Supplementary data

Table S1. Predicated values of WPI variables and DEA input and output indicators in 2025

Indicators	Nanjing	Wuxi	Xuzhou	Changzhou	Suzhou	Nantong	Lianyungang	Huai'an	Yancheng	Yangzhou	Zhenjiang	Taizhou	Suqian
Water resources per capita (m³)	375.858	456.652	445.559	714.030	666.618	510.027	461.499	834.511	757.513	518.037	586.038	520.879	587.104
The multi-year average of rainfall in each city (100 million m³)	80.925	51.761	96.813	57.856	107.012	111.513	67.247	100.039	146.744	69.610	46.524	64.390	76.862
The loosed water of urban public water supply (100 million m³)	1.923	1.107	0.496	0.629	1.519	0.482	0.271	0.246	0.322	0.365	0.303	0.203	0.192
Density of sewers in built up area (Kilometers / Spuare Kilometers)	14.324	19.503	17.865	24.458	21.768	12.101	16.067	16.365	5.375	19.530	8.852	15.886	12.174
Urban sewage treatment (%)	1.000	1.000	1.000	1.000	0.977	0.981	1.000	1.000	1.000	0.964	0.990	1.000	1.000
Investment in the construction of urban water-saving facilities (10000 yuan)	0.936	2.737	11.631	7.751	7.785	11.206	2.635	0.600	4.350	2.994	0.373	0.390	2.200
Average number of students in colleges and universities per 10000 people	1273.734	331.498	187.563	434.463	393.935	229.623	144.138	275.147	107.462	285.641	454.707	171.019	58.773
Engel's Coefficient of urban residents (%)	24.752	22.794	27.116	22.719	24.253	25.716	32.008	28.334	24.970	25.542	24.364	25.470	28.589
The contribution of each city to the provincial GDP (%)	0.137	0.122	0.072	0.074	0.199	0.090	0.031	0.038	0.057	0.057	0.042	0.051	0.030
Consumption of Water for Livelihood per Capita (litre per day)	334.076	198.304	111.839	266.450	205.268	257.098	297.805	179.553	140.959	208.886	221.392	239.263	137.355
Industrial structure (%)	0.402	0.238	0.279	0.250	0.220	0.291	0.552	0.535	0.341	0.336	0.501	0.334	0.318
Agricultural water consumption (100 million m³)-	14.671	8.599	29.369	9.233	10.810	22.909	20.454	23.962	35.714	21.527	7.701	17.132	16.663
Citywide wastewater discharge (Total amount of water use * 0.7)(100 million m³)	25.123	19.124	26.912	17.544	36.281	33.355	18.529	21.631	32.035	25.270	29.221	35.303	16.033
Rural Chemical Fertilizer Application(10000·ton)	4.362	3.877	47.410	4.672	4.892	18.401	29.679	28.654	43.770	17.004	4.059	12.618	32.718
Concentration of PM2.5 (μg /m³)	26.700	35.000	35.000	35.000	28.000	25.000	33.000	35.000	30.000	30.000	34.000	30.000	39.000
Investment in sewage treatment (10,000 yuan)	23.071	12.347	42.889	19.479	23.944	0.837	3.389	11.199	88.183	28.636	40.732	5.663	31.767
Per capita output of grain (kg)	88.297	50.605	572.669	116.650	90.164	460.920	693.234	1114.171	927.706	571.299	245.154	552.468	849.693
Added value of the secondary industry (100 million yuan)	7335.770	8181.202	4026.701	5400.537	13017.179	7435.997	2103.290	2459.463	3350.529	4122.687	2821.988	3768.373	2059.618
Green space in urban built-up area (hectare)	9.863	3.174	2.379	1.711	4.235	2.726	2.432	1.253	1.336	1.447	1.575	1.603	1.211

Note: All indicators in this table are obtained by Gray Prediction Model.

Table S2. Supply capacity of unconventional water in 2025 in Jiangsu

City	Total water control (100 million m³)	Sewage treatment rate	Total quantity of wastewater treated (100 million m³)	Rainfall (100 million m³)	Rainwater harvesting rate	Available rainwater (100 million m³)	Amount of coal mining (10,000 tons)	Water yield per ton of coal (t/m³)	Available mine water (10,000 tons)	Seawater desalination capacity (100 million m³)	Amount of available unconventional water (100 million m³)
Nanjing	46.07	100.00%	32.249	80.925	0.23‰	0.019					32.268
Wuxi	50.00	100.00%	35.000	51.761	0.23‰	0.012					35.012
Xuzhou	44.05	100.00%	30.835	96.813	0.23‰	0.022	999.000	0.35	349.650		30.892
Changzhou	27.84	100.00%	19.487	57.856	0.23‰	0.013					19.500
Suzhou	103.00	97.70%	70.442	107.012	0.23‰	0.025					70.466
Nantong	50.50	98.10%	34.678	111.513	0.23‰	0.026					34.704
Lianyungang	29.83	100.00%	20.881	67.247	0.23‰	0.015				0.166	21.063
Huai'an	33.00	100.00%	23.100	100.039	0.23‰	0.023					23.123
Yancheng	57.64	100.00%	40.348	146.744	0.23‰	0.034				0.04	40.418
Yangzhou	40.97	96.40%	27.647	69.610	0.23‰	0.016					27.663
Zhenjiang	30.65	99.00%	21.240	46.524	0.23‰	0.011					21.251
Taizhou	33.79	100.00%	23.653	64.390	0.23‰	0.015					23.668
Suqian	30.43	100.00%	21.301	76.862	0.23‰	0.018					21.319
Total	577.77		400.861	1077.297	0.23‰	0.248	999.00	0.35	349.65	0.20	401.346

Note: According to the China Urban-Rural Construction Statistical Yearbook (2012-2021), the coefficient for urban integrated wastewater discharge is 0.7; Rainwater harvesting rate is determined based on actual conditions in Jiangsu.

Table S3. Maximum utilization/demand of unconventional water in 2025 in Jiangsu

City	Road sweeping and cleaning area (100 million m²)	Road watering demand (100 million m³)	Year-end urban resident population (10,000 people)	Flushing water demand (100 million m³)	Green space in urban built-up area (100 million m²)	Green belt sprinkling water demand (100 million m³)	Amount of private cars (10,000 pieces)	Water demand for car washing (100 million m³)	Construction area (100 million m³)	Construction water demand (100 million m³)	Power generation capacity (100 million Kwh)	Power generation water demand (100 million m³)	Total amount of consumable unconventional water (100 million m³)
Nanjing	0.908	0.663	980.335	1.431	9.863	4.931	396.621	0.076	3.662	1.282	835.061	0.292	8.675
Wuxi	0.908	0.663	777.237	1.135	3.174	1.587	345.734	0.066	0.577	0.202	976.860	0.342	3.995
Xuzhou	0.647	0.473	935.115	1.365	2.379	1.189	309.654	0.059	1.196	0.418	410.664	0.144	3.649
Changzhou	0.447	0.327	402.365	0.587	1.711	0.856	241.490	0.046	1.566	0.548	698.802	0.245	2.609
Suzhou	1.985	1.449	816.375	1.192	4.235	2.118	721.234	0.138	2.108	0.738	1916.619	0.671	6.305
Nantong	0.820	0.599	747.667	1.092	2.726	1.363	303.018	0.058	13.007	4.552	676.952	0.237	7.901
Lianyungang	0.427	0.312	542.400	0.792	2.432	1.216	146.388	0.028	0.418	0.146	252.855	0.088	2.583
Huai'an	0.441	0.322	458.644	0.670	1.253	0.626	107.288	0.021	1.470	0.515	252.855	0.088	2.241
Yancheng	0.588	0.429	803.866	1.174	1.336	0.668	178.615	0.034	1.445	0.506	446.958	0.156	2.967
Yangzhou	0.397	0.290	463.097	0.676	1.447	0.723	129.516	0.025	4.382	1.534	344.077	0.120	3.368
Zhenjiang	0.543	0.396	324.298	0.473	1.575	0.787	108.755	0.021	0.247	0.087	341.939	0.120	1.884
Taizhou	0.442	0.323	450.401	0.658	1.603	0.801	135.674	0.026	4.464	1.562	412.000	0.144	3.514
Suqian	0.363	0.265	507.263	0.741	1.211	0.606	140.053	0.027	0.746	0.261	420.005	0.147	2.046
Total	8.916	6.508	8209.063	11.985	34.944	17.472	3264.040	0.627	35.287	12.350	7985.647	2.795	51.738

Note: The basic indicators in this table are obtained using Gray Prediction Model. The water quota for road sprinkling is denoted by a common value of 2L/(m²·d); Water quota for green space is denoted by 0.5 m³/(m²·a) on lawn irrigation; The water quota for car washing is denoted by 40 L/(vehicle ·time) with an average 4 times per month for small cars; The water quota for construction is denoted by 0.35m³/m²; The water quota for electricity production is denoted by 0.35m³/MWh (level 3) for 1,000MW power generation; The water quota for toilet flushing is denoted by 5L/(person ·time); And based on clinical standard for healthy urination frequency, the average figure is 8 times per person per day.

Table S4. Integrated weights of WPI variables

Components	Resources		Access			Capacity			Use				Environment		
Weights	0.109		0.217			0.178			0.277				0.220		
Variables	R1	R2	A1	A2	A3	C1	C2	C3	U1	U2	U3	U4	E1	E2	E3
Weights	0.054	0.055	0.076	0.069	0.072	0.046	0.064	0.068	0.078	0.059	0.060	0.078	0.077	0.075	0.068

Table S5. WPI values of each city

Variables	Nanjing	Wuxi	Xuzhou	Changzhou	Suzhou	Nantong	Lianyungang	Huai'an	Yancheng	Yangzhou	Zhenjiang	Taizhou	Suqian
R1(+)	0.000	0.949	0.819	3.974	3.417	1.577	1.006	5.390	4.485	1.671	2.470	1.704	2.483
R2(+)	1.898	0.289	2.775	0.625	3.338	3.586	1.143	2.953	5.530	1.274	0.000	0.986	1.674
A1(−)	0.000	3.571	6.249	5.664	1.767	6.308	7.235	7.343	7.008	6.822	7.094	7.529	7.580
A2(+)	3.245	5.123	4.529	6.920	5.944	2.439	3.877	3.985	0.000	5.133	1.261	3.811	2.465
A3(+)	7.160	7.160	7.160	7.160	2.586	3.381	7.160	7.160	7.160	0.000	5.171	7.160	7.160
C1(+)	0.229	0.960	4.570	2.995	3.009	4.397	0.918	0.092	1.615	1.064	0.000	0.007	0.742
C2(+)	6.430	1.443	0.682	1.988	1.774	0.904	0.452	1.145	0.258	1.201	2.095	0.594	0.000
C3(−)	5.288	6.715	3.565	6.770	5.652	4.586	0.000	2.678	5.129	4.713	5.571	4.765	2.492
U1(−)	2.886	3.586	5.883	5.807	0.000	5.043	7.787	7.473	6.592	6.596	7.272	6.861	7.840
U2(−)	0.000	3.629	5.940	1.808	3.443	2.057	0.969	4.130	5.162	3.346	3.012	2.534	5.258
U3(−)	2.729	5.713	4.967	5.494	6.040	4.748	0.000	0.309	3.839	3.930	0.928	3.966	4.257
U4(−)	5.882	7.579	1.774	7.402	6.961	3.579	4.265	3.285	0.000	3.965	7.830	5.194	5.325
E1(−)	4.260	6.550	3.577	7.153	0.000	1.117	6.777	5.593	1.621	4.204	2.695	0.373	7.730
E2(−)	7.407	7.490	0.000	7.353	7.315	4.991	3.051	3.227	0.626	5.231	7.459	5.986	2.528
E3(−)	5.957	1.937	1.937	1.937	5.327	6.780	2.906	1.937	4.359	4.359	2.421	4.359	0.000
WPI	53.370	62.694	54.427	73.051	56.572	55.494	47.548	56.700	53.383	53.507	55.279	55.829	57.533