Northwest Planning Region

REGIONAL DESCRIPTION

The Northwest Planning Region covers 11 counties totaling 14,339 square miles (Figure 27). The counties include Alfalfa, Beaver, Blaine, Cimarron, Dewey, Ellis, Harper, Major, Texas, Woods and Woodward. The Panhandle counties of Cimarron, Texas and Beaver are generally flat while the remainder of the region is characterized by rough terrain marked with high sand hills and deep erosion. This region contains 20.2 percent of the state's total land area and supports the most extensive agricultural activities in Oklahoma. The Northwest Planning Region accounts for approximately 59 percent of the total statewide projected agricultural water demand. Crops and feed cattle flourish on lands irrigated from the Ogallala Aquifer and terrace and alluvium deposits.

The climate is semi-arid in the Panhandle and sub-humid in the remainder of the region. Annual precipitation ranges from 16 to 28 inches, including an average of 18 inches of snowfall. The majority of the precipitation occurs in the spring with May being the wettest month of the year. Thunderstorms producing high winds and damaging hail are a common occurrence throughout the region. Annual evaporative losses from lakes in the region range from 56 to 64 inches and greatly exceed precipitation. These losses create critical and persistent water problems and greatly affect the design of reservoirs in the region. Droughts are fairly common and mean annual temperatures range from 54 degrees in the Panhandle to 60 degrees in the southeast corner of the region. While flooding is relatively uncommon in the Northwest Region, four large flood control reservoirs and a few smaller watershed protection structures protect the area from widespread agricultural and property losses.

WATER RESOURCES

Stream Water

Table 24 summarizes stream water development of the Northwest Planning Region. The four major streams in the region are the Cimarron River, Salt Fork of the Arkansas River, North Canadian (Beaver) River and Canadian River. Available stream water quality is inadequate and quantity is insufficient to provide significant amounts of water to the region. Water quality in all major streams is poor, containing excessive amounts of salt and other dissolved minerals. This results in most local surface water being unacceptable under public health standards for municipal or industrial use.

The Cimarron River, encompassing 18,927 square miles of drainage area, originates in New Mexico and terminates in Keystone Lake. Of its 698 total miles of length, approximately 410 are in Oklahoma. Water quality in the river is degraded by salt sources near the Harper/Woods County line, often raising the salt content of the river to levels that exceed that of sea water. The water is very hard with moderate to high turbidity and some toxic metals problems. Dissolved oxygen levels are typically at or near saturation throughout the year.

The Salt Fork of the Arkansas River enters the state from Kansas in northeast Woods County. While water quality in many of its tributaries is of good or fair quality, the river is highly mineralized and chemically unsuitable for most beneficial uses.

The North Canadian River, also known as the Beaver River, enters Oklahoma in southwestern Cimarron County from New Mexico and has a drainage area of approximately 9,100 square miles. Water quality of the river in this region is generally poor due to elevated levels of nitrogen and phosphorus in the upper portion and increased mineralization by sulfates and chlorides downstream. Downstream from where Palo Duro Creek joins the North Canadian River east of Hardesty, high levels of sodium and other dissolved minerals cause fair to poor quality for irrigation purposes. Upstream from the junction with Palo Duro Creek, water is of good quality and suitable for most uses.

The Canadian River enters into Oklahoma from Texas. Within this planning region, water in the river is hard and highly mineralized. Nutrient levels are high where the river enters the state, but diminish as it flows through the state. Turbidity and pH occasionally exceed standards but dissolved oxygen is typically at or near saturation throughout most of the year.

MAJOR RESERVOIRS

There are four major reservoirs in the Northwest Planning Region. Canton and Fort Supply provide water for municipal and industrial use, while Great Salt Plains Lake and Optima Reservoir serve primarily as flood control structures.

Canton Lake is located in Blaine County on the North Canadian River in the Arkansas River Basin approximately two miles north of Canton and 75 miles northwest of Oklahoma City. The project, completed by the Corps of Engineers in April 1948, has a drainage area of 12,483 square miles. Its authorized purposes are flood control, water supply and irrigation. In addition, eight recreation areas have been developed around the lake which is the primary source of walleye eggs used by state fish hatcheries for stocking in other lakes. The lake contains 265,790 ac-ft of flood control storage, 97,170 ac-ft of water supply storage, and has a water supply yield of 13,440 af/yr (12 mgd). All yield, including irrigation storage, is allocated to Oklahoma City in the Central Planning Region.

Fort Supply Lake, located on Wolf Creek, a tributary of the North Canadian River in Woodward County, is about one mile south of the town of Fort Supply and about 12 miles northwest of Woodward. This Corps project, completed in May 1942, encompasses a drainage area of 1,735 square miles. Flood control and water supply are the authorized uses of the lake. The Corps maintains four public use areas covering 542 acres at the project. The lake contains 86,800 ac-ft of flood control storage, 13,900 ac-ft of conservation storage (which includes 400 ac-ft of water supply storage), and has a water supply yield of 224 af/yr (0.2 mgd).

Great Salt Plains Lake is located on the Salt Fork of the Arkansas River in Alfalfa County, approximately 5.5 miles northeast of Jet and about 12 miles east of Cherokee. This project, built by the Corps in 1941, is authorized for flood control, recreation, and fish and wildlife and has a drainage area of 3,200 square miles. Except for 761 acres in the vicinity of the dam, which is under Corps jurisdiction, the Great Salt Plains National Wildlife Refuge is administered by the U.S. Fish and

Wildlife Service. The lake contains 239,980 ac-ft of flood control storage and conservation storage of 31,420 ac-ft. Due to high mineral content, the lake is not utilized for water supply.

Optima Lake is located on the North Canadian River in Texas County, about 4.5 miles northeast of Hardesty and 20 miles east of Guymon. The project was completed by the Corps of Engineers in 1978. However, to date, the conservation pool has yet to fill; the maximum water surface elevation attained was 3.1 feet below the top of the inactive pool (May 1980). The lake is authorized for flood control, water supply, recreation, and fish and wildlife purposes with a drainage area of 5,029 square miles. The lake contains 71,800 ac-ft of flood control storage and 76,200 ac-ft of water supply storage. There is no dependable water supply yield in Optima at this time.

MAJOR MUNICIPAL LAKES

There are six major municipal lakes in the Northwest Planning Region, all owned by the State of Oklahoma with recreation as their authorized purpose. They are Lake Carl Etling (1,717 ac-ft of approximate conservation storage), Lake Schultz (528 ac-ft), Lake Chambers (708 ac-ft), Lake Lloyd Vincent (2,579 ac-ft), American Horse Lake (2,200 ac-ft) and Lake Watonga (656 ac-ft). None of the lakes are used for water supply.

AUTHORIZED DEVELOPMENT

There are no major authorized water supply projects in the Northwest Planning Region.

POTENTIAL DEVELOPMENT

The northwest Oklahoma/southwest Kansas area has been extensively studied for potential water supply projects. But, due to water quality considerations and the insufficient availability of stream water, there is limited potential for additional stream water development in this region (Table 24).

Modifications to Fort Supply have been proposed to increase the annual yield to 11,500 af/yr (10.3 mgd). To accomplish this, the conservation storage would be raised to 30,000 ac-ft while the existing spillway crest would be raised five feet to maintain the 86,800 ac-ft of flood control storage.

Forgan Reservoir is a potential project on the Cimarron River in southwest Kansas, near the Kansas/Oklahoma border. As proposed, the project would include 77,500 ac-ft of conservation storage, 26,500 ac-ft of flood control storage, and a firm yield of 24,100 af/yr (21.5 mgd). However, water from the impoundment would require treatment (including implementation of a reverse osmosis process) to meet drinking water standards, reducing the yield for M&I purposes to 12,450 af/yr (11 mgd), one-half of which would be available to Oklahoma. Modification of the Arkansas River Basin Compact would be required prior to construction.

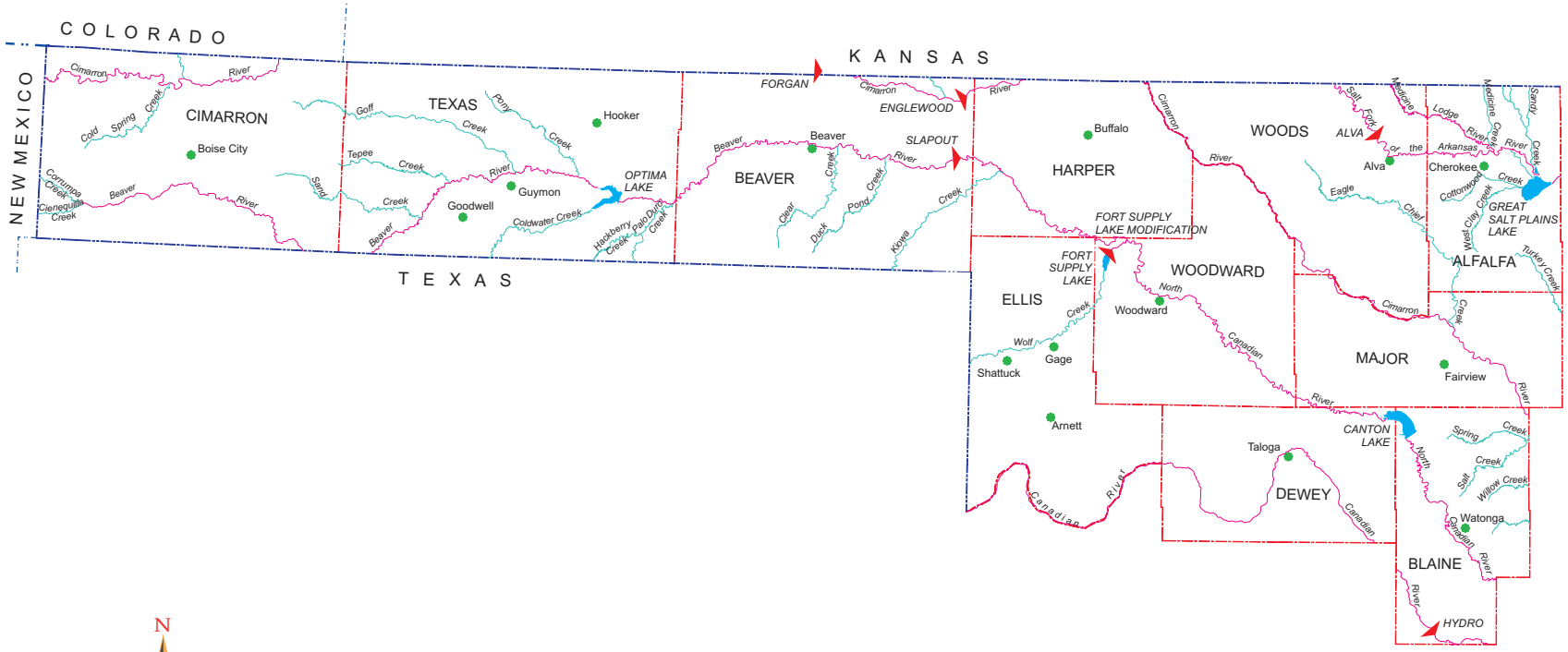
Englewood Reservoir is another potential impoundment on the Cimarron River in Beaver County. As proposed by the Corps of Engineers, the project would include 110,900 ac-ft of flood control storage and 63,500 ac-ft of conservation storage yielding 37,000 af/yr (33 mgd). As with

Table 24
STREAM WATER DEVELOPMENT
Northwest Planning Region

PROJECT	STREAM	PURPOSE*	FLOOD CONTROL STORAGE (acre-feet)	WATER SUPPLY STORAGE (acre-feet)	WATER SUPPLY YIELD (ac-ft/year)
		EXISTING OR UNDER CONSTRUCTION			
Canton	North Canadian River	ws, fc, i	265,790	97,170	---- [1]
Fort Supply	Wolf Creek	ws, fc	86,800	400	224
Great Salt Plains	Salt Fork of Arkansas River	fc, r, fw	239,980	---	---- [2]
Optima	North Canadian River	ws, fc, r, fw	71,800	76,200	---- [3]
TOTAL			**664,370**	**173,770**	**224**
		POTENTIAL			
Alva	Salt Fork of Arkansas River	ws, fc, r, fw, i	98,600	200,500	32,500
Englewood	Cimarron River	ws, fc, r, fw, i	110,900	63,500	37,000
Forgan	Cimarron River	ws, fc, r, fw	26,500	77,500	12,450 [4]
Fort Supply Modification	Wolf Creek	ws, fc, r, fw	---	29,600	11,276 [5]
Hydro	Canadian River	ws, fc, r, fw	---	173,000	114,900
Slapout	North Canadian River	ws, fc, r, fw	137,000	249,000	18,800
TOTAL			**373,000**	**793,100**	**226,926**
TOTAL YIELD					**227,150**

*ws-municipal water supply, fc-flood control, r-recreation, fw-fish and wildlife, i-irrigation.

[1] Entire 18,480 af/yr available yield allocated to Oklahoma City in the Central Region.
[2] Water unsuitable for use due to high mineral content.
[3] Lake has never filled; no dependable yield.
[4] Proposed reservoir in southwest Kansas. Of proposed 24,100 af/yr yield, approximately 17,000 af/yr would be available for M&I purposes, resulting in approximately 12,450 af/yr after treatment losses. One-half of the water would be available to Oklahoma.
[5] Additional yield with modification.



Reservoir, Existing or Under Construction

Reservoir, Potential Modification

Reservoir, Potential

Mainstem

Tributary

OKLAHOMA COMPREHENSIVE WATER PLAN

Figure 27
NORTHWEST PLANNING REGION

Mapping and Graphics - Oklahoma Water Resources Board

Forgan Reservoir, water quality would be poor and the Arkansas River Basin Compact would require modification to allow construction.

Hydro Reservoir is a project proposed for construction on the Canadian River in Blaine County. The reservoir would provide 173,000 ac-ft of conservation storage with a yield of 114,900 ac-ft (102.6 mgd). The water is anticipated to be of marginal quality, although chloride levels should be within acceptable limits. However, sulfates may require treatment.

Regarding other potential projects in the region, Alva is expected to have poor water quality and the proposed site is not in close proximity to areas with anticipated demands. Uncertainty regarding future storage flows at Slapout, which would be constructed downstream of Optima Lake, decreases the potential viability of that project.

STREAM WATER RIGHTS

As of June 1994, the OWRB had issued stream water allocation permits totaling 41,615 ac-ft per year from lakes, rivers and streams within the Northwest Planning Region (Table 25).

Groundwater

Groundwater is the major source of water supply in the Northwest Planning Region. The region overlies alluvium and terrace deposits of the Salt Fork of the Arkansas River, Cimarron River, Beaver/North Canadian River and Canadian River, as well as three bedrock aquifers -- the Ogallala Formation, Rush Springs Sandstone and Cedar Hills Sandstone.

The Ogallala Formation, which is the single largest source of groundwater in the state, underlies the Panhandle and portions of extreme western counties in Oklahoma. The water is of good quality, although hard, and some local portions of the formation have high fluoride and chloride concentrations. The semi-consolidated aquifer consists primarily of fine sands and silt with lesser quantities of gravel, clay and minor beds of limestone and caliche. The saturated thickness of the formation ranges from a few feet to more than 500 feet. Wells range from 100 to 500 feet in depth with yields commonly between 100 and 1,000 gpm. The Ogallala in Oklahoma has an estimated storage of 112 million acre-feet, based on USGS studies. Even with the aquifer's large storage volume, localized water levels have declined in recent years, with some wells reporting drops of up to 100 feet.

The Rush Springs Sandstone is a fine-grained sandstone aquifer with some shale, dolomite and gypsum. Within the region, the aquifer is found in portions of Blaine and Dewey Counties. Thickness of the formation ranges from 200 feet in the southern end to 300 feet in the north. Well depths are usually 200 to 400 feet and yield between 200 and 600 gpm. The water tends to be of a calcium bicarbonate type and very hard, though suitable for most uses. Levels of TDS are generally less than 500 mg/L.

The Cedar Hills Sandstone Aquifer is found in portions of Woods, Alfalfa and Major Counties. While not widely used, the aquifer is a fine- to medium-grained sandstone, siltstone and silty shale. Wells yield between 150 and 300 gpm from

Table 25
WATER RIGHTS
Northwest Planning Region

STREAM WATER ALLOCATIONS
(acre-feet)

COUNTY	Municipal	Industrial	Agricultural	Commercial	Rec, F&W	Power	Other	TOTAL
Alfalfa	---	---	1,093	---	3,494	---	---	4,587
Beaver	---	---	1,981	---	423	---	---	2,404
Blaine	---	5	2,015	---	553	---	---	2,573
Cimarron	---	---	4,087	10	665	---	---	4,762
Dewey	---	---	---	---	700	---	---	700
Ellis	---	---	429	---	380	---	---	809
Harper	---	42	10,822	10	270	---	---	11,144
Major	---	60	1,307	---	---	---	---	1,367
Texas	---	---	3,904	---	261	---	---	4,165
Woods	---	---	174	---	20	---	---	194
Woodward	6,971	---	1,929	---	10	---	---	8,910
TOTAL	**6,971**	**107**	**27,741**	**20**	**6,776**	**---**	**---**	**41,615**

GROUNDWATER ALLOCATIONS
(acre-feet)

COUNTY	Municipal	Industrial	Agricultural	Commercial	Rec, F&W	Power	Other	TOTAL
Alfalfa	10,184	1,590	14,428	324	110	---	240	26,876
Beaver	3,525	1,039	159,723	145	27	---	1	164,460
Blaine	4,904	957	22,042	7	124	---	---	28,034
Cimarron	3,200	275	304,600	72	---	---	---	308,147
Dewey	558	2,747	35,250	---	---	---	1	38,556
Ellis	3,683	102	57,403	---	10	---	---	61,199
Harper	2,997	8	45,889	80	---	---	---	48,974
Major	28,472	309	52,327	25	2,412	---	---	83,545
Texas	10,128	3,115	566,859	898	1,056	---	---	582,056
Woods	11,180	20	17,209	648	---	60	---	29,117
Woodward	26,824	489	36,283	245	137	4,804	---	68,782
TOTAL	**105,655**	**10,652**	**1,312,012**	**2,444**	**3,876**	**4,864**	**242**	**1,439,745**

Note: Agricultural allocations include Irrigation. Mining included in Industrial.
Source of data: Oklahoma Water Resource Board printout, June 23, 1994.

formation thicknesses of 150 to 180 feet. Little water quality data is available, although the water is generally suitable for most uses.

Alluvial and terrace deposits of the Cimarron River are normally found in silt and clay deposits degrading downward to sandy clay, sand and fine gravel. Maximum thicknesses reach 80 feet with well yields ranging between 100 and 200 gpm in the alluvium and 100 to 500 gpm in the terrace deposits which are overlain by sand dunes. The water, which is very hard, is classified as a calcium magnesium bicarbonate type. Extensive pumping makes this formation susceptible to saltwater intrusion.

In the alluvial and terrace deposits of the North Canadian River, the formation consists of fine- to coarse-grained sand with minor clay and silt and local lenses of basal gravel overlain by dune sand. Formation thicknesses average 30 feet in the alluvium with a maximum of 300 feet in the terrace deposits. Yields in the alluvium range between 300 and 600 gpm and between 100 and 300 gpm in the terrace. The water is a very hard calcium bicarbonate type with TDS concentrations of approximately 1,000 mg/L.

In the alluvial and terrace deposits of the Canadian River, the formation consists of clay and silt downgrading to fine- to coarse-grained sand with lenses of basal gravel. Formation thicknesses range from 20 to 40 feet in the alluvium with a maximum of 50 feet in the terrace deposits. Yields in the alluvium range between 100 and 400 gpm and between 50 and 100 gpm in the terrace. The water is a very hard calcium bicarbonate type with TDS concentrations of approximately 1,000 mg/L.

GROUNDWATER DEVELOPMENT

Groundwater allocations in the region exceed surface water allocations by a ratio of more than 34 to 1. The scarcity of surface water, along with high agricultural demands, contribute to the region's dependance upon groundwater. Careful groundwater utilization is essential to ensuring the continued viability of the resource.

GROUNDWATER RIGHTS

As of June 1994, the OWRB had issued groundwater allocation permits totaling 1,439,745 ac-ft per year from aquifers in the Northwest Planning Region (Table 25).

SUPPLY AND DEMAND ANALYSIS

Total 2050 demands for municipal and industrial, agricultural, and power uses in the Northwest are projected to reach 1,107,300 af/yr, substantially higher than any other planning region. Preliminary analysis indicates that these demands can be met with existing surface and groundwater sources (Table 26). Due to the uncertainty associated with long-term reliability of groundwater supplies, the development of new surface water sources, either inside or outside the region, may be necessary to satisfy future demands.

Table 26
SUPPLY AND DEMAND ANALYSIS
Northwest Planning Region
(1,000 ACRE-FEET/YEAR)

	COUNTY											
SOURCE	**Alfalfa**	**Beaver**	**Blaine**	**Cimarron**	**Dewey**	**Ellis**	**Harper**	**Major**	**Texas**	**Woods**	**Woodward**	**TOTAL**
MUNICIPAL AND INDUSTRIAL COMPONENT												
Canton	---	---	---	---	---	---	---	---	---	---	---	---
Fort Supply	---	---	---	---	---	---	---	---	---	---	7.0	7.0
Optima	---	---	---	---	---	---	---	---	---	---	---	---
SCS & Municipal Lakes	---	---	0.6	1.3	---	1.3	---	---	---	---	---	3.2
Groundwater	12.4	4.7	6.0	3.5	3.3	3.8	3.1	31.2	15.2	11.8	27.7	122.9
M & I Supply	**12.4**	**4.7**	**6.6**	**4.8**	**3.3**	**5.1**	**3.1**	**31.2**	**15.2**	**11.8**	**34.7**	**133.1**
2050 M & I Demand	**2.4**	**2.6**	**5.2**	**1.4**	**1.6**	**1.9**	**1.0**	**2.4**	**9.4**	**3.8**	**13.8**	**45.5**
M & I Surplus/(Deficit)	**10.0**	**2.1**	**1.4**	**3.4**	**1.7**	**3.2**	**2.1**	**28.8**	**5.8**	**8.0**	**20.9**	**87.6**
AGRICULTURAL COMPONENT												
Canton	---	---	---	---	---	---	---	---	---	---	---	---
Fort Supply	---	---	---	---	---	---	---	---	---	---	---	---
SCS & Municipal Lakes	0.1	0.5	1.3	---	3.3	0.2	1.1	0.2	0.4	0.4	0.1	7.5
Groundwater	14.4	159.7	22.0	304.6	35.3	57.4	45.9	52.3	566.9	17.2	36.3	1,312.0
Agricultural Supply	**14.5**	**160.2**	**23.3**	**304.6**	**38.5**	**57.6**	**47.0**	**52.5**	**567.3**	**17.6**	**36.4**	**1,319.5**
2050 Agricultural Demand	**10.1**	**117.1**	**7.2**	**307.3**	**6.2**	**48.8**	**34.0**	**29.5**	**455.9**	**10.1**	**31.5**	**1,057.7**
Agricultural Surplus/(Deficit)	**4.4**	**43.1**	**16.1**	**(2.7)**	**32.3**	**8.8**	**13.0**	**23.0**	**111.4**	**7.5**	**4.9**	**261.8**
POWER COMPONENT												
SCS & Municipal Lakes	---	---	---	---	---	---	---	---	---	---	---	---
Groundwater	---	---	---	---	---	---	---	---	---	0.1	4.8	4.9
Power Supply	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**0.1**	**4.8**	**4.9**
2050 Power Demand	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**4.1**	**4.1**
Power Surplus/(Deficit)	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**0.1**	**0.7**	**0.8**
TOTALS												
Total Local Supply	**27.0**	**165.0**	**29.9**	**309.4**	**41.8**	**62.7**	**50.1**	**83.7**	**582.5**	**29.5**	**75.9**	**1,457.5**
Total 2050 Demand	**12.5**	**119.7**	**12.4**	**308.7**	**7.8**	**50.7**	**35.0**	**31.9**	**465.3**	**13.9**	**49.4**	**1,107.3**
Net Surplus/(Deficit)	**14.5**	**45.3**	**17.5**	**0.7**	**34.0**	**12.0**	**15.1**	**51.8**	**117.2**	**15.6**	**26.5**	**350.2**