

11. ECONOMIC IMPACT

11.1 Summary

Table 11-1 compares the present value of initial investment and OMR costs (October 1998 dollars) for the regional water project with selected economic impacts accruing to the United States, State of Montana, Tribes and water users. The narrative following Table 11-1 describes the analysis that resulted in the conclusions. Table 11-1 finds that life-cycle benefits exceed life-cycle costs by \$65,413,000 based on a 50-year project life and a discount rate of 4%.

TABLE 11-1
NET BENEFITS
FORT PECK RESERVATION RURAL WATER SYSTEM

<u>Statistic</u>	<u>Assiniboine and Sioux</u>	<u>Dry Prairie</u>	<u>Total Project</u>
Project Life Cycle Costs (October 1998\$)			
Federal Investment	\$99,596,000	\$35,923,000	\$135,519,000
State Investment	0	5,671,000	5,671,000
Water User Investment	0	5,671,000	5,671,000
Present Value OMR	<u>31,217,000</u>	<u>25,015,000</u>	<u>56,232,000</u>
	130,813,000	72,280,000	203,093,000
Direct Benefits			
Federal Tax Revenues From Construction			
FICA	3,224,000	1,744,000	4,968,000
Medicare	754,000	408,000	1,162,000
Montana Tax Revenues From Construction			
Gross Receipts	0	422,000	422,000
Income Tax	0	773,000	773,000
Employment in Construction	25,997,000	14,061,000	40,058,000
Employment in OMR	31,217,000	25,015,000	56,232,000
Increased Livestock Income	9,925,000	12,257,000	22,182,000
Avoided Costs			
Federal Regulated Drinking Water Standards			
Nitrate Removal (Distillers)	2,599,000	2,252,000	4,851,000
Arsenic/Sulfate Proposed Rules	212,000	1,928,000	2,140,000
Monitoring	115,000	276,000	391,000
Partial Mitigation Brine Contamination	1,000,000	0	1,000,000
PWS Treatment Replacement Cost	7,312,000	23,540,000	30,852,000
PWS Water Source Replacement Cost	5,713,000	19,286,000	24,999,000
Rural Water Source Replacement Cost	15,999,000	13,752,000	29,751,000
Excess Water Softening Costs	3,078,000	6,781,000	9,859,000
Excess Replacement of Water Heaters	0	0	0
Excess Bottled Drinking Water Costs	<u>7,620,690</u>	<u>16,320,880</u>	<u>23,941,570</u>
Subtotal	114,765,690	138,815,880	253,581,570
Indirect Benefits			
Health Care From Improved Income Level	14,924,000	0	14,924,000
Improved Water Quality (Secondary Contaminants)	0	0	0
Subtotal	<u>14,924,000</u>	<u>0</u>	<u>14,924,000</u>
Total Direct and Indirect Benefits	129,689,690	138,815,880	268,505,570
Net Benefits	-\$1,123,310	\$66,535,880	\$65,412,570

The uniform application for Montana Public Facilities Projects requires a 6% discount rate. Net benefits are reduced to \$40,025,000 with the higher discount rate. Dry Prairie will use the alternative analysis in its application.

11.2 Project Costs

Total project construction costs were estimated at \$192,000,000 (Table 7-1). Operation, maintenance and replacement (OMR) costs were estimated at \$3,545,000 annually (Chapter 9). In Table 11-1, life-cycle costs were presented based on initial construction and OMR costs for the Assiniboine and Sioux and Dry Prairie segments of the project. Both project construction and OMR costs were discounted over a 50 year period at 4% with discounting to reflect the construction and initial OMR costs in the first 10 years of the project. (See Table 8-1 for discounted construction costs, for example). The present value of project construction and OMR costs was estimated at \$130,813,000 and \$72,280,000 for the Fort Peck and Dry Prairie portions of the project, respectively.

11.3 Employment and Earnings

Through the construction of the project, an estimated 1,535 man years (full-time equivalents) in contract and non-contract jobs will be created. Earnings income from contract and noncontract positions has an estimated value of \$49,990,000. The discounted value of these earnings is shown in Table 11-1 at \$25,997,000 and \$14,061,000 for the Assiniboine and Sioux and Dry Prairie projects, respectively.

OMR activities will also employ significant staff, and discounted earnings through the life of the project will have an estimated value of \$31,217,000 (Assiniboine and Sioux) and \$25,015,000 (Dry Prairie).

The United States will receive an estimated \$3,224,000 and \$754,000 in Social Security and Medicare receipts from the Assiniboine and Sioux project. These will be new revenues from the employment of an underemployed labor force on the Reservation. Regional impacts will also derive from the employment and earnings in the Dry Prairie portion of the project. Social Security and Medicare payments from construction activities will not contribute to increases in federal revenues for these programs because the higher levels of employment will cause a transfer of labor force and earnings from one sector of the economy to another or from one region to another.

Montana will have an estimated gross receipts and income tax revenue of \$422,000 and \$773,000, respectively (Table 11-1). These revenues will offset the appropriation of funds by the Montana Legislature to finance 50% of the non-federal cost share of project construction.

11.4 Livestock

Table 11-3 presents an increase in livestock (cattle) income of \$9,925,000 and \$12,257,000 in the service areas of the Assiniboine and Sioux and Dry Prairie projects, respectively. The values were derived as the present value (50 years, 4% discount rate) of an additional 30 pounds of livestock weight at sale time derived from an improved water quality with less total dissolved solids than existing sources. The weight increase is the same as used in the Taylor Watershed of North Dakota¹ to the east of the project area in a similar geologic and water quality setting. The Taylor livestock water program is a federally funded undertaking. The value of the additional livestock weight was based on \$0.55 per pound. The values were also based on delivery of water to 40% of the total area in each project region as an estimate of the rangeland area. It was further assumed that rangelands require 30 acres per animal unit month (AUM).

The present value of increased livestock revenues on the Reservation will be used in tribal programs and enterprises to employ additional unemployed members of the Assiniboine and Sioux Tribes. This will constitute a national benefit. Benefits in the Dry Prairie area will be regional in nature.

11.5 Avoided Costs

11.5.1 PWS Treatment

Implementation of the regional project proposed here will permit the avoidance of future costs of upgrading and maintaining existing treatment plants and water sources throughout the project area. The regional project will not eliminate these costs but will replace them with the costs of the regional project. Having listed the regional project costs in Table 11-1, it is also necessary to present the costs of existing systems that will be avoided. Beneficiaries of the avoided costs include the United States, Montana, local governments and consumers. Table 11-2 presents estimates of avoided costs for replacing treatment plants with existing, but deficient, water treatment processes (maintenance of the status quo), and Table 11-3 presents estimates of avoided costs for replacing existing water sources, primarily wells.

Water treatment processes described in Chapter 5 for the existing communities were used in the estimates of avoided costs. Water treatment capacities were based on design criteria for the regional projects assuming that communities would undertake water conservation in the future as a condition of grant and loan success. Field costs were defined as the construction costs. Project costs are higher and reflect costs of the design, administration and other non-contract functions necessary to support the construction effort.

¹Soil Conservation Service, January 1994, *Taylor Watershed Agricultural Water Supply, Stark and Dunn Counties, North Dakota, Watershed Plan Environmental Assessment*, U.S. Department of Agriculture, Bismarck, North Dakota.

TABLE 11-2

ESTIMATED LIFE CYCLE COSTS OF BUILDING AND REPLACING WATER TREATMENT PLANTS
FOR INDIVIDUAL COMMUNITIES THROUGHOUT THE PROJECT REGION

System	PWS Population	Gallons Per Day	WTP Field Cost	WTP Project Cost	Replace Cost	Salvage Value	Future WTP Cost	Annual O and M	PV O and M	Life Cycle Costs
Fort Peck Indian Reservation										
Brockton	507	205,335	\$120,000	\$177,432	\$21,292	\$4,258	\$194,465	\$6,144	\$131,982	\$326,447
Frazer	422	170,910	120,000	177,432	21,292	4,258	194,465	6,144	131,982	326,447
Poplar	2,114	856,170	1,069,000	1,580,619	189,674	37,935	1,732,359	40,300	865,742	2,598,101
Wolf Point	3,528	1,428,840	1,669,000	2,467,777	296,133	59,227	2,704,684	63,147	1,356,535	4,061,219
	6,571	2,661,255	2,978,000	4,403,259	528,391	105,678	4,825,972	115,735	2,486,242	7,312,214
Dry Prairie										
Antelope	421	170,505	120,000	177,432	21,292	4,258	194,465	6,144	131,982	326,447
Bainville	166	67,230	273,000	403,657	48,439	9,688	442,408	8,826	189,600	632,008
Culbertson	784	317,520	1,361,806	2,013,561	241,627	48,325	2,206,863	91,092	1,956,855	4,163,718
Flaxville	77	31,185	250,000	369,649	44,358	8,872	405,135	7,388	158,708	563,844
Froid	253	102,465	411,000	607,703	72,924	14,585	666,043	10,232	219,797	885,840
Glasgow	3,652	1,479,060	2,753,799	4,071,757	488,611	97,722	4,462,645	199,932	4,294,983	8,757,628
Medicine Lake	381	154,305	358,000	529,337	63,520	12,704	580,154	12,300	264,225	844,379
Nashua	379	153,495	120,000	177,432	21,292	4,258	194,465	6,144	131,982	326,447
Opheim	144	58,320	120,000	177,432	21,292	4,258	194,465	6,144	131,982	326,447
Outlook	143	57,915	120,000	177,432	21,292	4,258	194,465	6,144	131,982	326,447
Plentywood	2,119	858,195	1,047,000	1,548,090	185,771	37,154	1,696,707	40,381	867,478	2,564,185
Scobey	1,160	469,800	231,000	341,556	40,987	8,197	374,345	6,144	131,982	506,327
St. Marie	58	23,490	1,009,439	1,492,553	179,106	35,821	1,635,839	63,025	1,353,922	2,989,760
Westby	265	107,325	120,000	177,432	21,292	4,258	194,465	6,144	131,982	326,447
	10,002	4,050,810	8,295,044	12,265,021	1,471,803	294,361	13,442,463	470,039	10,097,461	23,539,924
Total FPRRS	16,573	6,712,065	\$11,273,044	\$16,668,280	\$2,000,194	\$400,039	\$18,268,435	\$585,774	\$12,583,703	\$30,852,138

It was assumed that all systems would be replaced in year 1 of the regional project and again at the end of the regional project life. Future replacement costs were estimated as a single payment in the future, equivalent to 12% of the initial project cost. Salvage values were estimated at 20% of the replacement costs and were deducted from replacement costs. The sum of the original “WTP Project Cost” and “Replace Cost” less the “Salvage Value” resulted in the “Future WTP Cost”. Annual OMR costs and present value of OMR costs are also presented in Table 11-2. The sum of “Future WTP Cost” and “PV O and M” is the “Life Cycle Costs” presented in the last column of Table 11-2 and in Table 11-1.

The methodology for estimating avoided water treatment plant costs was developed in cooperation with the State of Montana, Department of Natural Resources and Conservation. The methodology was generally in use for all regional water projects under consideration in Montana, and standardization was being sought.

Most treatment plants in the region rely on groundwater for a water source. Exceptions are the communities of Culbertson, Glasgow and St. Marie, which have surface water treatment plants diverting from the Missouri River.

All treatment plants drawing groundwater provide chlorination as a primary process. Six of the communities provide iron and manganese removal. One of the communities has an ion- exchange process, and one of the communities has a reverse osmosis process. All of the treatment plants are expensive to construct and are being replaced on a regular basis.

11.5.2 Community and Rural Water Sources

A similar process was followed for determining the cost by community of replacing water sources, namely wells, pumps and pipelines connecting sources with the distribution system. The sum of the initial investment in community water sources of \$12,591,200 and the future replacement costs of \$7,372,000 was added to estimates of annual electrical costs and wells/pump OMR costs to arrive at the life-cycle costs given in Table 11-3 and carried forward to Table 11-1.

Wells were assumed to have a 20 year life, and pumps were assumed to have a 15 year life. Present value of replacement was based on single payments in the future during the life of the regional project. All wells were assumed to be drilled to a depth of 200 feet at a cost of \$30 per foot. Pumping was assumed from the 150 foot level, and electrical costs were based on pumping water from the well and pressurizing the system. The number of wells was assumed on the basis of 50 gallons per minute per well. In actual practice, some wells in the larger communities may produce significantly more water per well, but the costs of drilling are also higher. Pumps were estimated at an initial cost of \$400 per 50 gallons per minute, and those costs would increase significantly with wells of larger production.

Note that Glasgow, Culbertson and St. Marie water sources were treated differently due to the fact that they rely on surface water sources. The costs presented for both communities were based on replacement of intakes and facilities necessary to connect the communities to the water source.

TABLE 11-3

AVOIDED COSTS OF COMMUNITY WATER SOURCES

System	Population	Maximum Gallons Per Day	Flow Rate (gpm)	Well Depth (ft)	Number of Wells/Intake	Cost Per foot (\$)	Initial Field Cost (\$)	Initial Project Cost (\$)	Life (years)	PV Replace Costs	Annual Electrical	Well/Pump OM	Life Cycle Costs
Fort Peck Indian Reservation													
Brockton	507	205,335	143	200	3	\$75.00	\$135,000	\$160,200	15	\$165,772	\$32,392	\$103,243	\$461,607
Frazer	422	170,910	119	200	2	75.00	90,000	106,800	15	110,515	26,961	68,829	313,105
Poplar	2,114	856,170	595	200	12	75.00	540,000	640,800	15	663,088	135,061	412,974	1,851,923
Wolf Point	3,528	1,428,840	992	200	20	75.00	900,000	1,068,000	15	1,105,147	225,401	688,289	3,086,837
	6,571	2,661,255	1,848	800	37	75.00	1,665,000	1,975,800	15	2,044,521	419,815	1,273,335	5,713,471
Dry Prairie													
Antelope	421	170,505	118	200	2	75.00	90,000	106,800	15	110,515	26,897	68,829	313,041
Bainville	166	67,230	47	200	1	75.00	45,000	53,400	15	55,257	10,606	34,414	153,677
Culbertson	784	317,520	221	0	1	0.00	1,000,000	1,280,000	30	516,325	0	274,972	2,071,297
Flaxville	77	31,185	22	200	1	75.00	45,000	53,400	15	55,257	4,919	34,414	147,991
Froid	253	102,465	71	200	1	75.00	45,000	53,400	15	55,257	16,164	34,414	159,236
Glasgow	3,652	1,479,060	1,027	0	1	0.00	5,000,000	6,400,000	30	2,581,626	0	1,374,860	10,356,486
Medicine Lake	381	154,305	107	200	2	75.00	90,000	106,800	15	110,515	24,342	68,829	310,485
Nashua	379	153,495	107	200	2	75.00	90,000	106,800	15	110,515	24,214	68,829	310,358
Opheim	144	58,320	41	200	1	75.00	45,000	53,400	15	55,257	9,200	34,414	152,272
Outlook	143	57,915	40	200	1	75.00	45,000	53,400	15	55,257	9,136	34,414	152,208
Plentywood	2,119	858,195	596	200	12	75.00	540,000	640,800	15	663,088	135,381	412,974	1,852,242
Scobey	1,160	469,800	326	200	7	75.00	315,000	373,800	15	386,801	74,111	240,901	1,075,614
St. Marie	58	23,490	16	0	1	0.00	1,000,000	1,280,000	30	516,325	0	274,972	2,071,297
Westby	265	107,325	75	200	1	75.00	45,000	53,400	15	55,257	16,931	34,414	160,002
	10,002	4,050,810	2,813	2,200	34	--	8,395,000	10,615,400	--	5,327,254	351,901	2,991,652	19,286,207
Total FRRWS	16,573	6,712,065	4,661	3,000	71	--	\$10,060,000	\$12,591,200	--	\$7,371,775	\$771,716	\$4,264,987	\$24,999,678

Rural water source replacements were estimated at \$15,999,000 and \$13,752,000 for the Assiniboine and Sioux and Dry Prairie service areas, respectively. Rural well replacement was based on a 1990 rural population of 11,071.

11.5.3 Excess Water Softening Costs

Table 11-4 summarizes the costs of household water softening in communities systems within the regional project assuming continuation of existing, individual treatment plants within each community. Occupied housing within each community was based on the 1990 census and includes housing connected to the public water system outside the boundaries of the community. The total number of occupied houses within the communities was 6,547.

Hardness from the records of the Montana Department of Environmental Quality is presented in Table 11-4. All existing water sources may have sufficient hardness to inspire homeowners to provide softening. However, hardness of 250 mg/l or less was considered equivalent to hardness from the Missouri River that would be typical of the regional water system. Note, for example, that the community of Culbertson has hardness of 238 mg/l in its water supply diverted from the Missouri River. Any community with hardness greater than 250 mg/l was treated as a community that would require water softening beyond the level of communities with hardness of 250 mg/l or less.

The amount of water softening chemicals was estimated at the rate of 50 pounds per month for hardness of 250 mg/l and a proportionately larger amount of chemical for hardness above 250 mg/l. Medicine Lake has a hardness of 816 mg/l, which is over three times the hardness of Culbertson, and the amount of chemical required monthly was estimated at over three times the amount required for communities with water quality comparable to the Missouri River.

The monthly cost of chemicals was estimated at \$8.00 per 80 pound bag of chemical. It was further assumed that water softening equipment would be purchased for each household at a cost of \$650 each. Present value was based on replacement in future years 15 and 40. Reduction in costs for hand soap, laundry detergent and replacement of fixtures are also benefits of softeners, but were not counted in the analysis. Based on these assumptions, the present value of the cost of water softening chemicals and equipment in the communities of the region was estimated at \$3,999,000.

Average hardness within the communities was 410 mg/l. This level of hardness was applied to the rural households of the region to arrive at an estimated present value of softening in the rural areas. As presented in Table 11-4, the combined present value of water softening in the communities and the rural areas was estimated at \$9,859,000, the value presented in Table 11-1.

TABLE 11-4

WATER SOFTENING COSTS ABOVE LEVEL OF MISSOURI RIVER HARDNESS

Place	Current Occupied Housing	Future Occupied Housing	Hardness (mg/l)	Chemical per Month (pounds)	Chemical Cost Per Month (\$)	Present Value Chem/Equip Cost (\$)
Fort Peck						
Brockton	134	212	250	50	0	0
Frazer	111	176	--	--	--	--
Poplar	876	1,389	250	50	0	0
Wolf Point	1,378	2,184	310	62	2,621	1,360,000
Rural	951	1,507	410	82	4,834	1,718,000
Subtotal	3,450	5,468			7,455	3,078,000
Average			270	61		
Dry Prairie						
Bainville	83	83	250	50	0	0
Culbertson	307	307	238	48	0	0
Flaxville	34	34	250	50	0	0
Froid	122	122	645	129	964	309,000
Glasgow	1,566	1,566	250	50	0	0
Medicine Lake	148	148	816	163	1,675	505,000
Nashua	172	172	706	141	1,569	489,000
Opheim	72	72	250	50	0	0
Outlook	56	56	377	75	142	65,000
Plentywood	894	894	711	142	8,243	2,569,000
Scobey	485	485	286	57	349	331,000
Westby	109	109	566	113	689	232,000
Rural	1,724	1,724	410	82	5,528	2,281,000
Subtotal	5,772	5,772			19,159	\$6,781,000
Average			410	89		
Total						\$9,859,000

11.5.4 Excess Costs of Water Heater Replacement

Table 11-5 presents estimates of the cost of replacing hot water heaters due to water hardness assuming the continuation of existing, independent community-based treatment plants and assuming, further, that water softening is not in use. Some communities, but not all, have hardness of treated water that requires water heater replacement more often than water with hardness comparable to the Missouri River. With a regional water system, extra costs would not be incurred because communities served from the Missouri River would have water of relatively low hardness that would not require replacement of hot water tanks more often than 1 in 10 years. The estimated cost of water heater replacement was \$1,161,000.

The same housing and water hardness statistics for each community as presented in Table 11-4 were used here. It was assumed that communities with water hardness comparable to the Missouri River could expect hot water heaters to have a life of 10 years. If water hardness was greater than 250 mg/l, the life of water heaters was reduced. A straight line reduction in water heater life was used where a 5 year life was assumed for communities with hardness of 800 mg/l.

TABLE 11-5

WATER HEATER COSTS ABOVE LEVEL OF MISSOURI RIVER HARDNESS

Place	Current Public System Occupied Housing	Future Public System Occupied Housing	Hardness (mg/l)	Water Heater Life (years)	Added Unit Present Value Replace (\$)	Added Total Present Value Replace (\$)
Fort Peck						
Brockton	134	134	250	10.0	0	0
Frazer	111	111	--	--	--	--
Poplar	876	876	250	10.0	0	0
Wolf Point	1,378	1,378	310	9.5	59	81,302
Rural	951	1,507	410	8.5	116	174,812
Subtotal	3,450	4,006				256,114
Average			270	9.5	44	
Dry Prairie						
Bainville	83	83	250	10.0	0	0
Culbertson	307	307	238	10.1	0	0
Flaxville	34	34	250	10.0	0	0
Froid	122	122	645	6.4	364	44,408
Glasgow	1,566	1,566	250	10.0	0	0
Medicine Lake	148	148	816	4.9	667	98,716
Nashua	172	172	706	5.9	469	80,668
Opheim	72	72	250	10.0	0	0
Outlook	56	56	377	8.8	96	5,376
Plentywood	894	894	711	5.8	475	424,650
Scobey	485	485	286	9.7	46	22,310
Westby	109	109	566	7.1	262	28,558
Rural	1,724	1,724	410	8.5	116	199,984
Subtotal	5,772	5,772				904,670
Average			445	8.2	192	
Total	9,222	9,778				1,160,784

The extra or excess costs of water heater replacement were determined by computing the present value of single payments of \$300 per hot water replacement tank over a 50 year period. Thus, the cost of replacement water heaters in a community, such as Medicine Lake with a hot water heater life of 4.9 years, was based on 10 equally spaced purchases of a new hot water tank over the 50 year life of the regional project. This would account for 49 years of the project life. In the remaining year, the \$300 dollar cost per hot water tank replacement was reduced by the ratio of 1 to 4.9.

The extra costs of hot water heater replacement would be minimal if water users have or install water softeners. The extra costs of hot water heater replacement were not carried to Table 11-1, because water softeners can assist in lengthening the life of water heaters; and to include the costs of water heater, would provide a double counting of benefits.

11.5.5 Excess Costs of Bottled Water

Estimates were prepared for the cost of purchasing bottled water above the level that would normally be purchased by consumers where water quality is comparable to that of the Missouri River. These are extra costs. It was recognized that bottled water is popular in all communities irrespective of the quality of water. It was assumed however, that as the water quality constituents affecting taste increase, consumers feel more compelled to buy bottled water for drinking and cooking.

In Table 11-6, the 1990 population of persons in the public water systems within and outside the communities is presented. There were 16,094 persons in public water systems operated by the communities and 8,735 persons in the rural areas. Hardness was used as the indicator of water quality affecting the purchase of bottled water. Other secondary drinking water parameters, such as total dissolved solids or sulfates, which have greater impact on taste, may be a better indicator of the extra cost of bottled water. It was also assumed that water softening will not improve the undesirable taste and odor of source water with high levels of undesirable constituents, indicated here by hardness.

It was assumed that average daily use per capita for drinking and cooking purposes is 2 gallons (Table 4-3) and that 0.53 gallons are consumed per person per day². It was further assumed that with water quality comparable to the Missouri River, consumers would not purchase extra bottled water for the reason that taste from the public water system would be acceptable. However, as parameters affecting taste increase, it was assumed that consumers would purchase as much as .53 gallons for drinking in the form of bottled water (based in Table 11-6 on hardness of 800 mg/l) and would use the balance needed for cooking (1.47 gallons) from existing sources. The purchase of bottled water would decrease to 0 where hardness is 250 mg/l or less.

²Federal Register, Dec. 20, 1994, *Drinking Water; National Primary Drinking Water Regulations -- Sulfate Proposed Rule*, EPA; National Primary Drinking Water Regulation Implementation, Volume 59.

TABLE 11-6

BOTTLED WATER COSTS ABOVE LEVEL OF MISSOURI RIVER HARDNESS

Place	1990 Population	Design Population	Hardness (mg/l)	Bottled Water Per Month (gpcpd)	Cost Per Month (\$)	Present Value Bottled Water (\$)
Fort Peck						
Brockton	507	804	250	0.00	0	0
Frazer	422	669	n/a	0.00	0	0
Poplar	2,114	3,353	250	0.00	0	0
Wolf Point	3,518	5,579	310	0.06	10,400	2,681,000
Rural	<u>4,161</u>	<u>6,590</u>	<u>441</u>	<u>0.18</u>	<u>39,107</u>	<u>10,081,000</u>
Subtotal	10,722	16,995			49,507	12,762,000
Dry Prairie						
Bainville	166	166	250	0.00	0	0
Culbertson	784	784	238	0.00	0	0
Flaxville	77	77	250	0.00	0	0
Froid	253	253	645	0.38	3,105	800,000
Glasgow	3,652	3,652	250	0.00	0	0
Medicine Lake	381	381	816	0.55	6,700	1,727,000
Nashua	379	379	706	0.44	5,370	1,384,000
Opheim	144	144	250	0.00	0	0
Outlook	143	143	377	0.12	564	145,000
Plentywood	2,119	2,119	711	0.44	30,350	7,824,000
Scobey	1,160	1,160	286	0.03	1,297	334,000
Westby	265	265	566	0.30	2,602	671,000
Rural	<u>4,584</u>	<u>4,584</u>	<u>441</u>	<u>0.18</u>	<u>27,202</u>	<u>7,012,000</u>
Subtotal	14,107	14,107			77,191	19,897,000
Total	24,829	31,102			\$126,697	\$32,659,000

Costs of bottled water were estimated at \$1.06 per gallon, including costs of transportation to purchase water.³ These assumptions resulted in a monthly cost of bottled water in the community of Medicine Lake, the community with highest hardness, of \$6,700, or \$17.59 per person per month: \$42.91 per household per month. The total extra cost of bottled water throughout the region was estimated at \$32,659,000 as presented in Table 11-6. This value includes \$15,566,000 in communities and \$17,093,000 in the rural areas. Only the community benefit and 49% of the rural benefit was carried forward to Table 11-1. Distillers, necessary for removal of nitrate in 51% of rural homes, were assumed to offset the need for bottled water, as discussed below.

11.5.6 Federal Water Quality Compliance

Nitrate Removal

Nitrates are an increasing problem in the project area. They cannot be removed by conventional treatment practices in the communities, but no communities are expected to have a nitrate problem. Distillers can be purchased to remove nitrates for individual rural households.

³*Ibid.*

The U.S. Geological Survey sampled the principal sources of groundwater on the Fort Peck Indian Reservation and found that over 80% of the wells in the Flaxville gravels, otherwise the best source of water in the project area, had nitrate levels exceeding national standards. Approximately 51% of wells, from all sources, had excessive nitrate levels. The high nitrate levels place infants at risk of serious illness.

Currently, some rural residents use distillers (some perhaps for purposes other than nitrate removal), which are capable of removing nitrate contamination. The value of \$4,851,000 in Table 11-1 for nitrate removal was based on the initial cost of distillers for 51% of rural households (11,071 persons) in the project area. Costs were based on an additional purchase price of \$400 with replacement every ten years. Filter costs were estimated at \$5.00 per filter and the use of 12 filters per year. No electrical costs were included in the computation. Based on these assumptions, the present value of distillers was estimated at \$2,405 per rural household. Replacement of distillers is a cost that can be avoided with the regional project.

Arsenic, Sulfate, and Monitoring

As presented in Chapter 6, arsenic concentrations have exceeded the arsenic rule slightly in Plentywood and Westby. The sulfate rule, proposed in 1994 and subsequently withdrawn, is exceeded in Fort Kipp, Medicine Lake and Westby. It will be necessary for these communities to comply with arsenic rule. It was further assumed that a sulfate rule will be implemented and that data describing the contaminants for each community are reasonably accurate. Table 11-7 lists the public water systems in the region and applies estimates of annual costs developed by EPA for compliance with the arsenic standard and with a future standard, not requiring removal, in the case of sulfate.

EPA has estimated that the average cost per household for communities with 100 to 500 persons to remove arsenic is \$213.11 annually and declines to \$106.00 per household per year for communities with populations ranging from 500 to 1,000⁴. Similar assumptions for sulfates place the annual cost per household at \$24 to \$534 annually, depending on community size and the option selected for treatment⁵. These assumptions are presented in Table 11-7 resulting in an estimated present value of \$2,140,000 for the affected communities to comply with the future rules. The annual costs for future sulfate compliance were based on \$24 per household, consistent with EPA Option 2 or 3 which requires information for travels but not removal of sulfate.

It was also assumed that most communities in the area currently comply with the proposed groundwater rule as discussed in Chapter 3. Therefore, it was assumed that the regional project would not avoid costs for future compliance on that subject.

⁴Federal Register, June 22, 2000, *National Primary Drinking Water Regulations; Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring*, Vol. 65, No. 121, p. 38967.

⁵Federal Register, Dec. 20, 1994, *Drinking Water; National Primary Drinking Water Regulations -- Sulfate Proposed Rule*, EPA; National Primary Drinking Water Regulation Implementation, Volume 59, Table 9.

TABLE 11-7

COSTS OF COMPLIANCE WITH CURRENT OR PROPOSED RULES

Place	1990 Housing	Design Housing	Annual Costs		Present Value Standards Compliance (\$)
			Arsenic Rule	Sulfate Rule	
Fort Peck					
Brockton	134	212	0	0	0
Frazer	111	176	--	0	0
Fort Kipp	100	176	--	9,853	212,000
Poplar	876	1,389	0	0	0
Wolf Point	1,378	2,184	0	0	0
Rural	851	1,173	0	0	0
Subtotal	3,450	5,310	0	9,853	212,000
Dry Prairie					
Bainville	83	83	0	0	0
Culbertson	307	307	0	0	0
Flaxville	34	34	0	0	0
Froid	122	122	0	0	0
Glasgow	1,566	1,566	0	0	0
Medicine Lake	148	148	0	8,288	178,000
Nashua	172	172	0	0	0
Opheim	72	72	0	0	0
Outlook	56	56	0	0	0
Plentywood	894	894	52,129	0	1,120,000
Scobey	485	485	0	0	0
Westby	109	109	23,229	6,104	630,000
Rural	1,824	1,824	0	0	0
Subtotal	5,872	5,872	75,358	14,392	1,928,000
Total	9,322	11,182	75,358	\$24,245	\$2,140,000

TABLE 11-8

SELECTED MONITORING COSTS

Place	Total N/ Inorganic	VOC	SOC	Present Value Selected Monitoring (\$)
Brockton	\$200	\$125	\$750	\$23,000
Fort Kipp	200	125	750	23,000
Frazer	200	125	750	23,000
Poplar	200	125	750	23,000
Wolf Point	200	125	750	23,000
Subtotal	1,000	625	3,750	115,000
Dry Prairie				
Bainville	200	125	750	23,000
Culbertson	200	125	750	23,000
Flaxville	200	125	750	23,000
Froid	200	125	750	23,000
Glasgow	200	125	750	23,000
Medicine Lake	200	125	750	23,000
Nashua	200	125	750	23,000
Opheim	200	125	750	23,000
Outlook	200	125	750	23,000
Plentywood	200	125	750	23,000
Scobey	200	125	750	23,000
Westby	200	125	750	23,000
Subtotal	2,400	1,500	9,000	276,000
Total	\$3,400	\$2,125	\$12,750	\$391,000

Table 11-8 presents estimates of the cost of monitoring for total nitrogen, volatile organic chemicals, and synthetic organic chemicals for each of the existing systems. Those costs (present value of \$391,000) would be avoided with a regional system. Other monitoring costs for lead, copper, microbiological activity and chlorine residuals will be required at levels comparable to existing systems with the implementation of the regional project.

11.5.7 Brine Contamination

Brine contamination is an area of concern on the Fort Peck Indian Reservation in the area north of Poplar. Secondary recovery of oil has lifted deep sources of groundwater with concentrations of total dissolved solids exceeding those of seawater. The process has contaminated near-surface groundwater, albeit poor groundwater in its natural state, to the point that it is unusable for most purposes.

The avoided costs of \$1,000,000 in Table 11-1, are the construction costs of a distribution system deriving water supply from an alternative source near the Missouri River that would bring water to the residences in the affected area. The costs do not include the development or treatment of the source, only the distribution system.

11.6 Indian Health Costs

As will be shown, improvement in income is correlated with falling mortality rates from major diseases: cancer, diabetes and heart disease. The present value of additions to income from the construction jobs in the building of this project (\$25,997,000) and future OMR (\$31,217,000) will add 9.4% to the present value of future per capita income (\$609,963,000 based on 1990 per capita income of \$4,877 over 50 years, discounted at 4%) on the Fort Peck Indian Reservation. A corresponding 3.8% decline in mortality rate will result in an estimated health care savings that is counted in Table 11-1 as an avoided federal cost. Table 11-9 summarizes the estimated health-care savings of \$14,924,000 based on average national health-care costs as presented in Table 11-10.

Table 11-9 shows that of the total Indian population on the Fort Peck Indian Reservation in 1990 (5,782), 4,191 were under the age of 35, 1,245 were between ages 35 and 59, and 346 were over the age of 60.

Deaths in the Indian population on the Fort Peck Indian Reservation due to diabetes were predicted at 10.13 times the number of deaths in the Dry Prairie region for ages 35 to 59, and 10.09 times the number of non-Indian deaths in the region for ages over 60. Similarly, deaths due to heart disease in the Indian population were 1.67 times the number in the non-Indian population for those under 35 years of age, and Indian deaths were 2.10 times the number in the non-Indian population for persons between 35 and 59 years of age. Cancer deaths in the Fort Peck Indian population were predicted to exceed those of the non-Indian population in Dry Prairie for persons aged 60 and over. Mortality statistics were converted to annual rates based on deaths between 1989 and 1997 as compiled by the Montana Department of Health in unpublished files.

TABLE 11-9

PROJECTED FEDERAL SAVINGS IN FUTURE INDIAN HEALTH CARE COSTS
FORT PECK INDIAN RESERVATION

Disease	1990		1989-1997		Annual			Annual		Annual		Annual	
	Fort Peck Indian Population	Regional Non-Indian Population	Fort Peck Indian Mortality	Regional Non-Indian Mortality	Fort Peck Death Rate (%)	Regional Disease Rate (%)	Ratio Indian to Difference (%)	Fort Peck Disease Rate (%)	Fort Peck Indian Population	Fort Peck Deaths	Fort Peck Added 2030	Annual Cost (1992 \$)	Added 2030 Present Value (1992 \$)
Health Care Costs without Project													
Total	5,782	20,454	--	--	--	--	--	--	13,369				
Diabetes													
Age Under Age 3	4,191	9,137	0	2	0.000	0.002	0.00	-0.002	9,690	-0.2	-\$299,371	-\$6,431,000	
Age 35 to 59	1,245	6,306	8	4	0.071	0.007	10.13	0.064	2,879	1.9	2,352,980	50,547,000	
Age 60 and Over	346	5,011	39	56	1.252	0.124	10.09	1.128	800	9.0	11,465,296	246,300,000	
Heart													
Age Under Age 3	4,191	9,137	5	1	0.005	0.003	1.67	0.002	9,690	0.2	57,886	1,244,000	
Age 35 to 59	1,245	6,306	32	30	0.147	0.070	2.10	0.077	2,879	2.2	662,040	14,222,000	
Age 60 and Over	346	5,011	55	570	1.440	1.234	1.17	0.206	800	1.6	492,229	10,574,000	
Cancer													
Age Under Age 3	4,191	9,137	2	7	0.005	0.009	0.62	-0.003	9,690	-0.3	-61,690	-1,325,000	
Age 35 to 59	1,245	6,306	10	69	0.089	0.122	0.73	-0.032	2,879	-0.9	-184,579	-3,965,000	
Age 60 and Over	346	5,011	43	430	1.381	0.953	1.45	0.427	800	3.4	678,110	14,567,000	
Total	5,782	20,454	194	1,169	0.373	0.635	0.59	-0.262	13,369	16.9	15,162,901	325,733,000	
Health Care Costs with Project													
Total	5,782	20,454	--	--	--	--	--	--	13,369				
Diabetes													
Age Under Age 3	4,191	9,137	0	2	0.000	0.002	0.00	-0.002	9,690	-0.2	-279,733	-6,009,000	
Age 35 to 59	1,245	6,306	8	4	0.071	0.007	10.13	0.060	2,879	1.7	2,198,625	47,231,000	
Age 60 and Over	346	5,011	39	56	1.252	0.124	10.09	1.076	800	8.6	10,936,399	234,938,000	
Heart													
Age Under Age 3	4,191	9,137	5	1	0.005	0.003	1.67	0.002	9,690	0.2	56,033	1,204,000	
Age 35 to 59	1,245	6,306	32	30	0.147	0.070	2.10	0.075	2,879	2.1	640,852	13,767,000	
Age 60 and Over	346	5,011	55	570	1.440	1.234	1.17	0.205	800	1.6	490,720	10,542,000	
Cancer													
Age Under Age 3	4,191	9,137	2	7	0.005	0.009	0.62	-0.003	9,690	-0.3	-60,581	-1,301,000	
Age 35 to 59	1,245	6,306	10	69	0.089	0.122	0.73	-0.032	2,879	-0.9	-181,261	-3,894,000	
Age 60 and Over	346	5,011	43	430	1.381	0.953	1.45	0.420	800	3.4	667,091	14,331,000	
Total	5,782	20,454	194	1,169	0.373	0.635	0.59	-0.252	13,369	16.2	\$14,468,147	\$310,809,000	
											Savings	\$14,924,000	

Referring to the upper half of Table 11-9, *extra* annual health-care costs for the population of Indians on the Fort Peck Indian Reservation, as projected in the year 2030, mid-way in the life of the proposed project, was estimated at \$15,162,900. The estimate represents the additional health-care costs above the level of mortality in the Dry Prairie region. For example, 1.25% of the Indian population over 60 died from diabetes between 1989 and 1970 as compared with .124% of the regional non-Indian population. Extra Indian health-care costs were based on the mortality above the .124% level, not the total health-care cost. The present value of *extra* Indian health-care costs for the three major diseases considered here was estimated at \$325,733,000.

TABLE 11-10

NATIONAL HEALTH COST INFORMATION

Disease	National Deaths	National Indirect Costs (bill)	National Direct Costs (bill)	National Total Costs (bill)	Cost Per Death
Diabetes	72,112	\$45.2	\$46.4	\$91.6	\$1,270,246
Heart	959,227	--	--	286.5	298,678
Cancer	539,533	37.0	70.0	107.0	198,320

Relationships between per capita income levels and mortality are presented in Figures 11-1, 11-2 and 11-3 based on mortality rates in Montana counties with significant Indian population. The data represent 11 counties with a non-Indian population of 360,657 and an Indian population of 40,507. In each of the figures a linear relationship is presented in the lower half of the chart for ages 35 through 59 and in the upper half of the chart for ages over 60. Per capita income levels of the Indian population are generally on the left side of the chart, and per capita income levels of the non-Indian population are generally on the right side of the chart. Correlation is fair for some diseases and age groups and is poor in other cases.

Linear relationships between mortality and per capita income are shown in Figures 11-1, 11-2 and 11-3. Solution of correlation equations predicts that the 9.4% increase in per capita income will result in a 3.8% reduction in mortality rates of the Indian population. This assumes that improvements in income, not genetic or other factors, will contribute to improved survival rates. The bottom half of Table 11-9 provides a downward adjustment in mortality rates on the Fort Peck Indian Reservation to account for the 9.4% increase in per capita income levels (from \$4,877 to \$5,335 per capita per year) based on the relationships between income and mortality. Health-care costs were recalculated, and the present value of health-care costs declined to \$310,809,000 or \$14,924,000 less than future health-care costs estimated at 1990 levels of per capita income.

Review of the foregoing analysis by health-care and other professionals will improve the methods and conclusions. However, the basic principles, the factual foundation, and the correctness of the level of benefits attributed to the rural water project are considered reasonable. Poverty has costs as recognized, in part, by the designation of an Enterprise Community on the Fort Peck Indian

Reservation and the acknowledged need for economic development, including employment and income.

11-7 Value of Improved Water Quality

Another measure of benefits of the project is the willingness of project beneficiaries to invest in the project beyond the level of their current costs in order to achieve improvement in water quality associated with conversion from existing sources to the Missouri River.

Table 10-8 (Chapter 10, Ability to Pay) presents the ability to pay by Dry Prairie at \$11.26 per month (80 percentile) and the willingness to pay at \$24.12 per month. The added “willingness to pay” of \$12.86 per month is a crude measurement of the value that the region may place on a conversion from existing water sources of relatively poor quality in terms of secondary contaminants to the higher quality Missouri River water. There is no added willingness to pay among the Indian population of Fort Peck due to low income levels.

The added “willingness to pay” by Dry Prairie customers is reflected in the *costs* of OMR in Table 11-1. Monthly OMR costs will be billed by Dry Prairie and their existing communities combined at rates between \$35 and \$40 per month, and those costs fully contain the \$12.86 per month added willingness to pay. That part of the bill equal to the added “willingness to pay” could be counted in Table 11-1 as the benefit of an improved water quality for the 5,772 Dry Prairie households or a present value of \$19,135,000. The benefit would total \$11,437,000 on the Fort Peck Indian Reservation with higher income levels and an ability and willingness to pay.

This benefit is more difficult to define than other benefits included in Table 11-1, and therefore was not included in the totals.

FIGURE 11-1

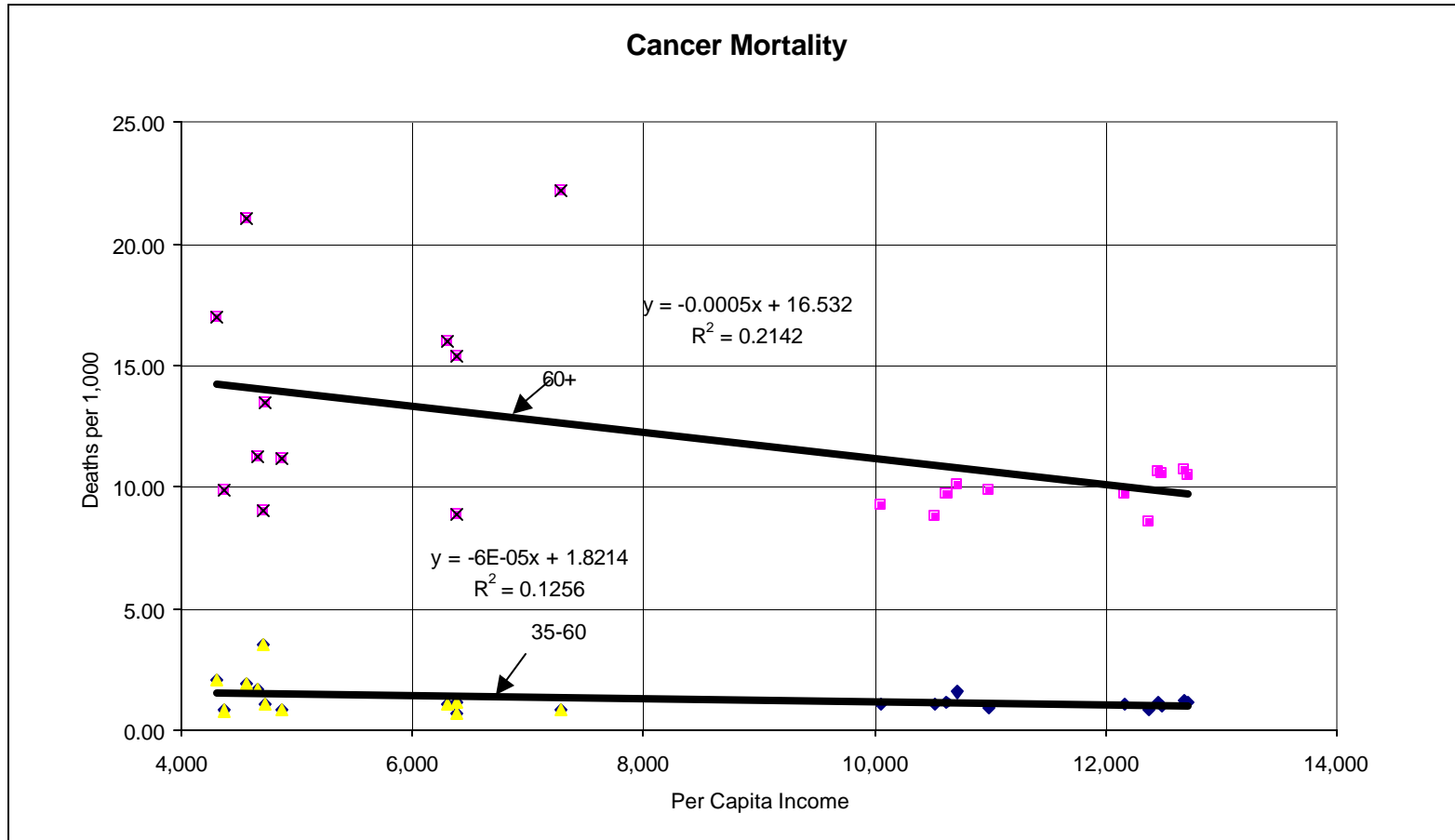


FIGURE 11-2

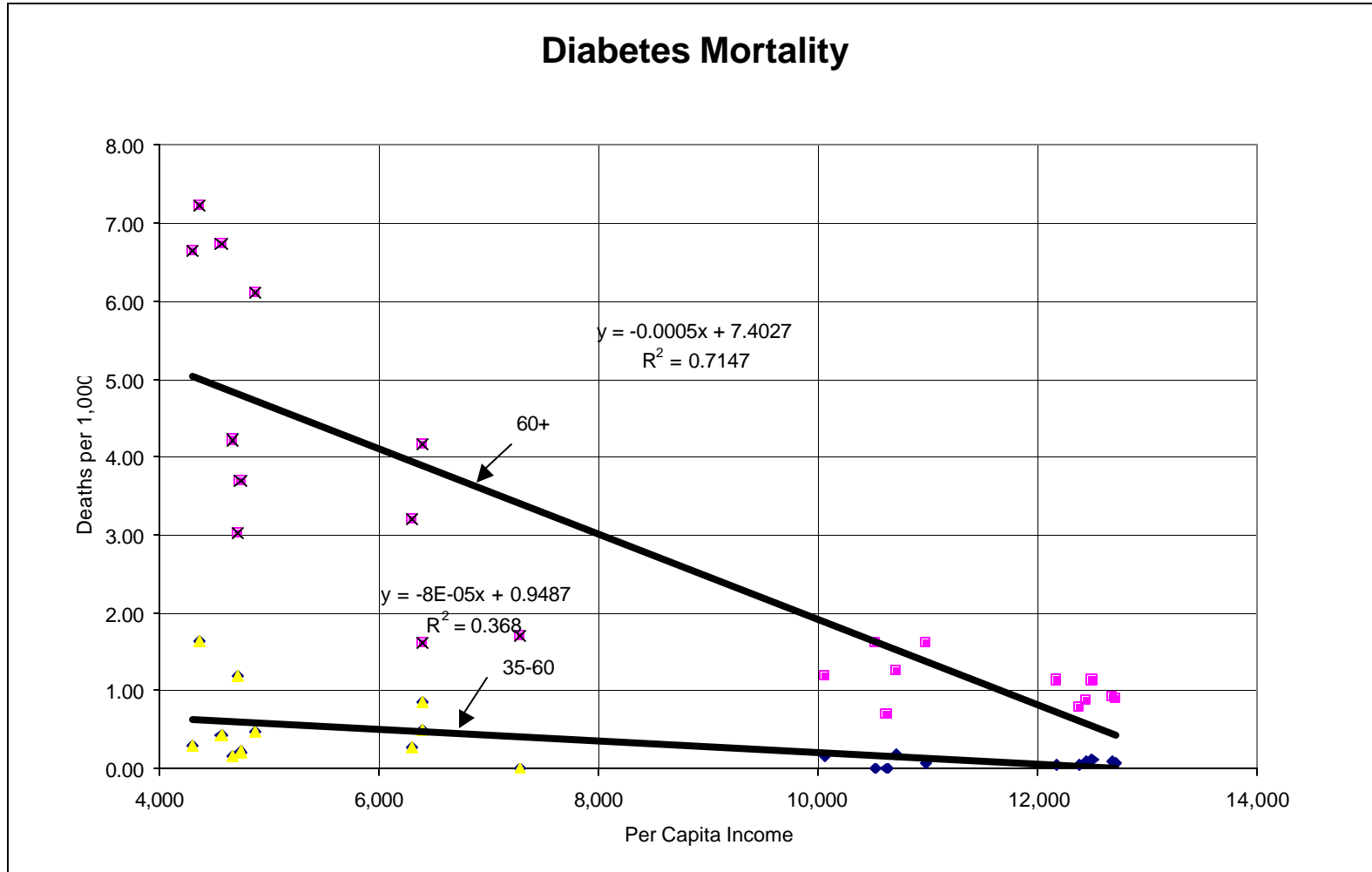


FIGURE 11-3

