32	25	15	11	8	6
El Houareb	35	25	61	45	31	17	12	9	8
Sidi Saad	165	121	261	185	147	99	84	68	41

2900 Mm^3/year

Groundwater resources

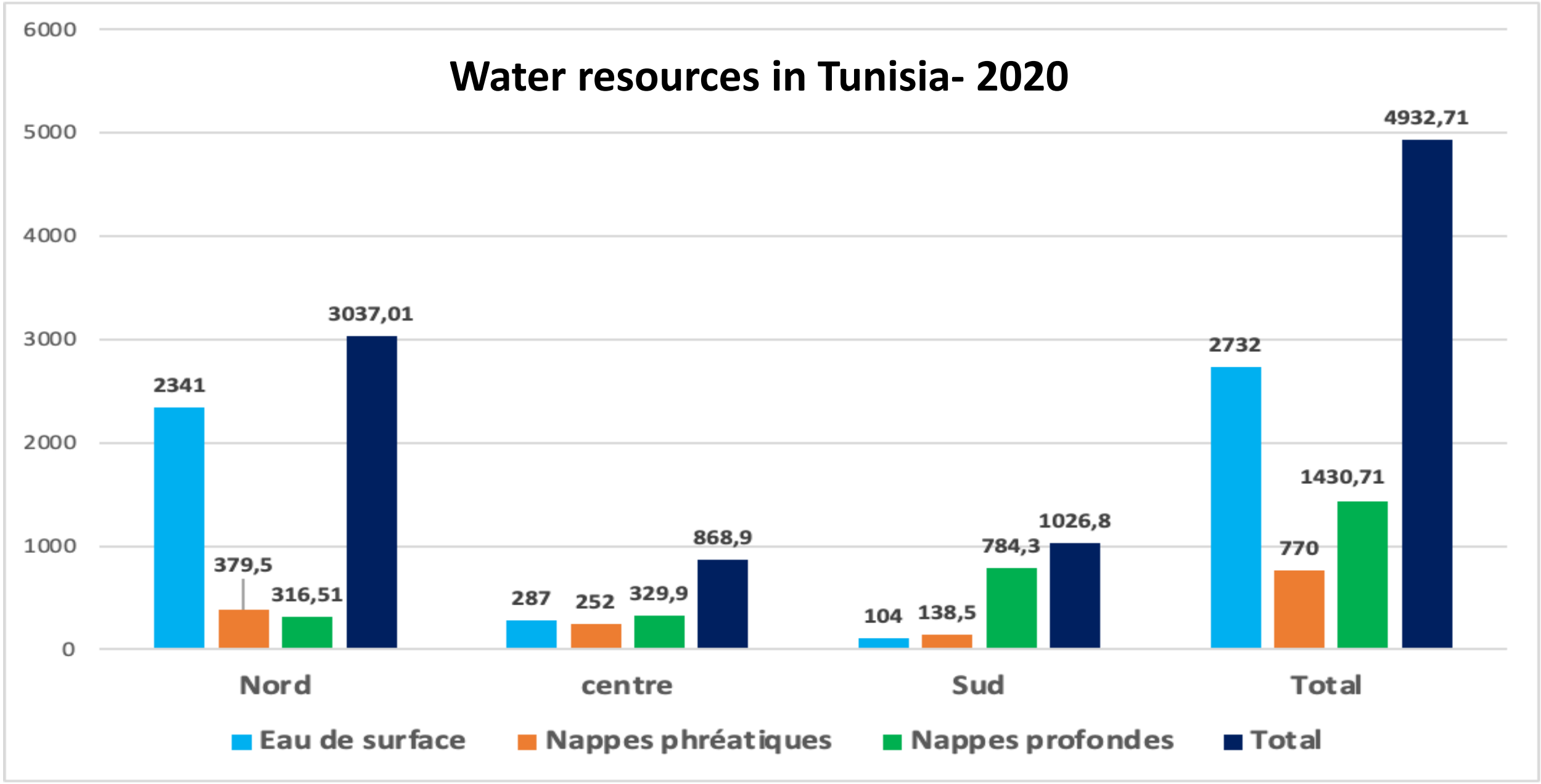




Renewable hydrogeological resources by region

Région / Province hydrologique	Nappes phréatiques (Mm3/an)		Nappes profondes Mm3/an		Total Mm3/an	
	Recharge	Exploitation	Recharge	Exploitation	Recharge	Exploitation
L'Extrême Nord	91,3	86,2	142,6	60,2	233,9	146,4
La province de Mejerdah	70,5	36,4	53,9	26,9	124,4	63,3
Le Cap Bon & Rmel	208,8	265,2	97,3	117,9	306,1	383,1
Hattab, Zeroud, Merguellil, Nebhana	108,0	129,0	175,8	184,5	283,8	313,5
Les Sebkhet Kelbia et Sidi El Hani	63,0	122,0	89,2	111,4	152,2	233,4
Le Sahel de Sousse, Sfax et Leben	79,8	97,6	66,3	58,4	146,1	156,0
Kebir et zones Endoréiques	67,4	70,0	256,9	236,2	324,3	306,2

1570 Mm^3/year

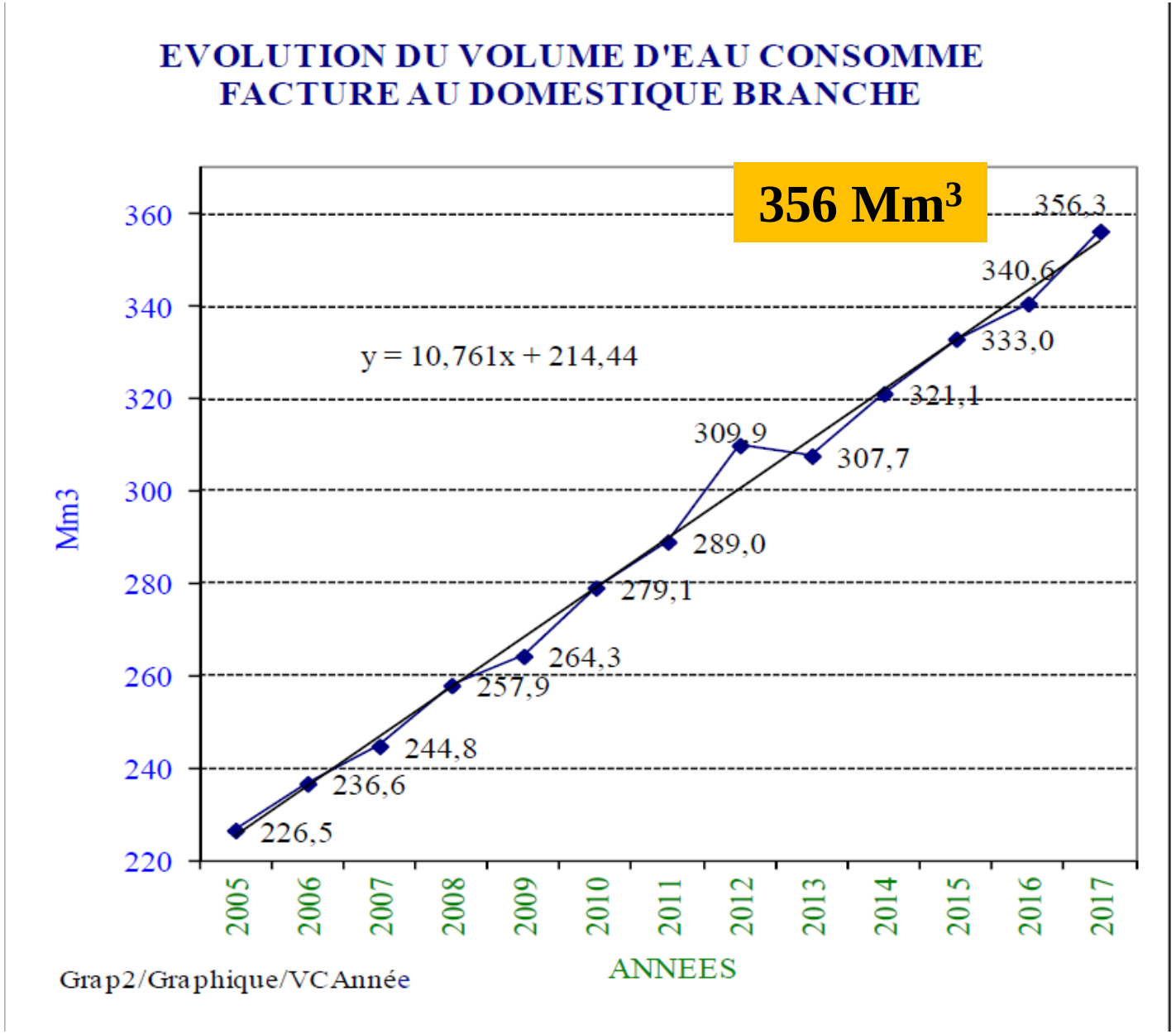

Water resources in Tunisia- 2020
6000
5000
4000
3000
2000
1000
0
2341
379,5
316,51
3037,01
287
252
329,9
868,9
104
138,5
784,3
1026,8
2732
770
1430,71
4932,71
Nord
centre
Sud
Total
Eau de surface
Nappes phréatiques
Nappes profondes
Total

Drinking water demands

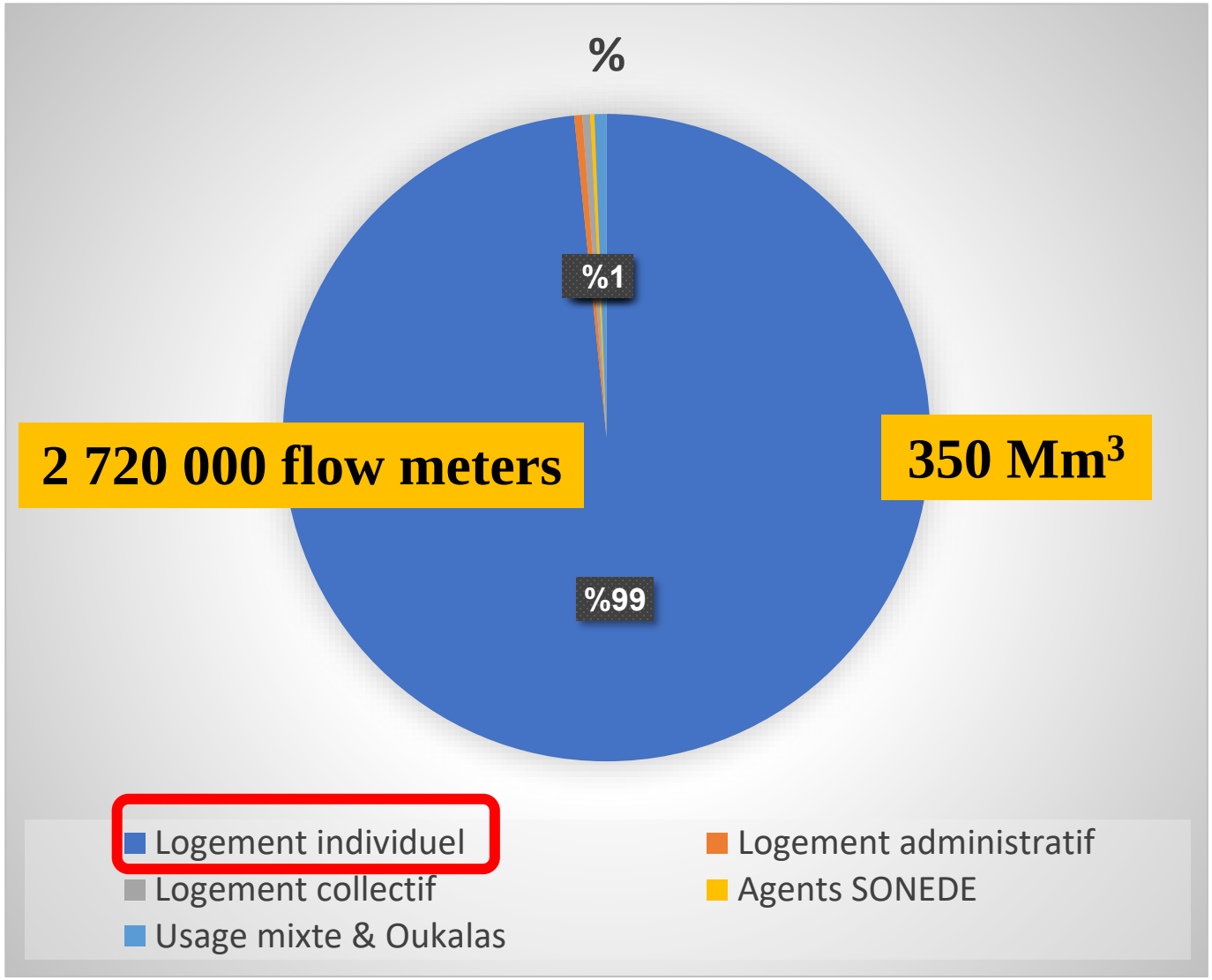
EVOLUTION DES PRINCIPAUX INDICATEURS

DESIGNATION		Unité	2016	2017	Evolution 2017 / 2016	2018	2019	Evolution 2019 / 2018
Nombre d'abonnés		Unité	2 800 355	2 884 958	3,0%	2 929 249	2 980 488	1,7%
Volume consommé facturé (VCf)		Mm^3	441,0	459,0	4,1%	447,2	461,2	3,1%
Volume consommé facturé redressé (1)		Mm^3	441,2	453,8	2,9%	461,6	474,5	2,8%
Ventes d'eau aux AIC de Gabes et CRDA Monastir et Medenine		Mm^3	3,0	1,9	-37,5%	2,6	2,8	9,5%
Volume consommé non facturé (VCnf)		Mm^3	13,6	13,3	-2,1%	13,9	18,2	30,5%
Volume consommé (VC)		Mm^3	454,6	472,3	3,9%	461,1	479,4	4,0%
Volume consommé redressé (VCr)		Mm^3	454,8	467,1	2,7%	475,6	492,7	3,6%
Volume distribué (VD)		Mm^3	592,9	612,3	3,3%	625,4	647,3	3,5%
Volume produit (VP)		Mm^3	653,7	680,5	4,1%	698,1	729,9	4,5%
Volume prélevé (VINT)		Mm^3	685,3	708,6	3,4%	725,3	758,6	4,6%
Rendement du réseau	Sur adduction (Ra)	%	92,1%	91,1%	- 1,0 point	90,5%	89,6%	- 0,9 point
	Sur distribution (Rd)	%	76,7%	76,3%	- 0,4 point	76,0%	76,1%	0,1 point
	Global (Rg)	%	71,5%	70,3%	- 1,2 point	69,5%	68,8%	- 0,7 point
Prix moyen de vente d'eau (sans redevances fixes) (3)		Mls/m^3	620	648	4,5%	669	648	-3,1%
Prix de revient de l'eau (3)		Mls/m^3	837	837	0,0%	1046	1198	14,5%

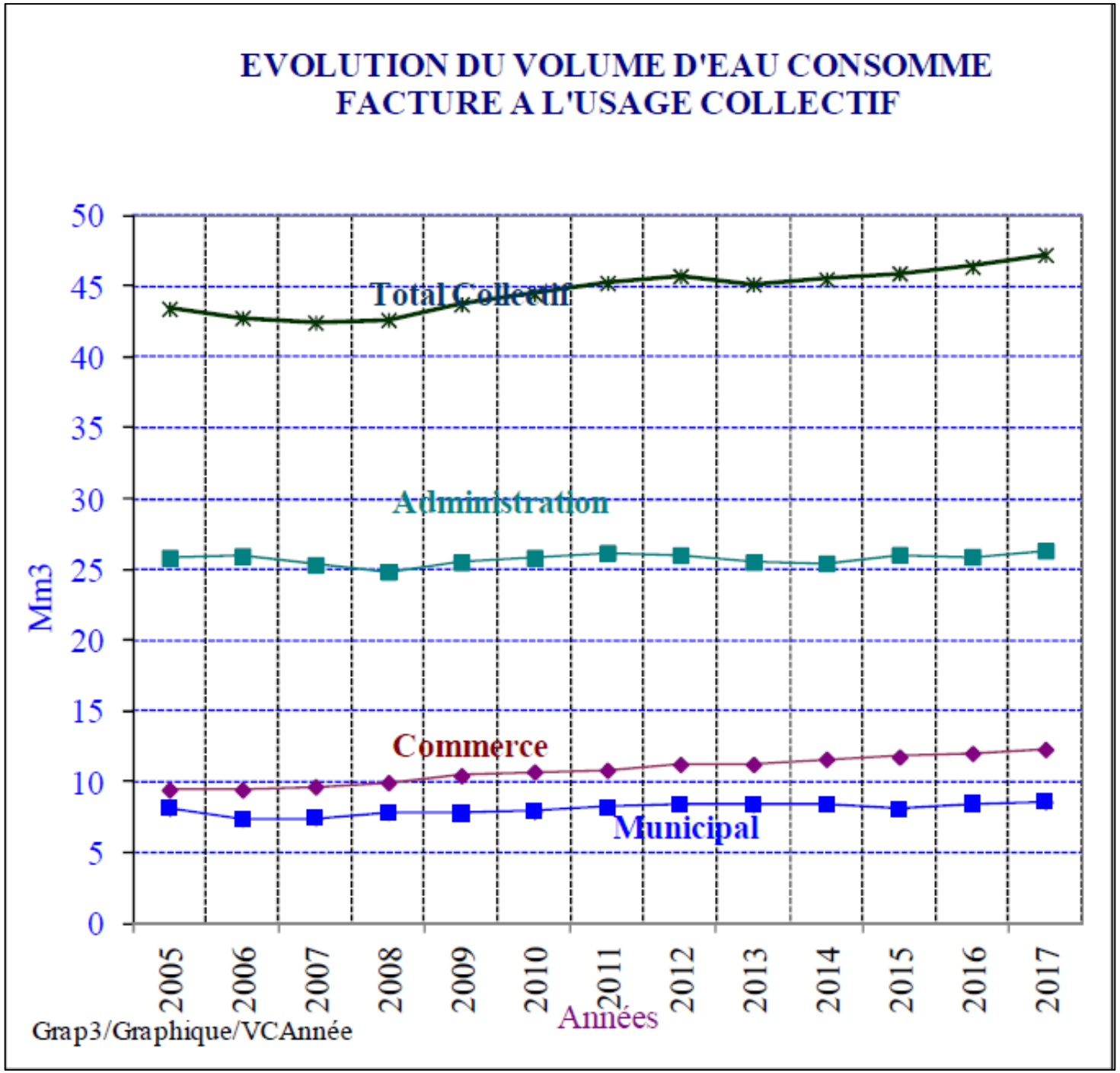
Trend of water consumed by householders



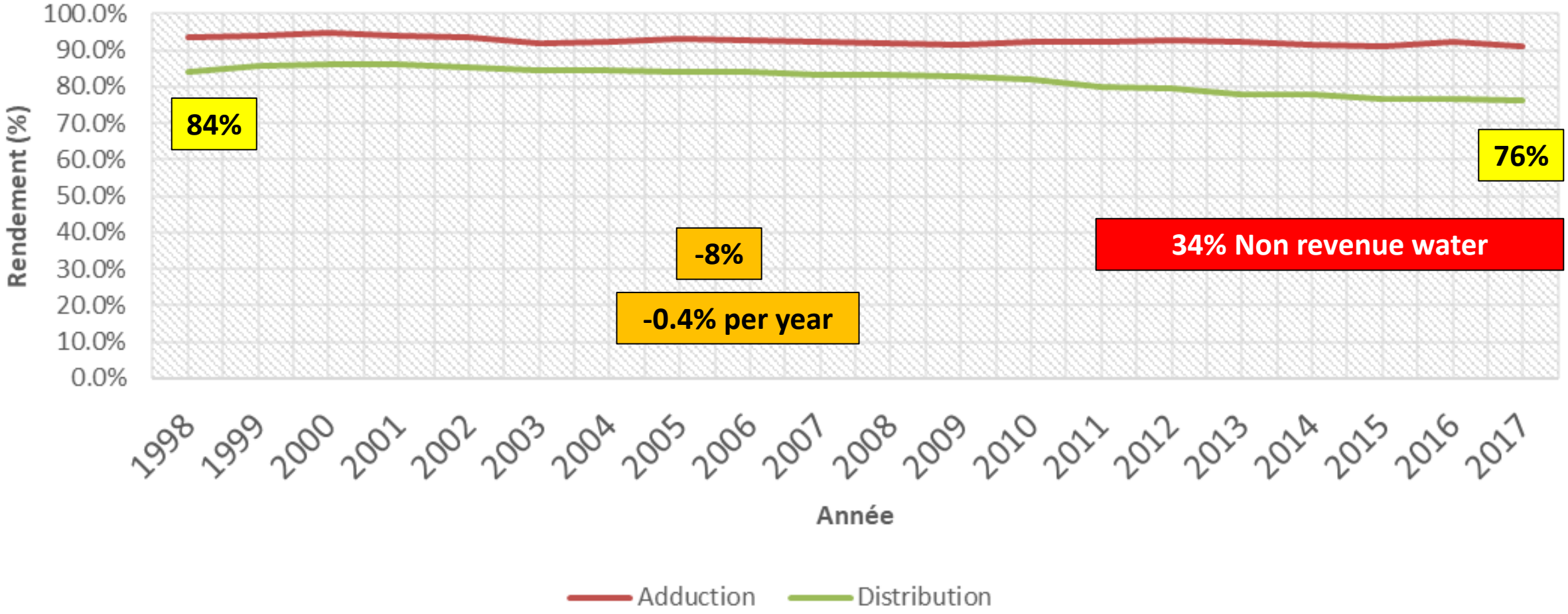
Water use by house type



Trends of water consumption by collective users



Drinking water network efficiency



Agriculture water demands

Areas of irrigated projects : Public and private (2013)

Gouvernorat	Surface irrigable (Ha)			Surface irriguée (Ha)		
	Publique	Privée	Totale	Publique	Privé	Totale
Tunis	0	540	540	0	380	380
Ariana	11 560	1 490	13 050	3 540	710	4 250
Manouba	19 530	5 840	25 370	10 250	4 350	14 600
Ben Arous	7 410	4 490	11 900	6 400	3 920	10 320
Nabeul	26 810	22 140	48 950	26 000	19 500	45 500
Bizerte	20 350	5 050	25 400	14 130	3 110	17 240
Béja	17 910	5 580	23 490	16 020	4 050	20 070
Jendouba	36 860	2 420	39 280	25 960	1 290	27 250
Le Kef	3 350	8 210	11 560	3 300	7 780	11 080
Siliana	9 550	5 620	15 170	8 660	4 570	13 230
Zaghouan	3 460	8 950	12 410	1 450	6 000	7 450
Sousse	8 220	4 280	12 500	4 640	3 810	8 450
Monastir	3 860	1 840	5 700	2 620	970	3 590
Mahdia	2 320	3 800	6 120	1 550	2 750	4 300
Sfax	3 210	11 790	15 000	1 020	8 880	9 900
Kairouan	19 570	38 520	58 090	17 380	35 950	53 330
Kasserine	9 990	16 640	26 630	8 680	15 340	24 020
Sidi Bouzid	5 830	42 270	48 100	5 070	37 320	42 390
Gafsa	6 530	11 630	18 160	6 330	11 500	17 830
Gabès	11 600	4 710	16 310	11 450	3 750	15 200
Tozeur	6 990	1 310	8 300	6 990	1 310	8 300
Kebili	10 560	13 370	23 930	10 560	13 370	23 930
Medenine	460	2 210	2 670	230	2 150	2 380
Tataouine	2 950	4 390	7 340	2 360	4 390	6 750
Total	248 880	227 090	475 970	194 590	197 150	391 740

Source : Enquêtes PI, DGEDA

Annual crop water requirement per crop type and by catchment

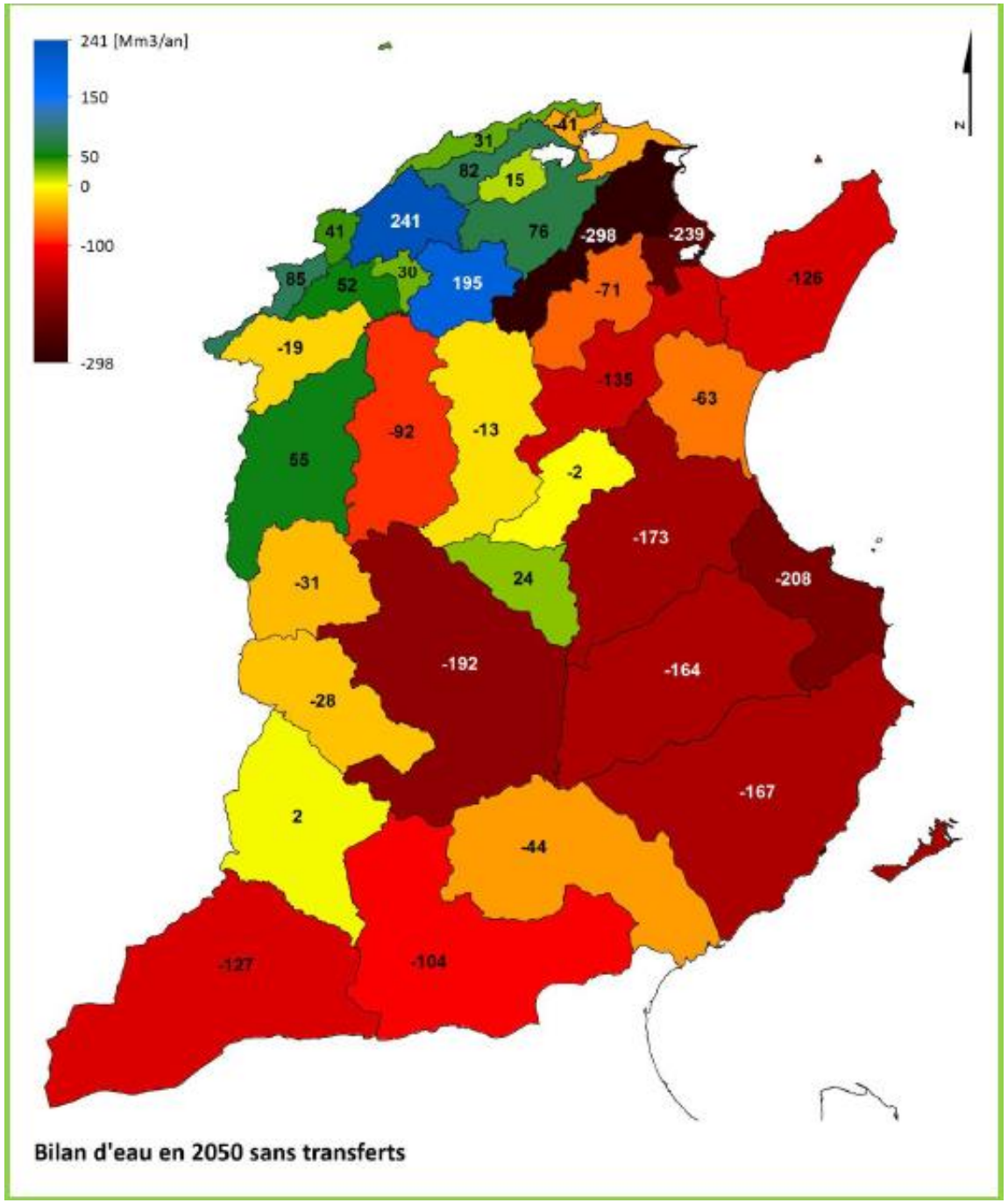
SBV_nom	Besoin annuel en m3/ha/an				
	Grande culture	Arbori-culture	Culture maraichère	Culture industrielle	Culture fourragère
Barbara - Zerga	1 000	5 000	4 000	3 500	5 000
Zouaraa	1 000	5 000	5 000	3 500	5 500
Côt. Extr. Nord	1 000	5 000	4 000	3 500	5 000
Melah - Joumine	1 500	6 000	6 000	3 500	5 500
Sejnane	1 500	5 000	5 000	3 500	5 000
Lac Bizerte - Medjerda Ouest - Bou Hertma - Kasseb	1 500	6 000	6 000	3 500	5 500
Mellegue	1 500	7 000	6 500	4 000	6 000
Tessa - Sarrat - Sidi Salem - Siliana - Chafrou - Medjerda Est - Miliane - Sebkhet Ariana - Cap-bon - Rmel	2 000	7 000	6 500	4 000	6 000
Zeroud - Hatab - Merguellil - Nebhana - Cuv. Sbkt. Kelbia - Sidi El Hani - Sousse - Sfax - Leben - Kebir - Zs. Endoréiques - Bayech - Gabes	3 000	8 000	7 000	4 500	6 500

2000 Mm^3/year

Main challenges

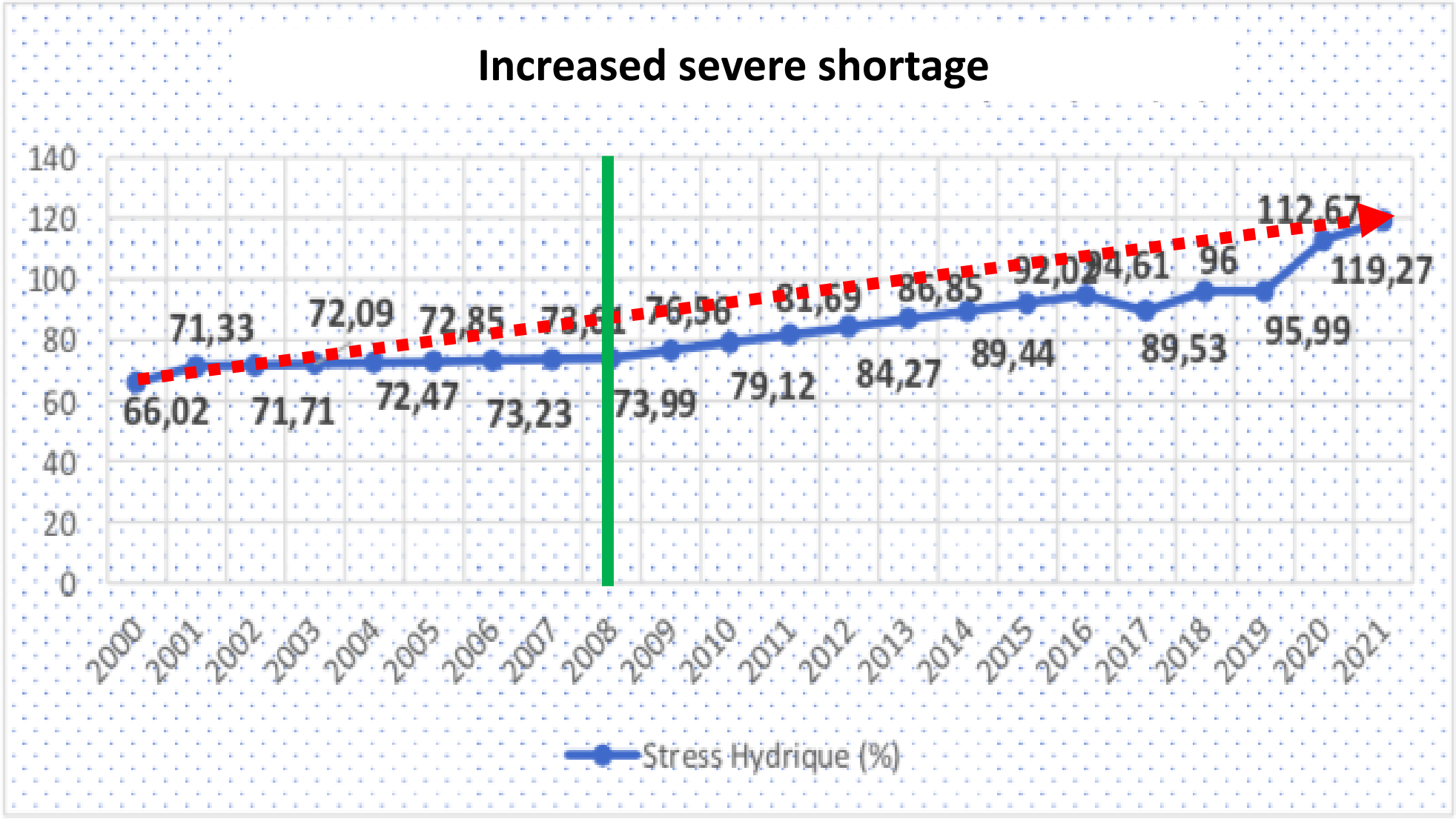
Water balance by catchment

Unité hydraulique	Somme ressources en eaux de surface et souterraines plus EUT Hydrologie 1960-2014			Somme besoins AEP et irrigation 2050	Bilan selon probabilité des écoulements		
	4/5	1/2	1/5		4/5	1/2	1/5
Extr. Nord & Ichkeul	788	1 064	1 456	160	668	944	1336
Mejerdah	701	873	1 311	818	-35	137	575
Cap Bon & Miliane	408	480	595	879	-243	-171	-56
Tunisie C avec apports	439	529	686	495	-22	68	225
Tunisie C sans apports	170	186	225	451	-241	-225	-186
Sahel & Sfax	154	160	177	449	-133	-127	-110
Leben & Bayech	354	395	455	495	-94	-53	7
Total	3 215	3 986	5 390	3749	99	870	2274

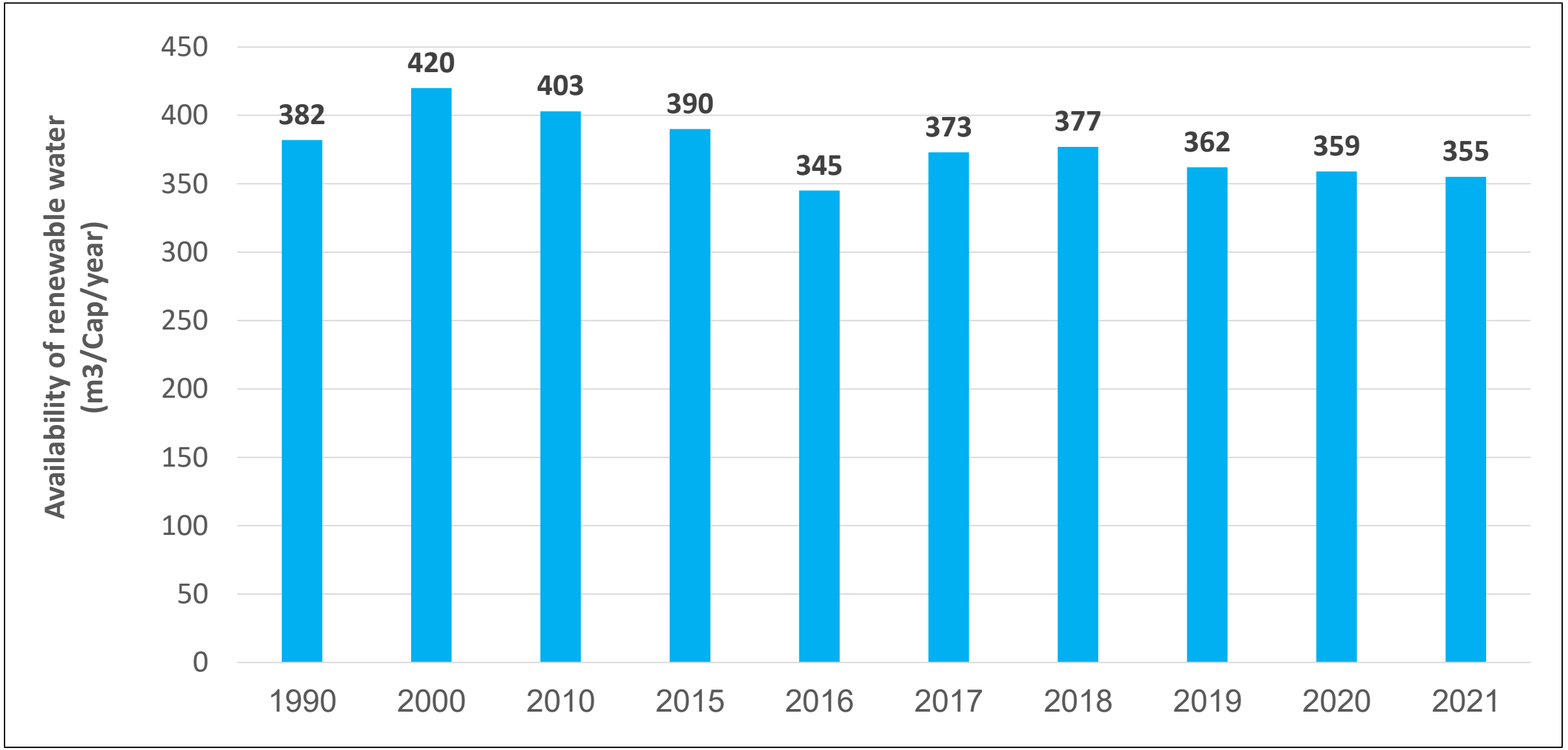


Bilan d'eau en 2050 sans transferts

Water stress indicator (%) (SDG 6.4.2) > 75%



1. Absolute water shortage (aridity standard < 1000m3 /capita)



1.1 Water transfer :

1. Investment costs.

2. Management costs (energy).

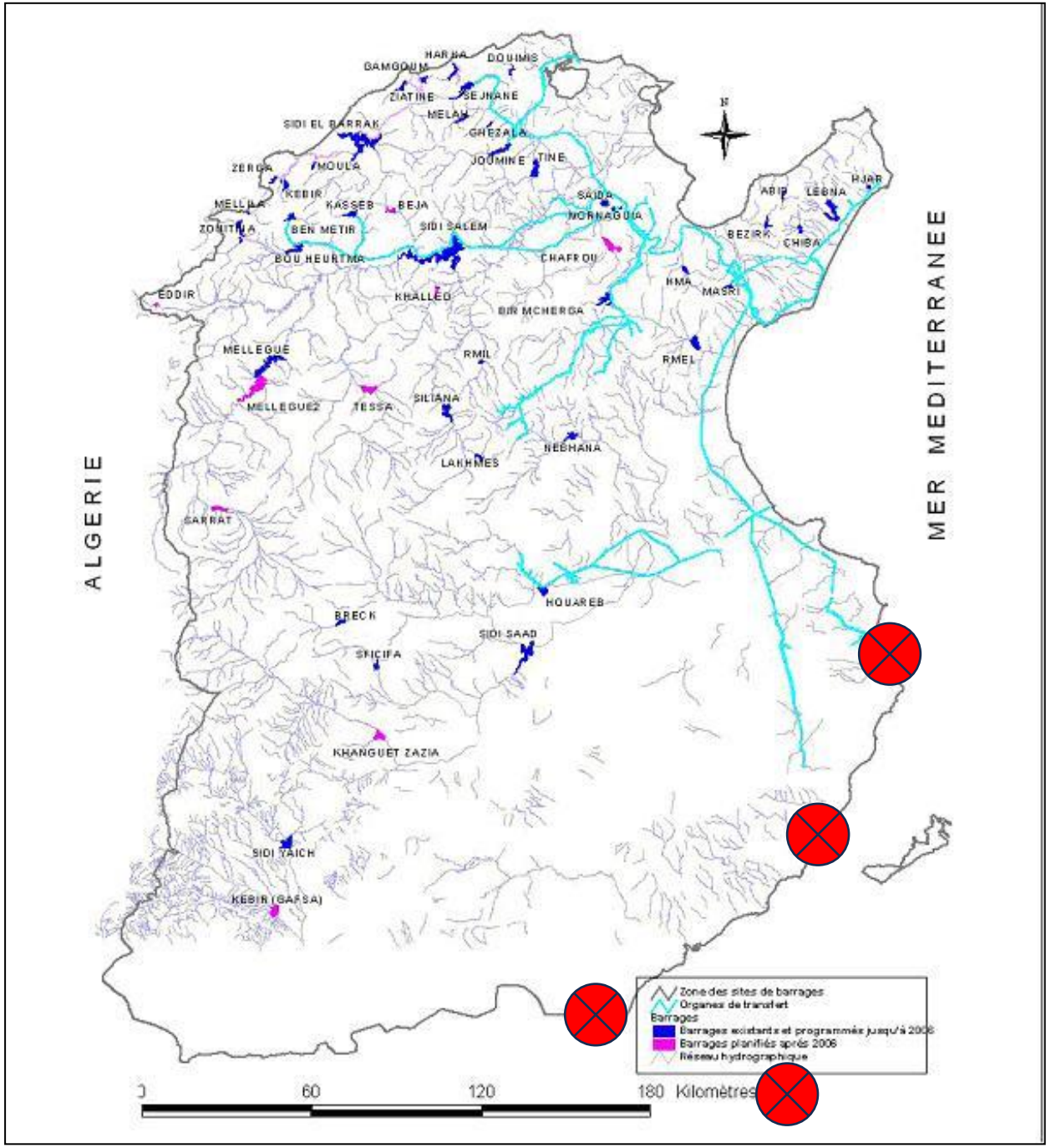
3. Surface water

1.2 Sea Water Desalination :

1. Investment costs.

2. Management costs (energy).

3. Renewable energies.



2. CC: Change in flow volumes from different projections compared to the period 1971 – 1990 – average statistic

Unités hydrauliques	1971-1990 Mm³	RCP45_ 2030	RCP85_ 2030	RCP45_ 2050	RCP85_ 2050	RCP45_ 2080	RCP85_ 2080
1 - Extrême Nord - Ichkeul	749	-26%	-35%	-24%	-29%	-17%	-45%
2 - Medjerda	663	-23%	-33%	-23%	-23%	-12%	-40%
3 - Cap Bon & Meliane	144	-37%	-44%	-40%	-27%	-14%	-45%
4 - Tunisie centrale avec apports propres	212	-38%	-26%	-36%	-26%	0%	-45%
5 - Tunisie centrale sans apports propres	47	-48%	-39%	-59%	-41%	-24%	-60%
6 - Sahel & Sfax	19	-57%	-34%	-60%	-32%	-35%	-61%
7 - Leben & Bayech	63	-54%	-42%	-64%	-39%	-40%	-59%
8 - Algérie	261	-21%	-26%	-14%	-10%	-8%	-41%
Régions 1, 2 & 8	1673	-24%	-33%	-22%	-24%	-13%	-43%
Toutes les régions	2159	-28%	-33%	-27%	-25%	-13%	-44%

Floods

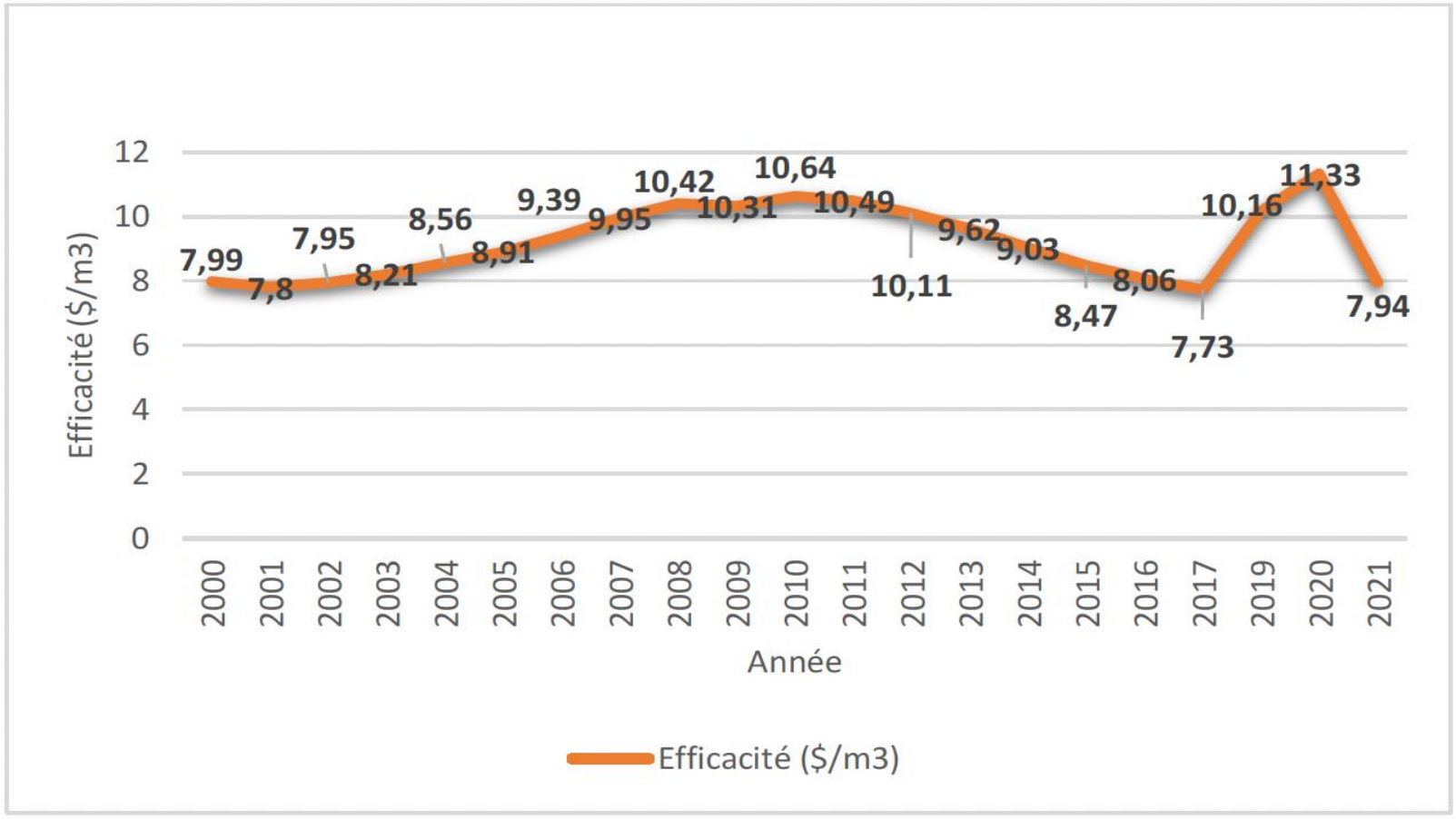
Nabeul floods in septembre 2018

Gabes floods in Novembre 2017

3. Low water productivity : Water use efficiency (8 – 10 $/m3) (the global average of $19/m3)

High water footprint (2200 m3/inhabitant/year)

The global average is 1340 m3/inhabitant/year.



Towards a new paradigm of water management

Two urgent measures to face absolute emergencies

- **The declaration of a state of WATER emergency**:
  - Implementation of **exceptional measures** for an exceptional situation to stop the current economic water losses in the sector: **Reduce** non-revenue water (**NRW**) and **increase** the water **productivity**
  - Adopt an adequate and resilient **legal and regulatory framework** that can be easily adapted to changes in the water context and the effectiveness of the measures applied.
- **The creation of a transversal institution**, **High-Water Security Council** (CSSE) (presidency of the government or the presidency of the State):
  - **Development of the national strategy** and **public water policies** and monitoring of their implementation at the **sectoral level** using modern management tools (information system and national water dashboard). The creation of this institution will introduce the necessary change in terms of management method and extend it to other actors.

Proposed intervention axes:

- **Axis 1**: Develop the volume of **resources mobilized** in the context of aridity and water stress using innovative and sustainable approaches .
- **Axis 2**: Improve **access to water** and the safety of its use and develop the ecological service of water in the context of water stress.
- **Axis 3**: Improve the **maintenance of national water security** over time.
- **Axis 4**: Increase the **effectiveness of cross-cutting water governance and research and innovation** functions based on the needs and expectations of water operators and users in the context of aridity and water stress

Thanks

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