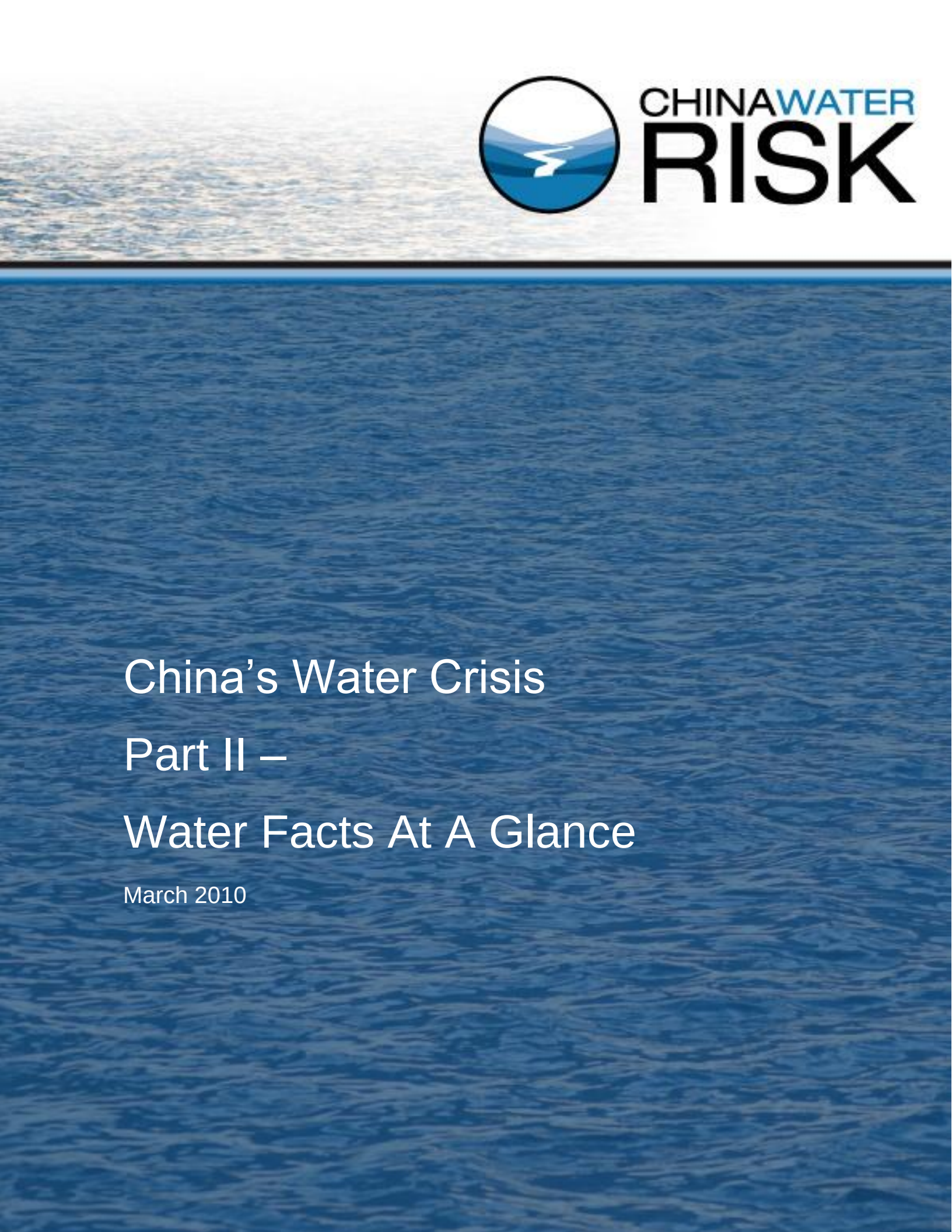


CHINAWATER RISK

China's Water Crisis

Part II –

Water Facts At A Glance

March 2010

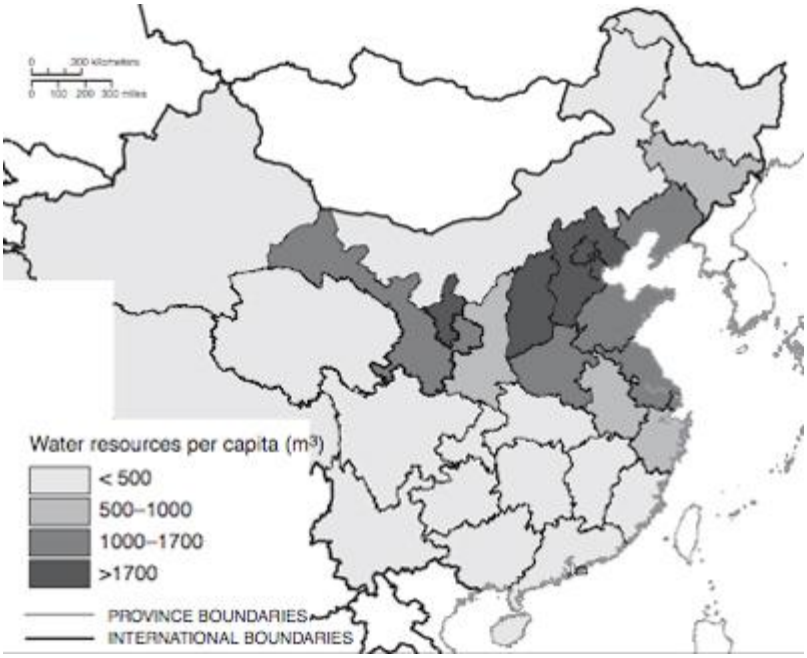
China's Water Crisis
Part II – Water Facts At A Glance

Contents

1. Who's Running Dry?

- China will have exploited all of its available water supplies by 2030, the government has warned[1].
- China's per capita natural freshwater resources are expected to decline to 1,875 m^3 by 2033, down from 2,156 m^3 in 2007 (among the lowest per capita for a major country). 1,000m^3 per capita is regarded the world water poverty mark[2].
- 60% of China's 660 cities are short of water[3].
- 108 cities, including Beijing and Tianjin, face serious water shortages. Beijing has 230 m^3 per capita of fresh water, far below the world water poverty mark[4].
- South China (the Yangtze River basin and areas to its south) accounted for 80.4% of the nation's naturally available water resources but only 53.3% of the population, whereas Northern China accounted for 19.6% of the water resources but 46.7% of the population[5].
- In 2006, nearly half of China's major cities did not meet provincial drinking-water quality standards[6]

Figure 1: Water Resources per Capita



Source: World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009.

For more information on scarcity and regional differences please refer to SCARCITY in The Big Picture on the China Water Risk website (www.chinawaterrisk.org).

[1] Buckley, Chris, China says water supplies exploited by 2030, Beijing Reuters, December 14, 2007
[2] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[3] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[4] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[5] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[6] Organisation for Economic Cooperation and Development (OECD), Environmental Performance Review of China, Paris, France, July 2007

2. North-South Divide

2.1 Southern China

- The Pearl River basin is faring better than many of the other great river systems in China in terms of quality. Water resources for the basin total 284 billion m^3, providing 2.383 m^3 per capita[7].
- Southern China has experienced multiple severe droughts over the last few years:
    - From October 2004 through January 2005, southern China suffered from what local authorities described as the worst drought in at least 50 years. The drought endangered the supply and quality of drinking water for more than 15 million people in the Pearl River Delta, Hong Kong, Hainan and elsewhere in the region[8]
    - In 2007 a severe drought left well over a million people short of drinking water[9]
    - In March 2010 another severe drought affected most of South-West China; about 51 million people faced water shortages, economic damage to agriculture and failed electricity generation from hydroelectric dams is estimated to be at least RMB 24 billion (USD 3.5 billion). The drought affected non-ferrous metal production in Guangxi, including of electrolytic zinc, with companies in Nandan County cutting production by 30%

2.2 Northern China

- In northern China, 45% of the water is considered unfit for human consumption, compared to 10% in southern China. For example, 80% of the rivers in the northern province of Shanxi have been rated "unfit for human contact."[10]
- The annual per capita level of naturally available water resources in the Huang-Huai-Hai River basin area ranges from 358 m^3 in the Hai-Luan basin to 750 m^3 in the Huang, both being below the world water poverty mark[11].
- In the Hai River basin, where Beijing and Tianjin are located, just 1.5% of China's water resources are available to support 10% (130 million people) of the total population[12.]
- The annual sustainable supply of groundwater in the Hai River basin is estimated at about 17.3 km^3 (17.3 billion m^3), while withdrawals were 26.1 km^3 (26.1 billion m^3). This indicates an annual over-extraction of 8.8 km3 (8.8 billion m^3)[13.]

[7] Civic Exchange, Liquid Assets: Water Security and Management in the Pearl River Basin and Hong Kong, December 2009
[8] USDA, Production Estimates and Crop Assessment Division Foreign Agricultural Service, Recent Rain Eases Drought in Southern China, 2005
[9] Gleick, Peter H., The World's Water 2008-2009: The Biennial Report on Fresh Water Resources, Island Press, December 2008
[10] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[11] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[12] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[13] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009

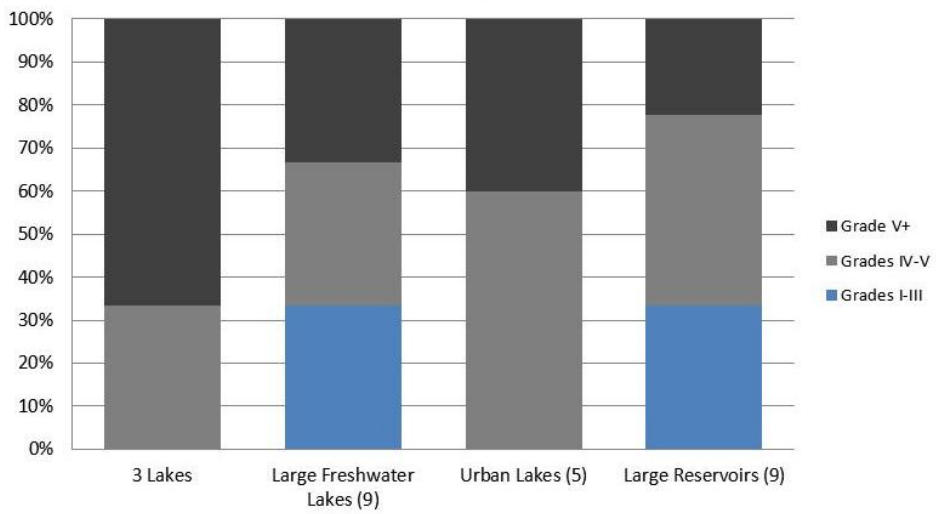
- It is estimated that over 80% of the wetlands in the North China Plain have been lost, and natural streams and creeks have dried up as a result of groundwater and surface water overdrafts[14].

3. Water Pollution

3.1 Overview

- More than three-quarters of the surface water flowing through China's urban areas is considered unsuitable for drinking or fishing[15].
- In MEP 2009, it was stated that about 42.7% of the rivers and more than three-quarters of the lakes and reservoirs in China are considered unsuitable for drinking or fishing[16].
- According to the Ministry of Water Resources in 2008-2009 there were 53627 water-related pollution violation cases, 92.65% of which were settled, resulting in preventing a further estimated economic loss of RMB 216.4 million.
- About 4.05 million hectares, or 7.4% of the nation's irrigated lands, are irrigated with polluted water; two-thirds of this land is in northern China[17].

Figure 2: Overall Water Quality of China's 26 Key Lakes and Reservoirs, 2009



Source: Graph based on data from MEP, "2009 State of the Environment Report"

[14] Gleick, Peter H., The World's Water 2008-2009: The Biennial Report on Fresh Water Resources, Island Press, December 2008
[15] Turner, Jennifer L., In Deep Water: Ecological Destruction of China's Water Resources, 2007. Original source: Chao Shengyu, Underground Water in 90% of Chinese Cities Polluted, Xinhua News, 2005
[16] MEP, 2009 State of the Environment Report
[17] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009

3.2 Rivers

- In 2009, the Ministry of Environmental Protection (MEP) reported that 18.4% of 408 sections of 203 rivers were graded worse than the Grade V standard. (Water quality is monitored in more than 2,000 river sections across the main rivers in China.)[18]

- In 2009, of all the 408 of 203 river sections:

    - 57.3% met the Grades I–III surface water quality standard;
    - 24.3% met Grades IV–V standards; and
    - 18.4% failed to meet Grade V[19]

Box 1: China's River Pollution Grades

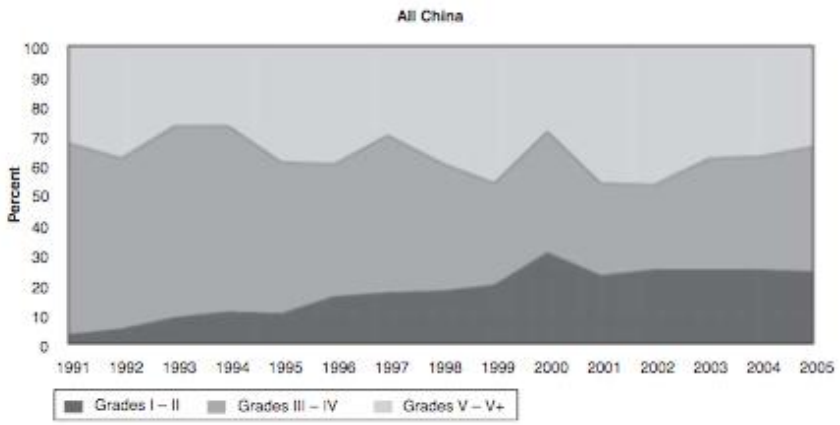
China's River Pollution Grades	
The source of the water body and national nature reserve	Drinking Water Quality
Class one water source protection area for centralized drinking water supply, natural habitat for rare species of fish and spawning grounds for fish and shrimps	
Class two water source protection area for centralized drinking water supply, sanctuaries for common species of fish and swimming zones	
Mainly applicable to water bodies used for general industrial water supply and recreational waters in which there is no direct human contact with the water (nonphysical)	Polluted
Mainly applicable to water bodies used for agricultural water supply and for general landscape requirements	Polluted
Essentially useless	Highly Polluted

Source: World Bank 2009

- In 2007, Chinese officials announced that over one third of the fish species native to the Yellow River had disappeared due to damming or pollution[20].
- An estimated 20,000 chemical factories, half of which are along the Yangtze River, are dumping uncontrolled or only marginally controlled pollutants into China's rivers[21].

[18] MEP, 2009 State of the Environment Report
[19] MEP, 2009 State of the Environment Report
[20] Economy, Elizabeth C., The Great Leap Backwards? The Costs of China's Environmental Crisis Foreign Affairs 86.5, Sept-Oct 2007: 37-59
[21] Gleick, Peter H.,The World's Water 2008-2009: The Biennial Report on Fresh Water Resources, Island Press, December 2008

Figure 3: Trends in Water Quality at Monitored River Sections in China, 1991-2005



Source: China Water Quality Management: Policy and Institutional Considerations (World Bank 2006a).

3.3 Lakes

- In 2009, MEP reported that of the 26 major lakes and reservoirs monitored:
  - 23.1% met the Grades I–III standard;
  - 42.3% met Grades IV–V standards; and
  - 34.6% failed to meet Grade V+[22].

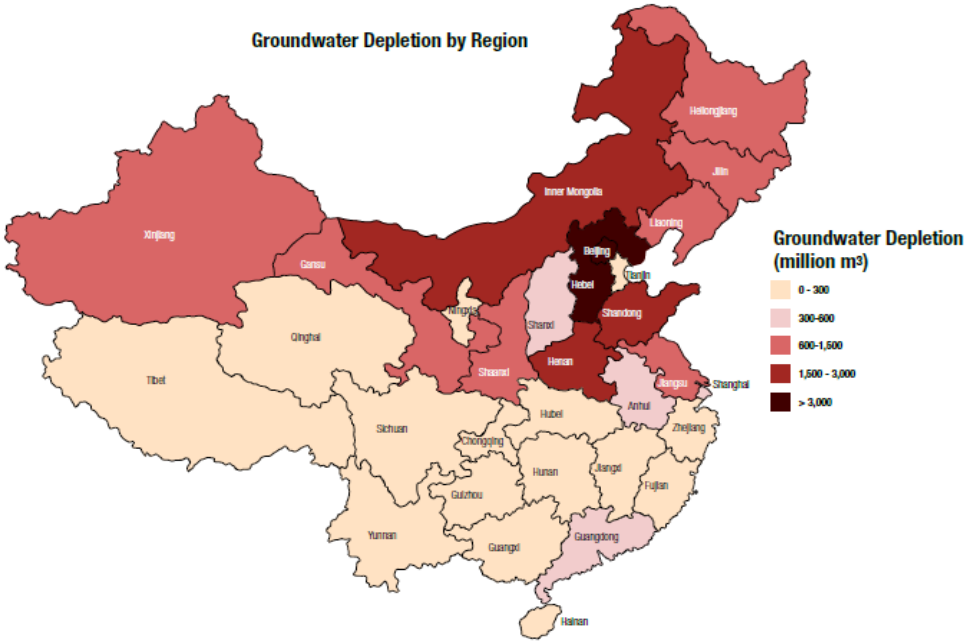
- Northern China's largest natural freshwater lake, Lake Baiyangdian, is both disappearing and grossly polluted[23].
- In 2007, there was serious eutrophication of Taihu Lake, which supplies the city of Wuxi. 70% of the local water supply became unusable severely affecting the water use of 2 million people[24].
- In 2007, it was reported that the overall water quality of Taihu Lake (the third largest freshwater lake in China) was worse than Grade V. Among 88 surface sections under the national monitoring program, 19.3% had water quality worse than Grade V[25].
- The overall water quality of Dianchi Lake (the largest freshwater lake in Yunnan Province and the sixth largest in China) was worse than Grade V. Rivers surrounding Dianchi Lake were badly polluted. Among the eight surface water sections under the national monitoring program, 62.5% had water quality worse than Grade V[26].
- The overall water quality of Chaohu Lake (the fifth largest freshwater lake in China) was Grade V. Among 12 surface water sections under national monitoring program, 41.7% had water quality worse than Grade V[27].
- In 2009, the Ministry of Environmental Protection (MEP) reported that 42.3% of the 26 lakes (reservoirs) under national monitoring programs on their nutrition state suffered from eutrophication[28].

[22] MEP, 2009 State of the Environment Report, 2009
[23] Gleick, Peter H., The World's Water 2008-2009: The Biennial Report on Fresh Water Resources, Island Press, December 2008
[24] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[25] MEP, 2009 State of the Environment Report, 2009
[26] MEP, 2009 State of the Environment Report, 2009
[27] MEP, 2009 State of the Environment Report, 2009
[28] MEP, 2009 State of the Environment Report, 2009

3.4 Groundwater Pollution and Depletion

- In 2009, the World Bank reported that a deficit of surface water has led to excessive overexploitation of groundwater resources, which in turn has resulted in the rapid depletion of groundwater reservoirs. For instance, in Beijing, groundwater tables have dropped by 100 to 300 meters.
- As much as 24 km^3 (24 billion m^3) of water beyond the amount that can be replenished through natural processes, is extracted from the ground. This leads to a lowering of water tables and the eventual exhaustion of groundwater reservoirs, as well as extensive subsidence (downward shift of the surface of the earth relative to sea level) in many cities[29].

Figure 4: China Groundwater Depletion (million m^3)



- In 2006, the World Bank reported that subsidence of up to several meters has been observed in cities like Beijing, Tianjin, Taiyuan, Shijiazhuang and Shanghai, causing damage to buildings and bridges, and even the collapse of construction projects[30].
- Half of the shallow groundwater in China is contaminated[31].
- 90% of urban groundwater is contaminated[32].
- Anecdotal evidence suggests that deep wells around Beijing now have to reach 1,000 meters to tap fresh water, adding dramatically to the cost of supply[33].
- In its 2009 State of the Environment Report, China's Ministry of Environmental Protection reported that based on monitoring data of 641 wells in the eight provinces,

[29] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[30] World Bank, Addressing China's Growing Water Shortages and Associated Social and Environmental Consequences, World Bank Policy Research Working Paper 3895, Washington, DC,2006
[31] Senior Official with the China Geological Survey (CGS), Xinhua News, October 8, 2006
[32] Turner, Jennifer L., In Deep Water: Ecological Destruction of China's Water Resources, 2007. Original source: Chao Shengyu, Underground Water in 90% of Chinese Cities Polluted, Xinhua News, 2005
[33] World Bank, China: Agenda for Water Sector Strategy for North China: Volume 1 Summary Report, April 2001

autonomous regions and municipalities of Beijing, Liaoning, Jilin, Heilongjiang, Shanghai, Jiangsu, Hainan, Ningxia and Guangdong:

- 2.3% had grade I-II quality;
- 23.0% had grade III quality; and
- 73.8% had grade IV-V quality

Please refer to POLLUTION in The Big Picture on the China Water Risk website (www.chinawaterrisk.org).

4. Water Use Efficiency

- China's water consumption for every RMB 10,000 of industrial value-add is 5 to 10 times that of developed countries[34]
- Chinese industry uses four to ten times more water per unit of production than the average in industrialised nations[35]
- China's water productivity of $12.26/m^3 is low in comparison with the average of G20 countries of 42.86/m^3. The per capita water productivity for a country is calculated by dividing GDP (adjusted for Purchasing Power Parity (PPP)) by per capita water withdrawal[36]
- The utilisation rate of irrigation water in China is only between 40 and 45% [37], the rest is wasted as a result of inefficient irrigation systems or leaks away during transport
- The McKinsey Global Institute estimates that a reduction of water leakage from pipes alone could save up to 20 billion tonnes of water annually[38.]

5. Inadequate Wastewater Treatment

- In 2007, China's total annual discharge of municipal and industrial wastewater reached 55.6 billion tonnes[39], of which only 56% had some form of treatment[40].
- In 2009, the World Bank reported that about 20 billion m^3 of untreated wastewater per year is directly discharged into water bodies in China[41].
- The Tenth Five-Year Plan (2001–2006) mandated the construction of thousands of new wastewater treatment plants, yet a 2006 survey by SEPA revealed that half of new plants actually built were operating improperly or not at all[42].
- A water study from 2006 found that 28 of the rivers in Guangdong were severely polluted, as a result of less than 2% of wastewater in the province's townships and cities being treated. The sewage treatment plants were either not in operation or not connected to collection systems[43.]

[34] NDRC,China Water Conservation Technology Policy Outline, 2005
[35] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[36] Responsible Research, Water in China: Issues for Responsible Investors, February 2010
[37] NDRC, China Water Conservation Technology Policy Outline, 2005
[38] McKinsey Global Institute, Preparing for China's Urban Billion, March 2008
[39] Note that other organisations may have conflicting figures. MWR in its 2007 -2008 Annual Report refer to a figure of 75 billion tonnes
[40] Ministry of Environmental Protection, 2007 State of the Environment Report, 2007
[41] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[42] Boyle, Christine E, Water-borne Illness in China, August 20, 2007
[43] Civic Exchange, Liquid Assets: Water Security and Management in the Pearl River Basin and Hong Kong, December 2009

6. Economic and Health Impacts of Water Pollution

6.1 Economic Impacts

- The external cost of water shortages and pollution already amounts to around 2.3% of China's GDP, of which 1.3% is attributable to the scarcity of water, and 1% to the direct impact of water pollution; the World Bank indicates that the actual costs are probably much higher[44]
- The economic cost of diseases and deaths associated with the excessive incidence of diarrhea and cancer in rural China has been estimated, based on 2003 data, at around RMB 66.2 billion[45].
- The impact of irrigating with polluted water in designated wastewater irrigation zones—considering only the impact on yields and produce quality, but not on human health—was estimated to reach RMB 7 billion in 2003[46].
- In July 2007, after SEPA asked local authorities in areas along the country's four major rivers to change the priority from economic development to environmental protection, 700 enterprises were closed, suspended or renovated[47].

For more on economic risks for business and investors please download the booklet "Water: The New Business Risk" on the CWR website (www.chinawaterrisk.org).

6.2 Health Impacts

Drinking Water

- The OECD estimates that hundreds of millions of Chinese are drinking water contaminated with inorganic pollutants such as arsenic and excessive fluoride, as well as toxins from untreated factory wastewater, inorganic agricultural chemicals and leeching landfill waste[48]
- According to a national survey, about 25% of over 1,000 source areas of drinking water nationwide do not meet the national water quality standard[49].
- In rural areas, around 300 million people rely on unsafe drinking water[50].
- According to the Guangdong Water Resources Department, in 2007, 7.25 million rural people in Guangdong accessed polluted drinking water[51].
- 63 million people in China consume water with high concentrations of fluorine[52]. The 1984 issue of Clinical Toxicology of Commercial Products lists fluoride as more poisonous than lead and just slightly less poisonous than arsenic; causing dramatically premature and fatal ageing of the whole body and cancer.

[44] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[45] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[46] World Bank, Cost of Pollution In China, Economic Estimates of Physical Damage, 2007
[47] Xinhua News, China's Environmental Chief Reiterates Measures to Combat Water Pollution, 2007
[48] Organisation for Economic Cooperation and Development (OECD), Environmental Performance Review of China, Paris, France, July 2007
[49] Sheng, Huaren, The Inspection Report of the Implementation of China Water Pollution Prevention Law, A Report to the 16th Plenary of the Standing Committee of the NPC on June 26, 2005, China Environment News, June 29, 2005
[50] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[51] Civic Exchange, Liquid Assets: Water Security and Management in the Pearl River Basin and Hong Kong, December 2009
[52] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009

- 190 million drink water with unhealthy levels of hazardous materials[53].
- 38 million people drink salty water, which dehydrates the body and can result in a variety of health issues[54].

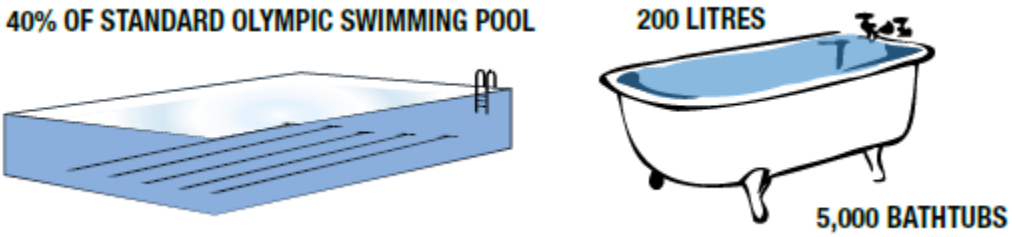
Sickness and Mortality

- 100,000 People die annually from water pollution-related illnesses in China[55].
- Research indicates that along major rivers and large lakes in China, communities suffer from higher than normal rates of cancer, tumors, spontaneous abortions and diminished IQs caused by the high level of contaminants in the soil and water[56].
- The effect of polluted water on people is shown by the fact that mortality rates for liver and stomach cancer in China are well above the world average. The mortality rates for liver, stomach and bladder cancer were found to be highest in rural areas because of the lower quality of water than found in cities[57].
- The lack of access to piped water has been associated with a 26% increase in diarrhea in children under five years of age[58].
- OECD Environmental Indicators in China estimate that in July 2007, 30,000 children in rural communities die each year from diarrhea caused by polluted water[59]
- Access to safe drinking water could potentially cut the number of under-five child deaths from diarrhea by over 50%, and the number of deaths from acute respiratory infection by almost 40%[60].
- The World Health Organisation reported an incidence of 108.4 mortalities per 100,000 persons from diarrhea-related illness in China in 2002 (WHO 2003). In comparison, Vietnam's diarrheal disease mortality rate in 2002 was under 11 per 100,000 people; Thailand's was under 5 (WHO 2004).
- A 2005 report prepared by researchers at the Chinese Academy of Sciences and the University of California, Davis, estimates that more than 20 million rural residents living in 20,000 villages are using groundwater contaminated by industrial runoff[61].

[53] Sheng, Huaren, The Inspection Report of the Implementation of China Water Pollution Prevention Law, A Report to the 16th Plenary of the Standing Committee of the NPC, June 26, 2005, China Environment News, June 29, 2005
[54] Sheng, Huaren, The Inspection Report of the Implementation of China Water Pollution Prevention Law, A Report to the 16th Plenary of the Standing Committee of the NPC, June 26, 2005, China Environment News, June 29, 2005
[55] WHO, cited in Water in China, Pacific Environment, http://www.pacificenvironment.org/article.php?id=1878
[56] Economy, Elizabeth C., The River Runs Black: The Environmental Challenge to China's Future, Ithaca: Cornell University Press, 2004
[57] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[58] World Bank, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, 2009
[59] Organisation for Economic Cooperation and Development (OECD), Environmental Performance Review of China, Paris, France,, July 2007
[60] Debbie Yan Lee, Child Mortality and Water Pollution in China: Achieving Millennium Development Goal 4, July 2007
[61] CLSA, Thirsty China: Its key resource constraint is water, CLSA, 2006

7. Measurement Perspectives

What does a cubic metre of water look like?



CONVERSIONS

$10cm^3$ = 1 litre = 1 kg
$15cm^3$ = 1.5 litres (standard large bottled water)
$0.2m^3$ = 200 litres (full average bath tub)
$1m^3$ = 1,000 litres
$1,000m^3$ = 1 tonne (World Bank Water Poverty Mark)
$1,816m^3$ = 1.8 tonnes China's National average of Renewable Water Resources per capita
$2,500m^3$ = 2.5 tonnes (Olympic swimming pool minimum size)
1 km^3 = $1,000,000,000m^3$ = 1 TL