

Table S1: The characteristics of 175 WWTPs in Beijing

No.	District	Name	Treatment capacity in 2019 (10000 tons/day)	Treatment technologies (MBR or non-MBR)	Government -owned plant	Electricity consumption in 2017 (kWh)
1	Changping	Shahe Reclaimed Water plant II	6	Non-MBR	Y	-
2	Changping	Beijing Water Group Changxiang Wastewater treatment Company (Ltd.)	3	Non-MBR	Y	-
3	Changping	Shahe Reclaimed Water Plant I	3	MBR	Y	2575927
4	Daxing	Dalonghe Wastewater treatment plant	0.15	Non-MBR	Y	-
5	Daxing	Beizangcun town Liuhezhuang & Macun Wastewater treatment plant	0.07	MBR	Y	-
6	Daxing	Jiangfeng wastewater treatment plant	0.05	MBR	Y	-
7	Daxing	Nanyuan Guanqu wastewater treatment plant	0.36	MBR	Y	-
8	Daxing	New Xifeng wastewater treatment plant	0.28	MBR	Y	-
9	Daxing	Yinghai wastewater treatment plant	3	MBR	Y	-
10	Huairou	Yanxi wastewater treatment plant	0.6	Non-MBR	Y	-
11	Huairou	Huairou wastewater treatment plant	13	Non-MBR	Y	-

12	Tongzhou	Ciqu wastewater treatment plant	1	Non-MBR	Y	-
13	Fangshan	Fangshan Chengguan wastewater treatment plant	2	Non-MBR	Y	1948138
14	Fangshan	Fangshan Chengguan reclaimed water plant	2	MBR	Y	-
15	Fangshan	Hebei town wastewater treatment plant	0.5	MBR	Y	-
16	Yanqing	Kangzhuang town wastewater treatment plant	0.89	Non-MBR	Y	-
17	Fangshan	Qinglonghu town wastewater treatment plant	0.35	MBR	Y	-
18	Fangshan	Zhoukou town wastewater treatment plant	0.5	Non-MBR	Y	-
19	Chaoyang	Beixiaohe wastewater treatment plant	10	MBR	Y	24986856
20	Chaoyang	Jiuxianqiao reclaimed water plant	20	Non-MBR	Y	-
21	Fengtai	Lugouqiao reclaimed water plant	10	Non-MBR	Y	9010770
22	Haidian	Qinghe reclaimed water plant	55	Non-MBR	Y	-
23	Fengtai	Wujiacun reclaimed water plant	8	Non-MBR	Y	-
24	Chaoyang	Xiaohongmen reclaimed water plant	60	Non-MBR	Y	97495503

25	Haidian	Cuihu reclaimed water plant	2	Non-MBR	Y	3195074
26	Haidian	Shangzhuang reclaimed water plant	1.2	Non-MBR	Y	-
27	Haidian	Wenquan reclaimed water plant	2	Non-MBR	Y	3624065
28	Haidian	Yongfeng reclaimed water plant	2	Non-MBR	Y	4623416
29	Fangshan	Hancunhe emergency wastewater treatment plant	0.6	MBR	Y	-
30	Fangshan	Nanhanji wastewater treatment plant	0.07	MBR	Y	-
31	Fangshan	Tianjiayuan wastewater treatment plan	1.34	MBR	Y	-
32	Fangshan	Xinjie wastewater treatment plan	0.12	MBR	Y	-
33	Fangshan	Yanduliming wastewater treatment plan	0.2	MBR	Y	-
34	Daxing	Daxing district east wastewater treatment plant (III & VI)	5	MBR	Y	-
35	Mentougou	Mentougou district reclaimed water plant II	8	MBR	Y	2906300
36	Yanqing	Zhangshanying town reclaimed water plant	0.26	MBR	Y	-
37	Chaoyang	Dingfuzhuang reclaimed water plant	30	Non-MBR	Y	-

38	Chaoyang	Gaoantun reclaimed water plant	20	Non-MBR	Y	-
39	Chaoyang	Gaobeidian reclaimed water plant	100	Non-MBR	Y	151562322
40	Fengtai	Huaifang reclaimed water plant	60	MBR	Y	-
41	Chaoyang	Qinghe reclaimed water plant II	50	Non-MBR	Y	35308118
42	Fengtai	Weijia wastewater treatment plant	10	Non-MBR	Y	-
43	Haidian	Daoxianghu reclaimed water plant	8	MBR	Y	-
44	Shunyi	Niulanshan reclaimed water plant	2	MBR	Y	-
45	Miyun	Miyun Xincheng reclaimed water plant	6.5	MBR	Y	-
46	Shunyi	Beishichao reclaimed water plant	0.3	MBR	Y	-
47	Shunyi	Beixiaoying reclaimed water plant	1	MBR	Y	-
48	Fangshan	Zhangfang wastewater treatment plant	0.2	-	Y	-
49	Fangshan	Doudian modern manufactory industry base reclaimed water plant	0.6	Non-MBR	Y	-
50	Fangshan	Changgou wastewater treatment plant	0.5	Non-MBR	Y	-

51	Fangshan	Changyang wastewater treatment plant	2	Non-MBR	Y	1770946
52	Tongzhou	Mayingcun wastewater treatment plant	0.2	Non-MBR	N	-
53	Tongzhou	Yuelianghe wastewater treatment plant	0.1	-	N	-
54	Tongzhou	Jinqiao wastewater treatment plant	0.5	Non-MBR	N	-
55	Daxing	Beijing Jinyuanjingkai wastewater treatment company (Ltd.)	6	Non-MBR	Y	10450510
56	Daxing	Anding wastewater treatment plant	0.154	MBR	Y	-
57	Shijingshan	Wulituo wastewater treatment plant	2	MBR	N	1607763
58	Shunyi	Shunyi district wastewater treatment plant	18	Non-MBR	N	24305600
59	Chaoyang	Fatou wastewater treatment plant	2	Non-MBR	N	-
60	Fengtai	Hexi reclaimed water plant	5	MBR	Y	-
61	Shunyi	Zhaoquanying reclaimed water plant	1.3	MBR	N	-
62	Fangshan	Lianggong industry district wastewater treatment plant	0.1	Non-MBR	Y	-
63	Yanqing	Badaling town wastewater treatment plant	0.45	MBR	Y	-

64	Yanqing	Chengxi reclaimed water plant	6	MBR	Y	-
65	Yanqing	Jiuxian town wastewater treatment plant	0.15	Non-MBR	Y	-
66	Yanqing	Yongning town wastewater treatment plant	0.36	Non-MBR	Y	-
67	Huairou	Qiaoxin wastewater treatment plant	0.24	Non-MBR	N	-
68	Daxing	Qingyundian town Fashang wastewater treatment plant	0.1	Non-MBR	Y	-
69	Chaoyang	Beiyuan wastewater treatment plant	4	Non-MBR	Y	4336600
70	Mentougou	Datai office wastewater treatment plant	0.15	Non-MBR	Y	5760120
71	Mentougou	Junzhuang town wastewater treatment plant	0.6	Non-MBR	Y	-
72	Mentougou	Miaofengshan town wastewater treatment plant	0.06	Non-MBR	Y	-
73	Mentougou	Tanzhesi town wastewater treatment plant	0.5	Non-MBR	Y	-
74	Mentougou	Wangping town Jiuyuan wastewater treatment plant	0.05	Non-MBR	Y	-
75	Mentougou	Zhaitang town wastewater treatment plant	0.15	MBR	Y	-
76	Mentougou	Qingshui town wastewater treatment plant	0.2	-	Y	-

77	Pinggu	Donggaocun town wastewater treatment plant	0.4	Non-MBR	Y	-
78	Pinggu	Liujadian town wastewater treatment plant	0.08	MBR	Y	-
79	Pinggu	Machangying town wastewater treatment plant	0.6	Non-MBR	Y	-
80	Pinggu	Mafangzhen town wastewater treatment plant	1.1	Non-MBR	Y	-
81	Pinggu	Yukou town Huxinhuang wastewater treatment plant	0.15	MBR	Y	-
82	Pinggu	Yukou town Zhongqiao wastewater treatment plant	0.1	Non-MBR	Y	-
83	Pinggu	Ruhe wastewater treatment plant	8	MBR	Y	15367380
84	Tongzhou	Huoxian town wastewater treatment plant	1	Non-MBR	N	892912
85	Changping	Nankou town central wastewater treatment plant	2	Non-MBR	Y	1836617
86	Changping	Nankou town west wastewater treatment plant	0.5	Non-MBR	Y	-
87	Changping	Feature technology city reclaimed water plant	8	Non-MBR	Y	-
88	Changping	Changping wastewater treatment center	5.4	Non-MBR	Y	6129350
89	Fengtai	Huaxiang south wastewater treatment plant	0.81	Non-MBR	Y	-

90	Fengtai	Xiaoyueyuan wastewater treatment plant	0.5	Non-MBR	Y	-
91	Tongzhou	Nanxiaoyingcun wastewater treatment plant	0.15	Non-MBR	Y	-
92	Tongzhou	Guantoucun south wastewater treatment plant	0.2	Non-MBR	Y	-
93	Tongzhou	Guantoucun west wastewater treatment plant	0.15	Non-MBR	Y	-
94	Tongzhou	Shuangfutoucun wastewater treatment plant	0.07	MBR	Y	-
95	Tongzhou	Wugezhuang wastewater treatment plant	0.05	MBR	Y	-
96	Tongzhou	Xindiancun wastewater treatment plant	0.2	MBR	Y	-
97	Daxing	Beijing textiles and clothing industry base emergency wastewater treatment plant	0.08	Non-MBR	Y	-
98	Fangshan	Yancun town wastewater treatment plant	0.3	Non-MBR	Y	-
99	Chaoyang	Dongba wastewater treatment plant	2	Non-MBR	Y	-
100	Shunyi	Capital airport west wastewater treatment plant	2	Non-MBR	Y	-
101	Daxing	Beijing Capital airport power and energy company (Ltd.)	2	MBR	Y	-
102	Shunyi	Capital airport east wastewater treatment plant	8	Non-MBR	Y	-

103	Shunyi	Nancaicaifeng community wastewater treatment plant	0.3	Non-MBR	Y	-
104	Shunyi	Hanshiqiao wetland wastewater treatment plant	0.65	MBR	Y	-
105	Shunyi	Mapo reclaimed water plant	4	MBR	Y	-
106	Shunyi	Wenyuhe water resources utilization project	2	MBR	Y	15756400
107	Shunyi	Yangzhen reclaimed water plant	0.3	Non-MBR	Y	-
108	Shunyi	Tianzhu wastewater treatment plant	2	Non-MBR	N	2468052
109	Miyun	Beijing Wanjia water company (Ltd.)	0.3	Non-MBR	N	-
110	Haidian	Beijing Xiaojahe wastewater treatment company (Ltd.)	8	Non-MBR	N	14717262
111	Tongzhou	Hedong reclaimed water plant	4	MBR	N	6687990
112	Tongzhou	Taihu wastewater treatment plant	1	Non-MBR	N	-
113	Tongzhou	Beijing Bishui reclaimed water plant	18	Non-MBR	N	23902740
114	Daxing	Yufa wastewater treatment plant	0.7	Non-MBR	N	-
115	Daxing	Xinhangcheng east district reclaimed water plant	3	Non-MBR	Y	-

116	Daxing	Xinhangcheng west district reclaimed water plant	5	Non-MBR	Y	-
117	Daxing	Huangcun reclaimed water plant	12	MBR	Y	31321040
118	Daxing	Daxinzhuang wastewater treatment plant	0.2	-	Y	-
119	Daxing	Liuminying wastewater treatment plant	0.1	-	Y	-
120	Daxing	Zhaojiayuan wastewater treatment plant	0.1	-	Y	-
121	Daxing	Xihongmen reclaimed water plant	4	Non-MBR	Y	-
122	Fangshan	Beijing Yancun Longrenshiji wastewater treatment plant	0.1	Non-MBR	Y	-
123	Fangshan	Niukouyu wastewater treatment plant	8.4	Non-MBR	N	-
124	Fangshan	Xingcheng wastewater treatment plant	0.6	Non-MBR	N	-
125	Daxing	Yizhuang east district wastewater treatment plant	5	MBR	Y	4713910
126	Daxing	Yizhuang south district wastewater treatment plant	2	MBR	Y	-
127	Tongzhou	Zhangjiawan reclaimed water plant	4	Non-MBR	N	-
128	Daxing	Panggezhuang wastewater treatment plant	1.1	Non-MBR	Y	-

129	Fangshan	Liangxiang wastewater treatment plant	8	Non-MBR	N	3452124
130	Fengtai	Qinglonghu reclaimed water plant	1	Non-MBR	Y	-
131	Haidian	Shangzhuang water recycle metabolism demonstration project	0.5	MBR	N	-
132	Daxing	EverBright Water (Beijing) company (Ltd.)	8	Non-MBR	N	8741888
133	Haidian	Baishuiwacun wastewater treatment plant	0.06	Non-MBR	-	-
134	Haidian	Meisuotuncun wastewater treatment plant	0.075	Non-MBR	-	-
135	Haidian	Shangzhuang community north district wastewater treatment plant	0.15	Non-MBR	-	-
136	Haidian	Shangzhuang community south district wastewater treatment plant	0.25	Non-MBR	-	-
137	Haidian	Shangzhuang 134 wastewater treatment plant	0.08	Non-MBR	-	-
138	Haidian	Shuangtacun wastewater treatment plant	0.06	MBR	-	-
139	Haidian	Xiyuhecun wastewater treatment plant	0.05	Non-MBR	-	-
140	Haidian	Zaojiatuncun wastewater treatment plant	0.085	Non-MBR	-	-
141	Haidian	Beianhecun wastewater treatment plant	0.09	MBR	-	-

142	Haidian	Caochangcun wastewater treatment plant	0.05	Non-MBR	-	-
143	Haidian	Cheeryingcun wastewater treatment plant	0.1	Non-MBR	-	-
144	Haidian	Liulincun wastewater treatment plant	0.055	MBR	-	-
145	Haidian	Niegezhuangcun wastewater treatment plant	0.31	MBR	-	-
146	Haidian	Xifutoucun wastewater treatment plant	0.1	MBR	-	-
147	Haidian	Zhoujiaxiangcun wastewater treatment plant	0.06	MBR	-	-
148	Haidian	Hanjiachuang wastewater treatment plant	0.05	MBR	-	-
149	Tongzhou	Hujiafacun wastewater treatment plant	0.07	Non-MBR	Y	-
150	Daxing	Lvyinbieshu wastewater treatment plant	0.13	MBR	Y	-
151	Daxing	Qingyundian wastewater treatment plant	0.12	MBR	N	-
152	Fangshan	China institute of atomic energy wastewater treatment plant	0.192	Non-MBR	Y	-
153	Changping	Baishan town reclaimed water plant	2	Non-MBR	Y	-
154	Changping	Machikou town reclaimed water plant	2.5	Non-MBR	Y	-

155	Changping	Yangfang town north district reclaimed water plant	0.63	Non-MBR	Y	-
156	Changping	Liucun town reclaimed water plant	0.2	Non-MBR	Y	-
157	Changping	xiaotangshan town reclaimed water plant	7	Non-MBR	Y	862756
158	Tongzhou	Huoxian town Mizidian reclaimed water plant	0.1	Non-MBR	Y	-
159	Tongzhou	Lucheng Gantang reclaimed water plant	1	Non-MBR	Y	-
160	Tongzhou	Maquqiao town reclaimed water plant	2	Non-MBR	Y	-
161	Tongzhou	Songzhuang town Zhaixinzhuang reclaimed water plant	0.4	Non-MBR	Y	-
162	Tongzhou	Taihu reclaimed water plant II	1	Non-MBR	Y	-
163	Tongzhou	Xiji town central reclaimed water plant II	0.3	Non-MBR	Y	-
164	Tongzhou	Xiji town central reclaimed water plant I	0.2	Non-MBR	Y	-
165	Tongzhou	Yongledian town reclaimed water plant II	0.1	Non-MBR	Y	-
166	Tongzhou	Yongledian town reclaimed water plant I	1	Non-MBR	Y	-
167	Tongzhou	Yujiawu central reclaimed water plant II	0.5	Non-MBR	Y	-

168	Tongzhou	Yujiawu central reclaimed water plant I	1	MBR	-	-
169	Tongzhou	Zhangjiawan town Niubaotun wastewater treatment plant	0.3	Non-MBR	Y	-
170	Tongzhou	Zhangjiawan town west Dingfuzhuang wastewater treatment plant	0.2	Non-MBR	Y	-
171	Tongzhou	Shuangfutoucun Nankeng wastewater treatment plant	0.06	Non-MBR	N	-
172	Daxing	Weishanzhuang town reclaimed water plant	1.2	Non-MBR	Y	-
173	Daxing	Huangcun town reclaimed water plant	2	Non-MBR	Y	-
174	Mentougou	Datai community wastewater treatment plant	0.15	Non-MBR	Y	-
175	Daxing	Beijing Caiyu wastewater treatment plant	1.5	Non-MBR	N	-

Ltd.: limited; MBR: membrane bioreactor; - : no data.

Data sources: <https://www.mee.gov.cn/xxgk/xxgk01/202011/W020221214700986955780.pdf>; <http://xxgk.bevoice.com.cn/monitor-pub/index.do>

Table S2: Representative policies related to wastewater governance at the national and municipal levels

Category		Name & Number	Year Issued
National	CPC Central Committee and the State Council	<i>Opinions of the Central Committee of the CPC and the State Council on Accelerating the Promotion of Ecological Progress</i> [State Council Gazette, Issue No. 14, Serial No. 1517 (May 20, 2015)]	2015
		<i>Circular of the State Council on Printing and Issuing the Action Plan for the Prevention and Control of Water Pollution</i> [State Council Gazette, Issue No. 12, Serial No. 1515 (April 30, 2015)]	2015
		<i>Opinions of the Central Committee of the CPC and the State Council on Comprehensively Enhancing Eco-Environmental Protection to Completely Win the Battle Against Pollution</i> [State Council Gazette, Issue No. 19, Serial No. 1630 (July 10, 2018)]	2018
		<i>Opinions of the Central Committee of the CPC and the State Council on Further Fighting the Tough Battle of Pollution Prevention and Control</i> [State Council Gazette, Issue No. 32, Serial No. 1751 (Nov 20, 2021)]	2021
	The Ministries	<i>Guiding Opinions on Pushing Forward the Transformation of Wastewater into Resources for Use</i> [Department of Resource Conservation and Environmental Protection, National Development and Reform Commission, 2021, No.13]	2021
		<i>Implementation Plan for Conducting Experiments in Regional Reclaimed Water Circular Use</i> [General Office, Ministry of Ecological and Environment, 2021, No. 28]	2021
	Municipal	Plans	<i>Comprehensive City Plan of Beijing Municipality (2016-2035)</i>
<i>Outline of the Fourteenth Five-year Plan for National Economic and Social Development of Beijing Municipality (2021-2025)</i>			2021
Action plans		<i>Three-year action plan for further promoting urban-rural aquatic environment governance work (2019-2022)</i>	2019
		<i>Three-year action plan for further promoting wastewater treatment and reclaimed water reuse works (2016-2019)</i>	2016
		<i>Three-year action plan for promoting the construction of wastewater treatment and reclaimed water reuse (2013-2015)</i>	2013

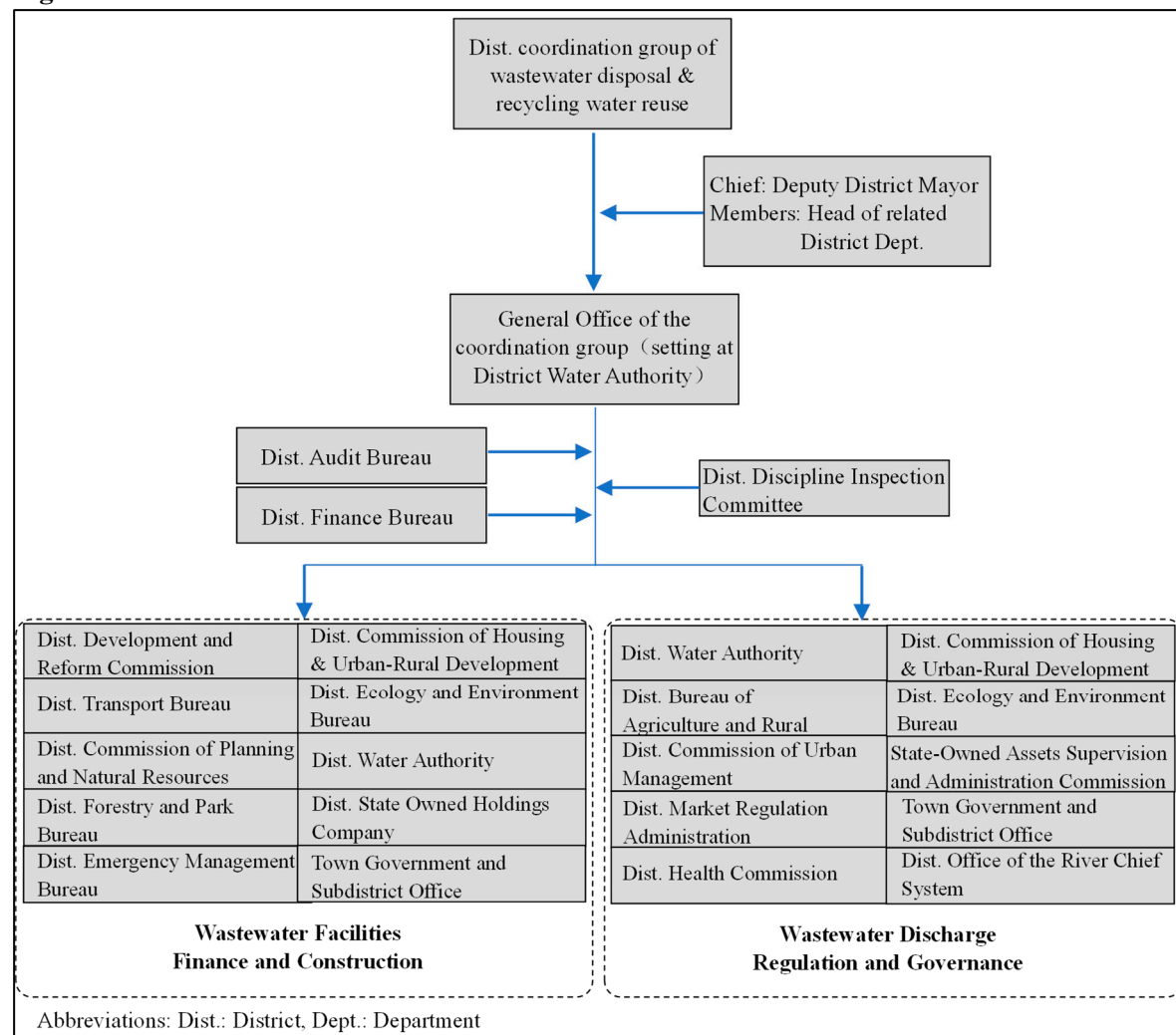
Data source: <http://english.www.gov.cn/archive/statecouncilgazette>

Table S3: Local standards of wastewater treatment and reuse in Beijing

Category	Name	Number
Collection & Treatment	Specification for Domestic Sewage Collection and Treatment in Villages	DB11/T 1495—2017
	The stipulation of energy consumption of municipal wastewater treatment	DB11/T 118—2014
	Technical specification constructed wetlands for rural sewage treatment engineering	DB11/T 376—2016
	Technical guidelines for odor control project of municipal reclaimed water plant	DB11/T 1755—2020
Wastewater Discharge	Discharge standard of water pollutants for municipal wastewater treatment plants	DB11/890—2012
	Discharge standard of water pollutants for rural sewage treatment facilities	DB11/ 1612—2019
Wastewater Reuse	Code for design of sewage-source heat pump system	DB11/T 237—2015
	Guidelines for the use of urban reclaimed water —Part 4: Scenic environment uses	DB11/T 1767.4—2021
	Guidelines for the use of urban reclaimed water —Part 1: Industrial uses	DB11/T 1767—2020
	Technical guideline for agricultural irrigation with reclaimed water	DB11/T 740—2010
	Technical specifications for green space irrigation with reclaimed water	DB11/T 672—2009
	Technical code for reclaimed water heat pump system	DB11/T 1254—2015
WWTP Construction & Operation	Technical specification for grade assessment of work safety Part 65: Municipal wastewater treatment plant (reclaimed water plant)	DB11/T 322.65—2019
	Monitoring and testing for energy saving of sewage-source heat pump heating system	DB11/T 1651—2019
	Guidelines for real-time monitoring of water flow and water quality for domestic sewage treatment facilities in rural areas	DB11/T 1852—2021
	Code for operation and safety management of underground water reclamation plant	DB11/T 1818—2021
	Assessment indicator system of ecological water reclamation plant	DB11/T 1658—2019

Data source: <http://scjgj.beijing.gov.cn/cxfw/>

Figure S1: Governance structure of wastewater treatment and reuse at the district level



Data sources: *Three-year action plan of Pinggu district for promoting the construction of wastewater treatment and reclaimed water reuse (2013-2015); Three-year action plan of Daxing district for further promoting wastewater treatment and reclaimed water reuse works (2016-2019); Three-year action plan of Changping district for further promoting urban-rural aquatic environment governance work (2019-2022).*