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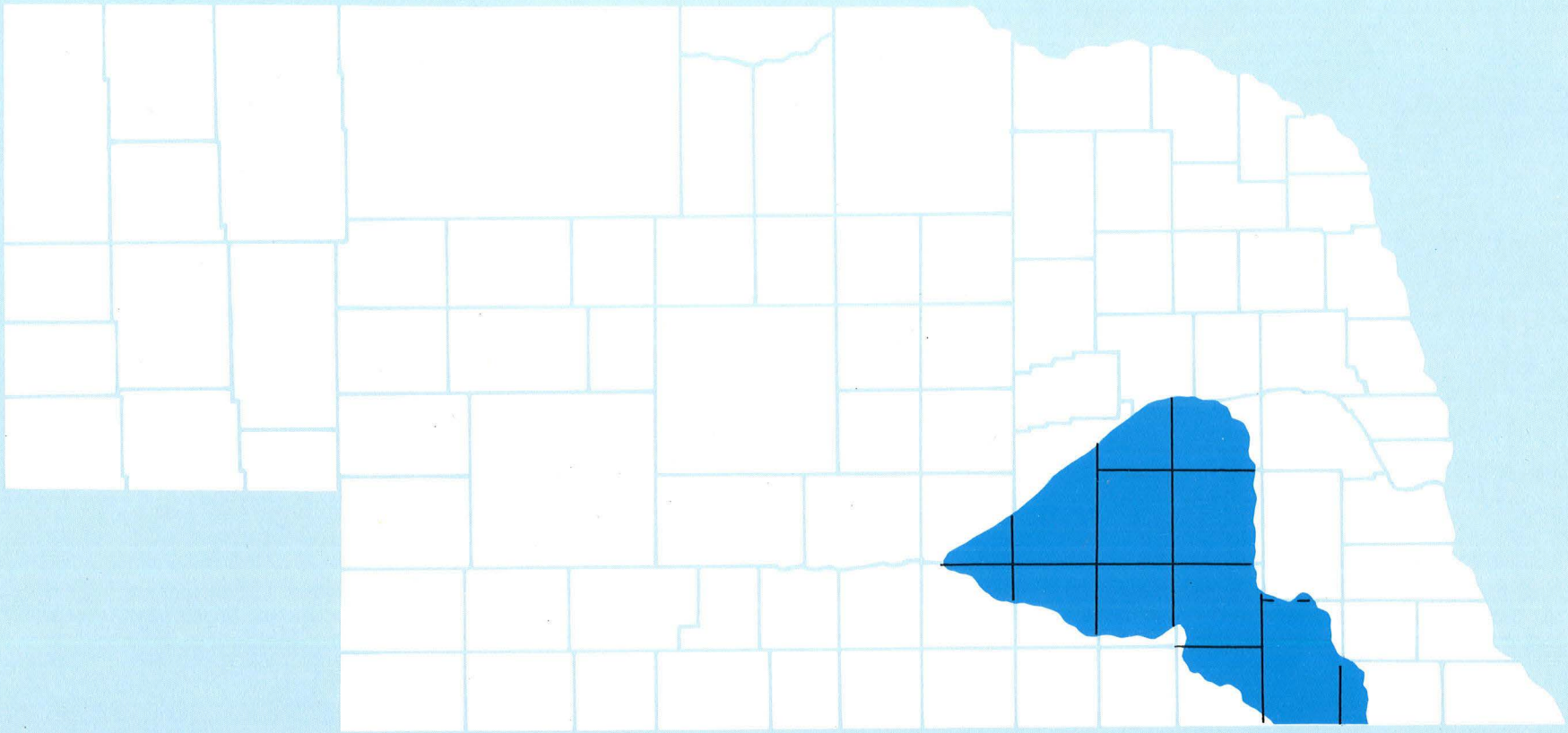
the BIG BLUE RIVER BASIN report summary

University of Nebraska
Agricultural Extension Service



THE BIG BLUE RIVER BASIN

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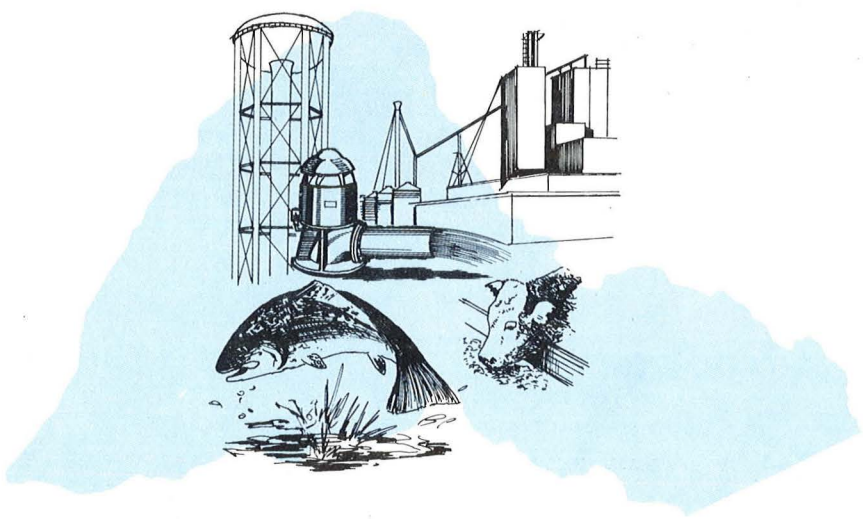
The Big Blue River Basin (Report Summary)

By

Deon D. Axthelm, Harold H. Gilman, Richard A. Wiese, David R. Miller, Howard L. Wiegers, and Jay P. Holman[1]



The State Soil and Water Conservation Commission has been assigned the task of developing a comprehensive water plan for Nebraska.

One part of this plan deals with water resource development of the Big Blue River Basin. A detailed basin report was developed by participating state and federal agencies as a result of requests from local citizens concerned with problems and needs in the basin.

This report summarizes the major points of the more detailed Big Blue Basin report with special emphasis on flood control, irrigation, municipal and industrial water supply, water quality, land treatment, recreation, major reservoir proposals and small watershed projects.

The Nebraska Soil and Water Conservation Commission looks to the Big Blue Watershed Planning Board for necessary leadership in implementing study recommendations.

The Commission will actively seek the necessary appropriations and authorizations for state, federal and local agencies to carry out their responsibilities.

Development of the features outlined in this report depends above all else on local initiative and assumption of responsibility. In addition, development depends on availability of funds, project sponsorship, future needs, possible changes in law and policy, and in part on future available water sources. Major findings:

1. Proper land treatment and use should have early and continued encouragement since it is basic to the region's economy.
2. Flood damage reduction can be achieved by a combination of flood plain zoning, small watershed project development, and various recognized forms of mainstem structural measures.
3. Lands in the lower basin can utilize available surface waters along with ground water for irrigation. Additional surface water will be required from outside the basin to achieve ground water stabilization in the upper basin.
4. Recreation development should be emphasized at those reservoir sites having the more stable water surface elevations.
5. Reservoir storage release to provide for controlled stream flow may be required for pollution abatement, recreation, fish and wildlife.

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Introduction

The Big Blue River Basin comprises 2,920,000 acres in southeast Nebraska.

The main drainage channel is the Big Blue River running generally north to south at the eastern edge of the basin and joined by more than a dozen tributaries which drain fertile flatlands to the west.

Within the basin are 108,000 people (as of 1966) one-third of whom live in Aurora, Beatrice, Crete, Hastings, Seward or York. Slightly less than one-third live on farms and slightly more than one-third live in communities of less than 2500.

The basin's economy is primarily agricultural, with wheat, corn and livestock main sources of farm income. Manufacturing is confined primarily to agriculturally related industries.

The net income of farm families in the basin is similar to farm income in other parts of the state and nation. Farm numbers decreased from 13,402 in 1944 to 9,540 in 1964. Average farm size increased from 212 acres in 1944 to 301 in 1964.

In 1960, 32.6 percent of the labor force was employed on farms, 13.6 percent in forestry, rock, sand and gravel mining, construction and manufacturing, and 53.8 percent in trade and service.

Some 83 percent of the agricultural acreage in the basin is in cropland, 12 percent is in pasture, 2 percent in woodland and the remaining 3 percent in other agricultural uses.

The Big Blue Basin, like other areas of Nebraska, is subject to great climatic variation.

Precipitation varies from an average of about 25 inches in the west to 30 inches in the east, with 80 percent of the precipitation falling during the growing season.

The basin's water supply comes from surface water and ground water. Ground water is the primary source for the nearly half-million acres of land irrigated in the basin. Fifty thousand acres are irrigated from surface water.

Ground water is of good quality except for areas near Wilber and DeWitt where it is highly mineralized.

Surface water quality varies with the time of year, depending upon pollution loads of sediments and waste discharges by agricultural, industrial and municipal sources.

The basin is an important waterfowl resource area. Major wildlife resources consist of upland game birds, waterfowl and deer. Quail and pheasant hunting is excellent.

FLOODS in the Big Blue Basin

The Big Blue Basin contains almost 2½ million acres of some of the finest cropland in the United States.

Many productive acres are subject to periodic flooding.

Streamflow records indicate that flooding has occurred somewhere in the basin in 35 of the 64 years since 1902—about one flood every two years.

Situation

Widespread and intense rainfall often causes severe problems on two types of lands in the basin.

Upland—where water tends to pond and not drain, causing extensive crop losses to some 110,000 acres.

Lowland—where flood waters cause millions of dollars of damage to about 242,000 acres of rural and urban land.

Flooding causes heavy losses to the economy of the Big Blue Basin. Reduced yields and lower use of the land are the principal items of damage with roads, bridges and urban damage next.

The 20 communities on the mainstem of the Big Blue River and its tributaries have lost some $3,327,500 from floods of the last 25 years. This figure does not include the 1967 flood in which both rural and urban damages were estimated at $2 million.

Problems

Upland—Topography is flat; channels are poorly defined. Water from heavy storms ponds and restricts use of land.

Lowland—Intense rainfall erodes cropland and poorly managed grasslands. Sediment is carried into tributaries, flood retarding structures and the main channel where most of it settles. Deposits build up and reduce water holding capacities of channels and detention structures. This increases the potential for more flooding.

Flood waters carry brush, weeds, trees and other debris which can jam the channel, destroy bridges and damage existing flood structures.

Desirable upstream floodwater retarding sites are not available in most major tributaries. Small watershed projects too often are not economically feasible. Flood programs need both types of projects.

Needs

Flood control can best be achieved with a total control program, including:

1. Soil and water conservation treatment on all lands.
2. Detention structures on tributaries.
3. Mainstem structures storing large amounts of flood water.
4. Proper flood plain use achieved through zoning and management.
5. Adequate flood warning, evacuation, and flood forecasting networks.
6. Channel improvement, levees, and bank stabilization projects.

Recommendations and Means of Development

Development of the overall flood program for the Big Blue Basin depends on support and action by local citizens. Some programs are in progress; others are needed:

1. Soil and water conservation treatment on all lands. Treatment of land areas is important not only in preventing floods but also in conserving soil resources.

2. Detention structures on tributaries. Watersheds are a means of obtaining a high level of flood protection for upstream tributaries. However, detention structures have only a limited effect in reducing the flood crest in downstream valleys.

Development of water disposal systems for cropland and depressional areas of the basin should be accelerated. These can be developed through cooperation with the Soil Conservation Service.

The construction phase of small watershed programs already planned has been lagging because of lack of funds. Local citizens can help by providing local funds and by encouraging State and Federal officials to secure funding.

Watershed Conservancy Districts already organized in the Big Blue Basin need to provide funds for easement and right-of-way procurement and operation and maintenance activities.

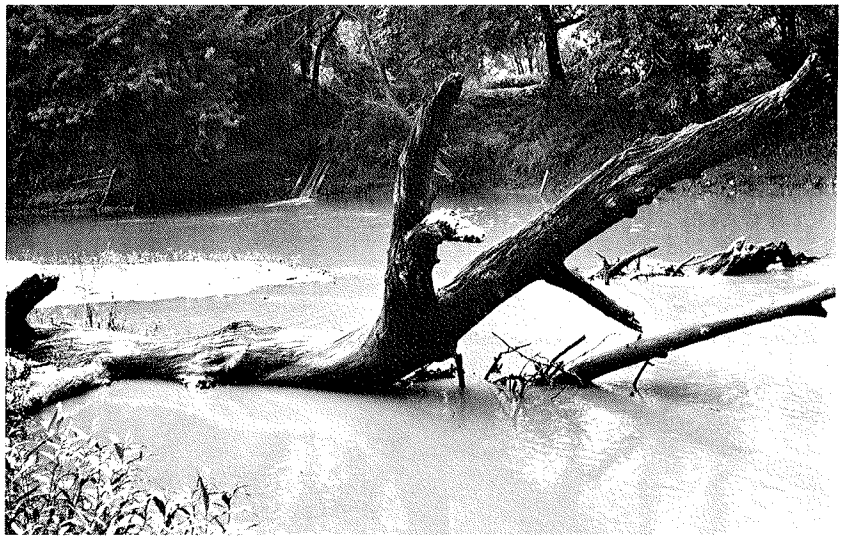
Counties should search for opportunities to incorporate flood water detention dams in road construction programs as a desirable alternative to constructing bridges. Local citizens should encourage county officials to consult with the county engineer, and local soil and water conservation districts.

3. Mainstem structures storing large amounts of flood water. As a result of flooding in June, 1967, the Corps of Engineers should be encouraged to re-examine the flood control potential of the five reservoirs previously investigated. These sites are at Surprise, Beaver Crossing, Sunbeam, Shestak and Seward View.

4. Proper flood plain use achieved through zoning. Inventories of past flood damage indicate that many towns in the basin have land areas subject to flooding. Surprise, Ulysses, York, McCool Junction, Pickrell, Wymore, Diller, Odell, Clatonia, and Barneston should work with their county officials to prevent further industrial, agricultural or municipal development in these areas. Information on managing flood plains can be obtained from the Nebraska Soil and Water Conservation Commission.

5. Adequate flood warning, evacuation, and flood forecasting networks. Floods usually catch cities and citizens unprepared. No matter how many structures are constructed, 100 percent flood protection is not possible. An adequate warning system and evacuation plan is vital. Local citizens should evaluate their systems to see if they are adequate. Assistance is available from the United States Weather Bureau, State Civil Defense Office and the Nebraska Soil and Water Conservation Commission.

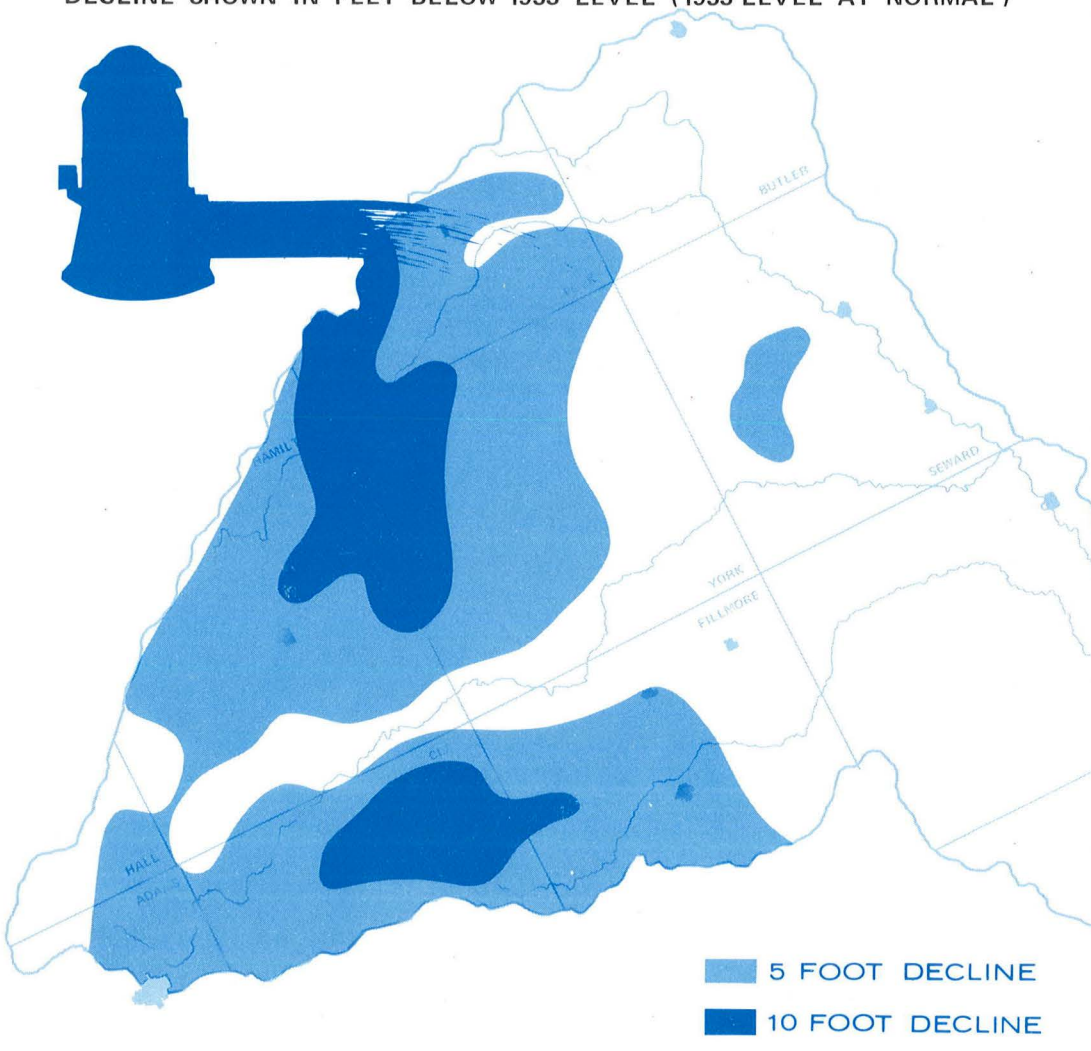
6. Channel improvement, levees and bank stabilization. Clogged channels, lack of levees and poor management of river and tributary banks increases the possibility of damage from flooding. Citizens should ask State and Federal agencies to provide technical aid and funds for adequate levees, culverts, bridges, clearing of debris and log jams and other channel improvement measures.



IRRIGATION in the Big Blue Basin

Ground Water Table Decline

DECLINE SHOWN IN FEET BELOW 1953 LEVEL (1953 LEVEL AT NORMAL)



Irrigation is one of the most important and largest water users in the basin. At present 489,000 acres (nearly 17 percent) of the land area in the basin is used for irrigated agriculture production.

Of that total, 50,000 acres are irrigated from surface water supplies (water pumped directly from the Big Blue River or its tributaries). The balance of the acreage is irrigated by ground water (water pumped from wells).

It is estimated that 613,200 acres of basin land will be irrigated by 1980.

Situation

Surface Water—Surface water is limited at certain times of the year, resulting in an unstable supply for irrigation. It is estimated that only one-half of the 50,000 acres which have surface water rights are irrigated in any one year. The quality of the surface water is generally acceptable for irrigation.

Ground Water—Ground water is the primary source of irrigation water in the basin. Certain areas are removing ground water from storage at a rate three to four times greater than the average annual recharge. It takes from 6–12 inches of water per acre in addition to that from normal precipitation to achieve high crop yields.

As much as 700,000 acre feet of water is pumped for irrigation purposes each year, while normal precipitation replaces only about 175,000 acre feet.

Ground water conservation districts have been organized in York and Hamilton Counties to develop a program for conservation of ground water.

In general, ground water quality is satisfactory for irrigation. Excessive salinity and some sodium does occur in certain areas.

Parts of Saline and Lancaster Counties have high salinity ground water, which precludes irrigation. Other areas have ground water of moderate salinity which may be used, with proper management procedures, for irrigation.

Certain areas of the basin have sufficient sodium in the ground water to cause an alkali hazard in some soils if used for irrigation.

Definite alkali hazards exist in areas of Saline, Lancaster and Gage Counties.

Problems

Surface Water—Unstable supply of water during high use periods, along with frequent flooding, has curtailed irrigation.

Ground Water—The demand for and use of ground water is exceeding the recharge to the ground water reservoir. Ground water tables have declined 5 to more than 10 feet in some areas. Further decline of the ground water levels is expected. For example, in York and Hamilton Counties, some 240,000 of the counties' 689,000 acres are irrigated. At a rate of one and one-half inches recharge per year, the total recharge to these counties is some 85,000 acre feet annually. This is roughly one-third of the withdrawal rate and relates directly to the lowering of the water table in those areas.

Other counties experiencing local drops in water table are Adams, Clay, Fillmore, Polk and Seward.

An area near Exeter, in Fillmore County, has a clay layer which does not allow significant amounts of water to reach the ground water reservoir. Surface water gathers in depressional areas until it evaporates, thus restricting the area for cropping.

Management—Many irrigation problems in the basin are related to water management.

Run-off water from irrigated fields ranges from 20 to 50 percent of the total water applied. This water is often diverted into streams which carry the water out of the basin.

Needs

Surface Water—A method of obtaining a stable supply of water during the cropping season is needed. Control of major floods would protect lowlands that have been developed for surface water irrigation.

Ground Water—Better management of the ground water used for irrigation is needed to gain the maximum benefit from the basin water supply.

Another need is to obtain sufficient water to supply the future irrigation needs in the basin, particularly in those areas where the ground water table is declining or available water is limited.

Recommendations and Means of Development

Maintenance of adequate water resources for irrigation in the Big Blue River Basin depends on support and cooperation from citizens in the area. Listed below are a few of the recommendations which would contribute to the irrigation potential of the basin:

1. *Surface Water*—The need for extending surface water irrigation in the basin by construction of appropriate irrigation projects should be determined. Proposed reservoirs could result in a more stable supply of water for some areas of the basin and also help control the frequent flooding of lowlands. The Bureau of Reclamation study to determine the economic and engineering feasibility of the Sunbeam Unit, the Beaver Crossing Reservoir, distribution systems and lands in the Goehner and Dorchester areas should be expedited.

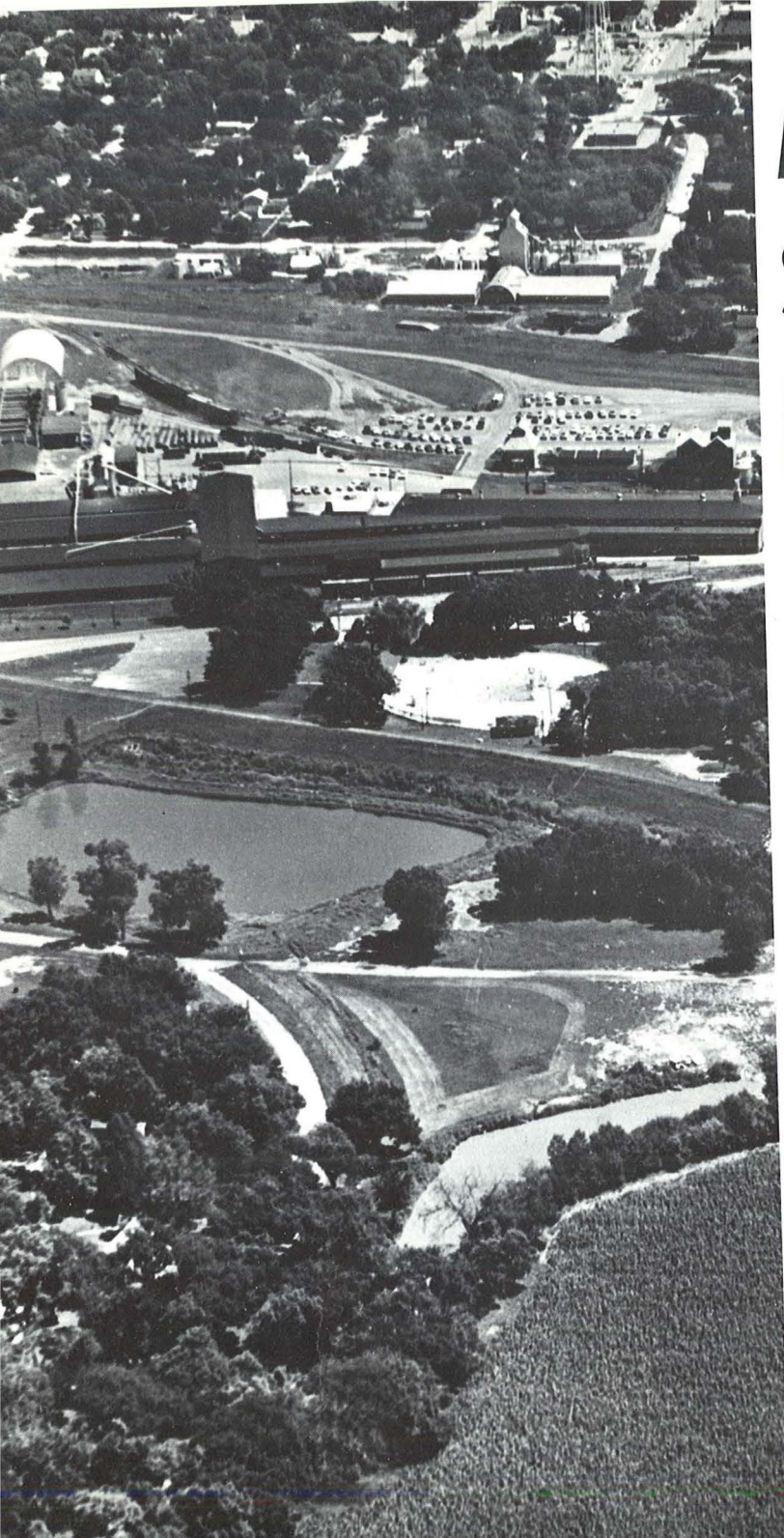
2. *Ground Water*—More technical help on management of irrigation water should be requested. The Conservation and Survey Division, the Agricultural Extension Service, the Soil Conservation Service, and Bureau of Reclamation provide this service. Examples of service available include design of reuse systems, information on crop-yield relationships, ground water sources, crop tillage, land shaping and sprinkler design.

It is estimated that use of all water management practices could save more than 120,000 acre feet of water per year in the basin. For example, reuse systems would allow from 20 to 50 percent of the total water supplied to be returned to fields. Irrigation and tillage practices and correct design of sumps and reservoirs will minimize evaporation.

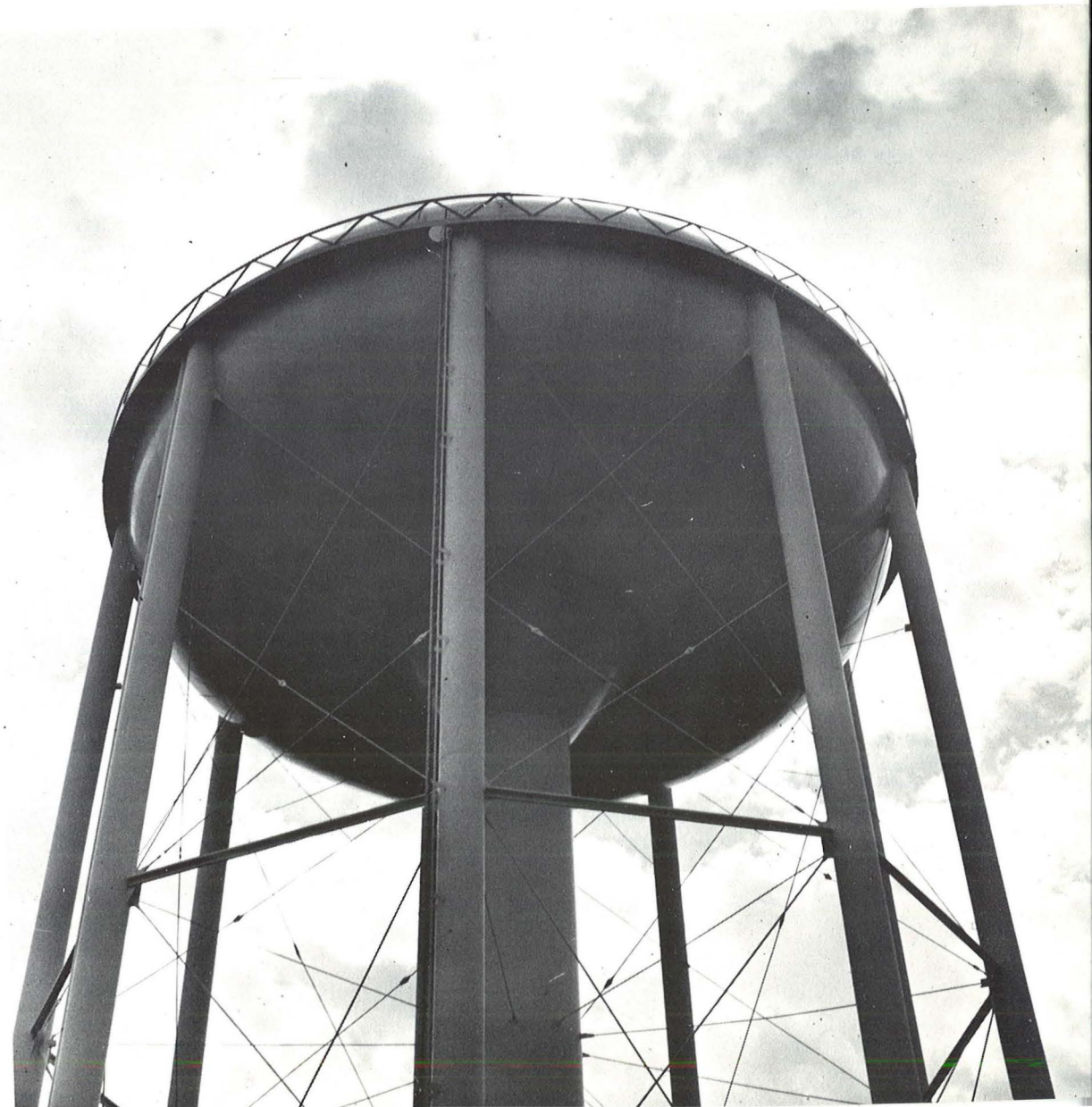
3. The Big Blue River Watershed Planning Board, in cooperation with the Agricultural Extension Service and the Soil and Water Conservation Commission, should determine whether potential and present irrigators would be interested in using imported water if it were available.

4. Methods of draining depressional areas and putting this water to good irrigation use should be studied.

5. Ground Water Conservation Districts to include a total problem area should be organized by local people to manage and regulate the ground water resource of the basin.



Municipal and Industrial Water Supplies in the Big Blue Basin



Water supplies for domestic and industrial uses in the Big Blue River Basin are drawn exclusively from ground water. About 25 million gallons per day are used (approximately 28 thousand acre feet annually). Estimates show the water needs will rise to 43 million gallons per day in 2020.

Situation

Quantity—Ground water supplies are sufficient to provide for needs in the foreseeable future.

Quality—All ground water contains some minerals. Some ground water in the Big Blue Basin has nitrate, sulfate and manganese levels greater than the Public Health Service drinking water standards. Some ground water near Wilber and DeWitt is highly mineralized. South of Crete, some ground water supplies may exceed the standards for sulfates, nitrates, and total dissolved solids set by the U.S. Public Health Service.

Problems

A definite danger to public water supply is the lack of disinfection by chlorination or other approved methods. No community in the basin provides such protection.

Dwight, Rising City, and Marquette use water that exceeds recommended nitrate levels. Sulfate in the water supplies for Marquette and Odell is above the recommended limit.

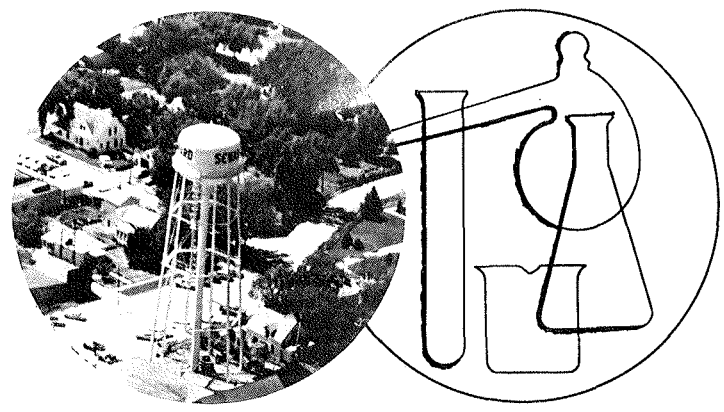
Declining water tables in some areas and highly mineralized ground water in other areas may limit future supplies of suitable water available for municipal uses.

Needs

Basin residents should be made aware that there are areas in which ground water mineralization exceeds standards set by the Public Health Service.

There is a need in the basin for protection and maintenance of present water supplies and development of new sources and systems by:

1. Disinfecting raw water supplies and maintaining the safety of the water in event of bacterial contamination.
2. Reducing high nitrate and sulfate levels.
3. Decreasing wasteful uses.
4. Developing new supply sources and systems.



Recommendations and Means of Development

Programs to protect and assure an adequate water supply for municipal and industrial uses need to be implemented by local citizens with the cooperation of Federal and State agencies. Included should be a continuation of educational programs showing effect of fluoridation of water in the control of tooth decay in children.

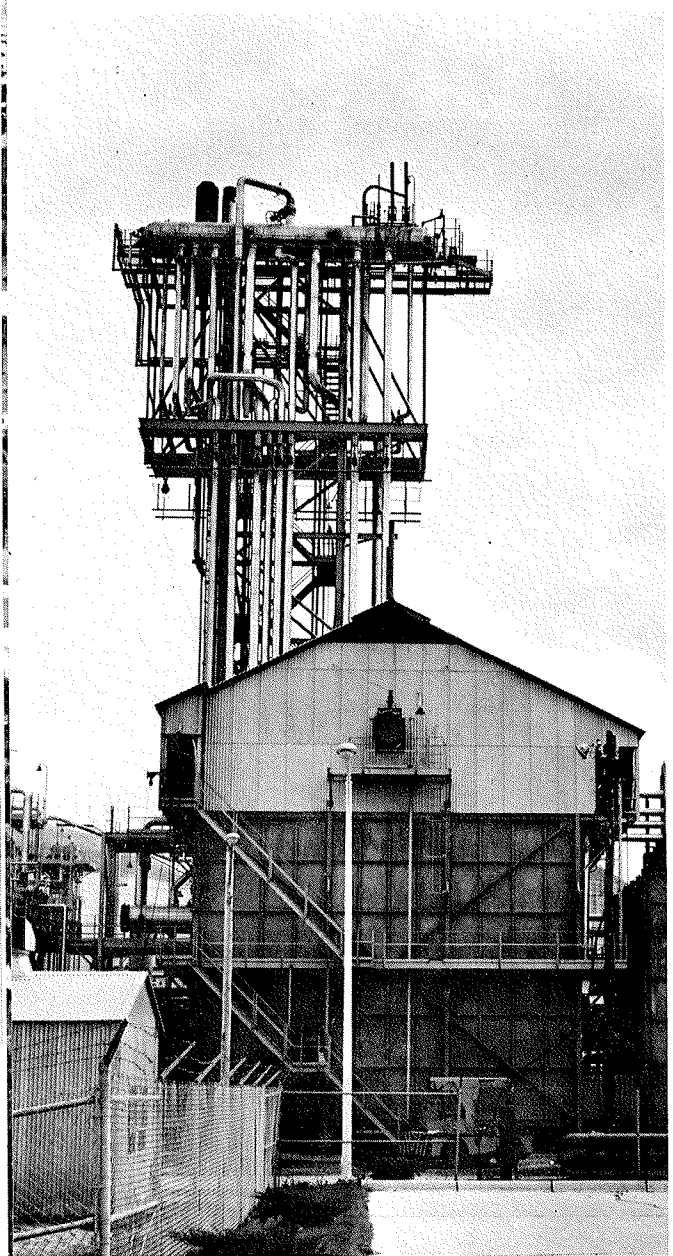
1. Disinfecting raw water supplies. Officials responsible for public water supplies should act immediately to protect such supplies from contamination by providing disinfection through chlorination or some other proven method.

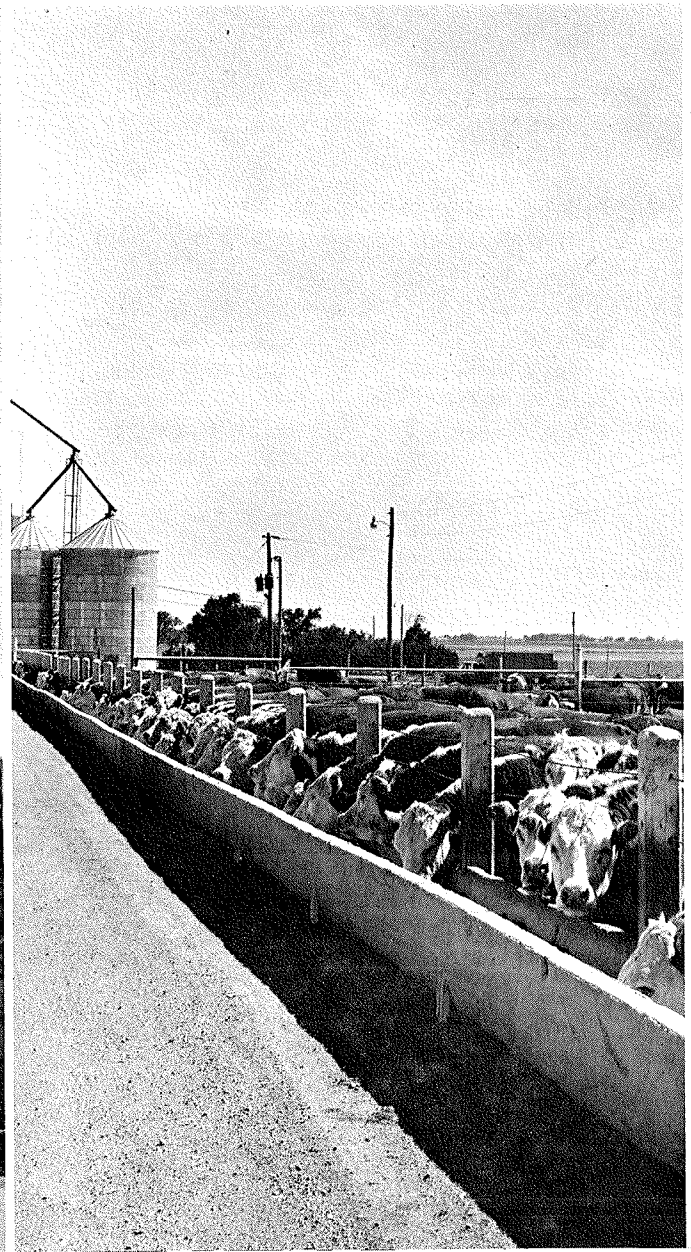
2. Reducing high nitrate and sulfate levels. Rising City, Dwight, Marquette, and Odell officials should seek help from the U.S. Public Health Service and the State Department of Health to find solutions to the problems posed by high nitrate and sulfate levels in the public water supplies.

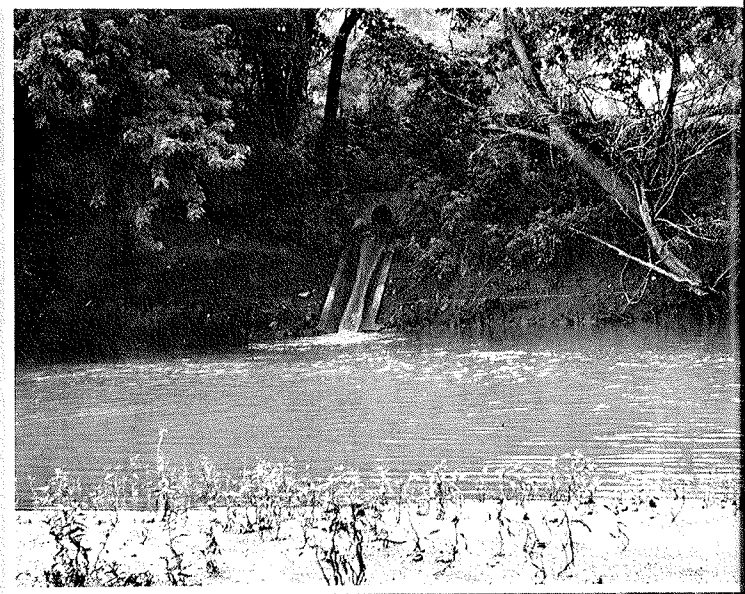
3. Decreasing wasteful use. Cities should institute a policy of metering water use and using a realistic graduated pricing system as one means of eliminating waste.

4. Developing new supply sources and systems. In areas having a declining water table, some control in well locations may be necessary to assure adequate supplies. Local officials should seek help from the Conservation and Survey Division, University of Nebraska, in locating water sources. The Farmers Home Administration provides assistance in development of needed rural systems.

WATER QUALITY in the Big Blue Basin







Water is essential to the environment of humans, plants and animals. It is vital for human and animal consumption, important for industrial processes, vital for crop and food production, desirable for recreation and important as a carrier for waste.

Water must be maintained at a quality that will support these functions. The quality is affected by the amounts of minerals, sediments, bacteria and other factors.

Municipalities will require slightly more water for future domestic and industrial uses. Per capita use of 120 gallons per day is expected to increase to 140 gallons in 40 years. During that time a comparatively slight increase in population of 4,450 is expected. Added water use indicates that greater amounts of wastes will require treatment and disposal.

Situation

Water quality standards for streams in the basin are being established by the Nebraska Water Pollution Control Council. More testing for and greater control of pollution sources can be expected.

The quality of the surface waters in the Big Blue River Basin varies during the year. Studies conducted by the Nebraska State Department of Health indicate that the best quality of water exists in the late winter and early spring before the spring runoff occurs. The Big Blue River may rank as the most polluted interstate river in Nebraska if silt is considered as a pollutant.

The Big Blue River receives municipal and industrial wastes from every community along the river. There are increasing amounts of waste materials from agricultural sources which are affecting the quality of water in the river. Although at present the quality for irrigation purposes is acceptable, problems may arise in the future if this water is used for drinking purposes. Marysville, Kansas uses the Big Blue River as its source of drinking water.

Ground water is of high quality in most of the basin. However, certain areas do contain minerals in excess of health standards. This is discussed in the preceding section on Municipal and Industrial Water Supplies.

Ground water is satisfactory for irrigation. Exceptions are discussed in the section on Irrigation.

Problems

As community growth and per capita consumption of water continues, additional wastes will be produced. This will cause a problem of pollution of river water where sufficient stream flow for dilution is not available.

Due to inadequate streamflows at Hastings and York, sewage treatment effluents are not now adequately assimiliated, resulting in increased pollution in the Big Blue River.

Agricultural sources, including soil erosion, feedlots, chemicals, and irrigation return flows, are contributing to pollution of the Big Blue River. Although no data on quantity is available, this type of pollution has a serious effect upon water quality.

Needs

There is a need to obtain better methods of municipal waste disposal and treatment and to increase the amount of streamflow available for dilution, particularly at Hastings and York.

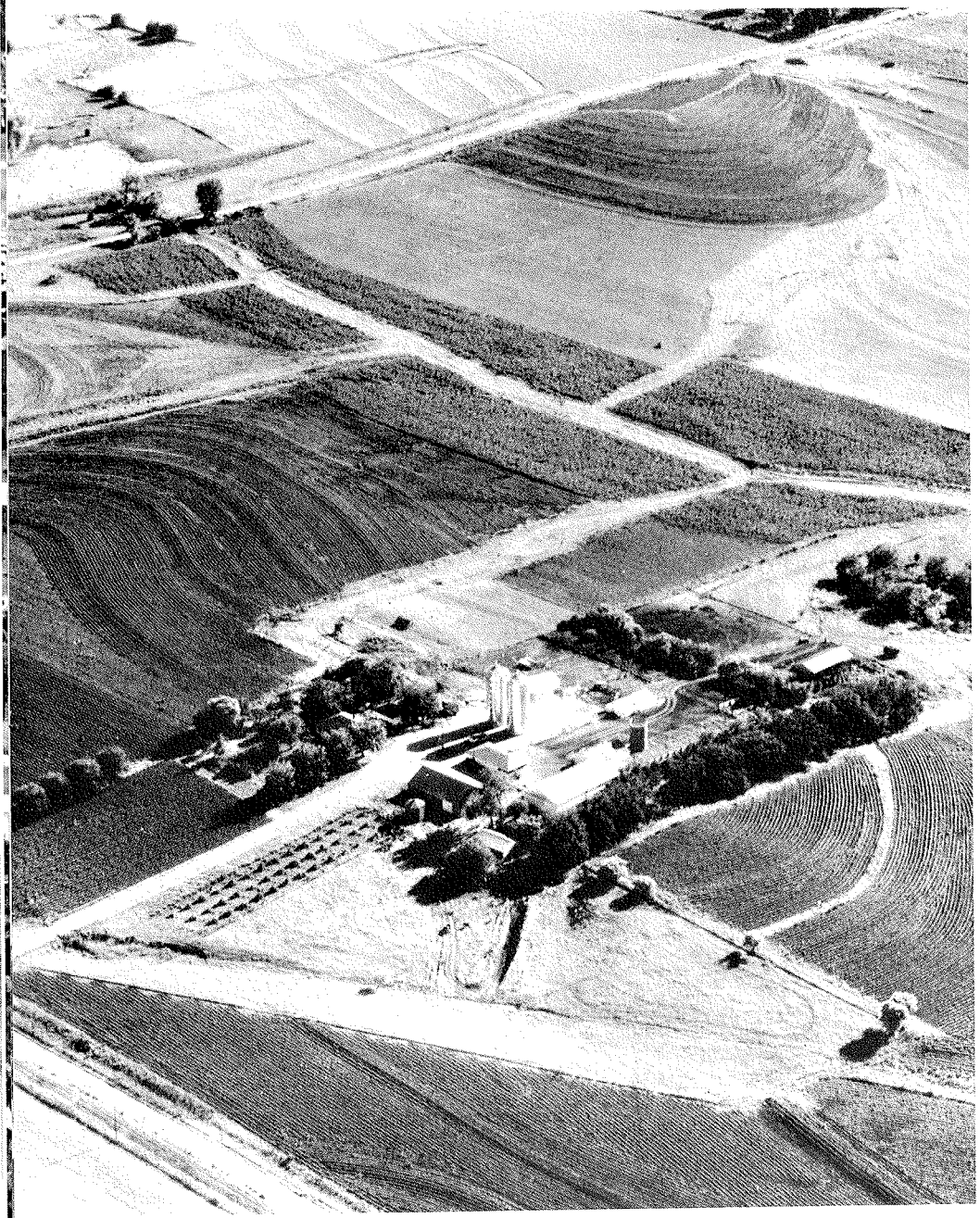
Cities will need added sewage treatment facilities in the future. Milford needs to act immediately.

There is a need to develop technology for the better management of agricultural wastes so as to minimize pollution. More research is necessary to determine economic methods of control and treatment.

Recommendations and Means of Development

Water quality is of primary importance to every basin resident. It is his responsibility to see that all steps necessary to protect and improve his water supply are taken. To do this the following recommendations are made:

1. Basin residents should encourage conservation programs to reduce soil erosion and resultant silt and sediment problems.
2. State and Federal agencies should be encouraged to provide financial and technical assistance in the development of agricultural waste disposal facilities.
3. Cities should plan now for needed expansion of treatment facilities.
4. Milford should act immediately to incorporate at least secondary treatment as a part of the operation of its sewage collection system.
5. Hastings should give consideration to the provisions of either additional sewage treatment or use of sewage effluent for some other purposes.



LAND TREATMENT in the Big Blue Basin

Good land treatment is a basic requirement in a program of development, conservation, and utilization of soil and water resources. Practices required to protect and conserve soil include: terraces, contour farming, grassed waterways, seeding eroded steep land to grass, good pasture management practices, and good cropping systems.

Situation

Ninety-six percent of all basin land is devoted to agriculture. Eighty-three percent of this is devoted to crops, 12 percent is in pasture, 2 percent is in woodland and the rest in other agricultural uses.

Future land use is not expected to change appreciably. Trends toward urban land use, so striking in some parts of the nation, are not expected in this basin.

The most notable land use change expected is the increase in irrigation which is projected to increase some 36% from the present 489,000 acres to 667,900 acres by 2020.

Lands requiring treatment have had some conservation practices applied. However, much remains to be done:

Contour farming, 37% completed, 625,000 acres remaining.

Correct application of irrigation water, 30% of acres properly managed; 341,700 need improvement.

Proper use of pasture and range, 30% of acres properly used, 360,000 need improvement.

Construction of level and gradient terraces, 30% completed, 34,000 miles to be constructed.

Soils in the basin range from deep to shallow. Fifty-seven percent of the soils are Class I and II land that have no or only slight limitations for cropping practices. About 33 percent of the soils are Class III and IV and have serious to very severe limitations for cultivation. The remaining 10 percent is pasture range and woodland.

Problems

Sediment deposit is a major problem. This problem is aggravated by overuse of pastures and rangelands and consequent erosion of topsoil. Erosion not only causes loss of soil and productivity but also produces sediment which decreases channel and reservoir capacities.

The lower portion of the basin and the steeply sloping areas of the upper basin are subject to severe sheet and gully erosion.

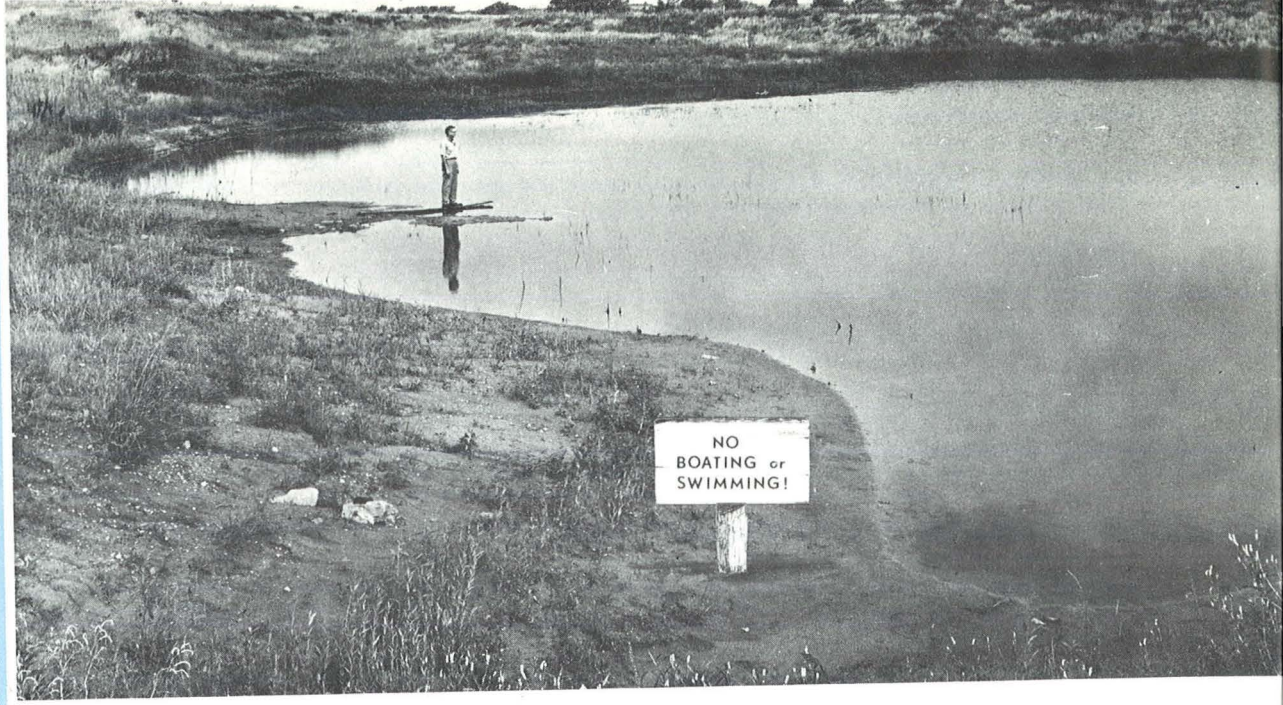
Needs

Land treatment is vitally needed to decrease soil erosion and resultant sedimentation of stream channels. Adequate land treatment measures can also assist in flood control, ground water recharge, and maintaining land productivity.

Recommendations and Means of Development

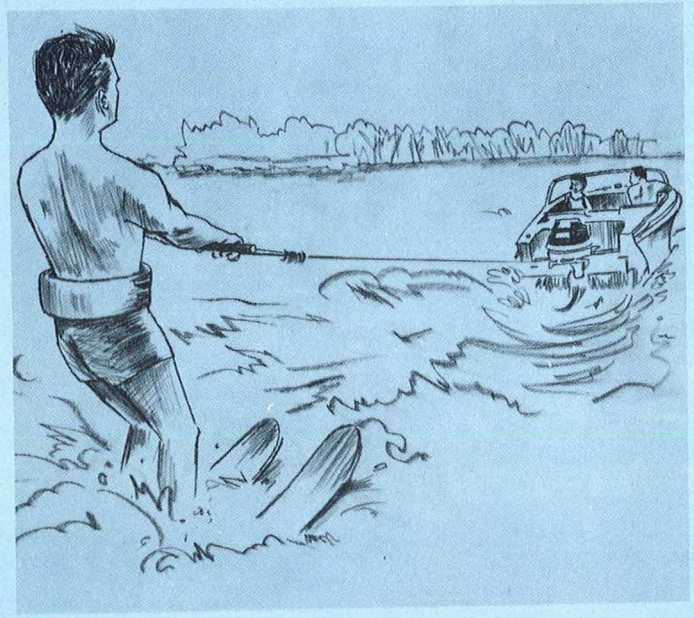
Local citizens must take an active part in the development of land treatment measures necessary to protect their interests in the Big Blue Basin. This can be done by:

1. Encouraging local government to employ personnel to carry out a more aggressive program of land treatment in the basin.
2. Encouraging county and township governing bodies to incorporate drop inlet structures on road systems where practical and to reshape and seed road ditches and drainageways to control erosion and sediment.
3. Encouraging accelerated research by Federal and State agencies to determine new soil conservation techniques.
4. Encouraging the continued use of Federal funds for permanent soil and water conservation practices.
5. Encouraging the University of Nebraska, through its research, teaching and Extension programs, to provide leadership in developing and promoting land treatment measures.



RECREATION—FISH AND WILDLIFE

in the Big Blue Basin



Nebraskans are becoming more outdoor recreation minded. Nearly all water use plans take this into consideration.

The Federal Outdoor Recreation Resources Review Commission estimates that the demand for recreation will triple by the year 2000. Demands for boating and water skiing areas are increasing and are in short supply, especially in the Big Blue River Basin.

Situation

The Big Blue River Basin is woefully lacking in outdoor recreation although some excellent pheasant and quail hunting exists in part of the basin plus limited deer and waterfowl hunting.

Except for the mainstem of the Big Blue River and a few local watershed impoundments, water for boating, water skiing and swimming (excluding city pools) is practically nonexistent.

Camping and picnicking facilities are extremely limited.

The plans for this reservoir under construction include recreation facilities. Many existing impoundments, like those on the opposite page, were not preplanned for recreation and are either too small or lack access roads, docks, picnic areas and safety features.

Problems

Areas available for recreation in the basin are now being used at or near capacity and any increase in capacity is unlikely.

Lack of adequate water storage sites is compounded by the basin's proximity to the population centers of the state.

Data available for 32 communities in the basin indicate they are deficient in public recreation lands.

Access to recreational areas is another problem.

The number of fishing permits issued is below average, which may indicate lack of quality fishing. Loss of waterfowl breeding areas has caused a decline in waterfowl population.

Another problem is the lack of recognition on the part of basin residents of the economic potential of recreational development. By 1980 the annual value from recreation in the basin, if developed, could be $2 million.

Needs

Demand for water-based recreation is increasing. People will travel a much greater distance for quality hunting, fishing and boating than for picnicking or outdoor games.

At present the Big Blue Basin has only 17 acres available for camping and picnicking, and only a few acres for water sports. It is estimated that by 1980 there will be a need for 6,354 surface acres of water for boating, water skiing, and swimming. Camping and picnicking needs in 1980 are estimated at 514 acres.

Based on fishing and hunting permit sales in the basin, there is a need for development of better fishing and waterfowl harvest opportunities.

Recommendations and Means of Development

Development of recreation, fish and wildlife programs must start with action by local citizens.

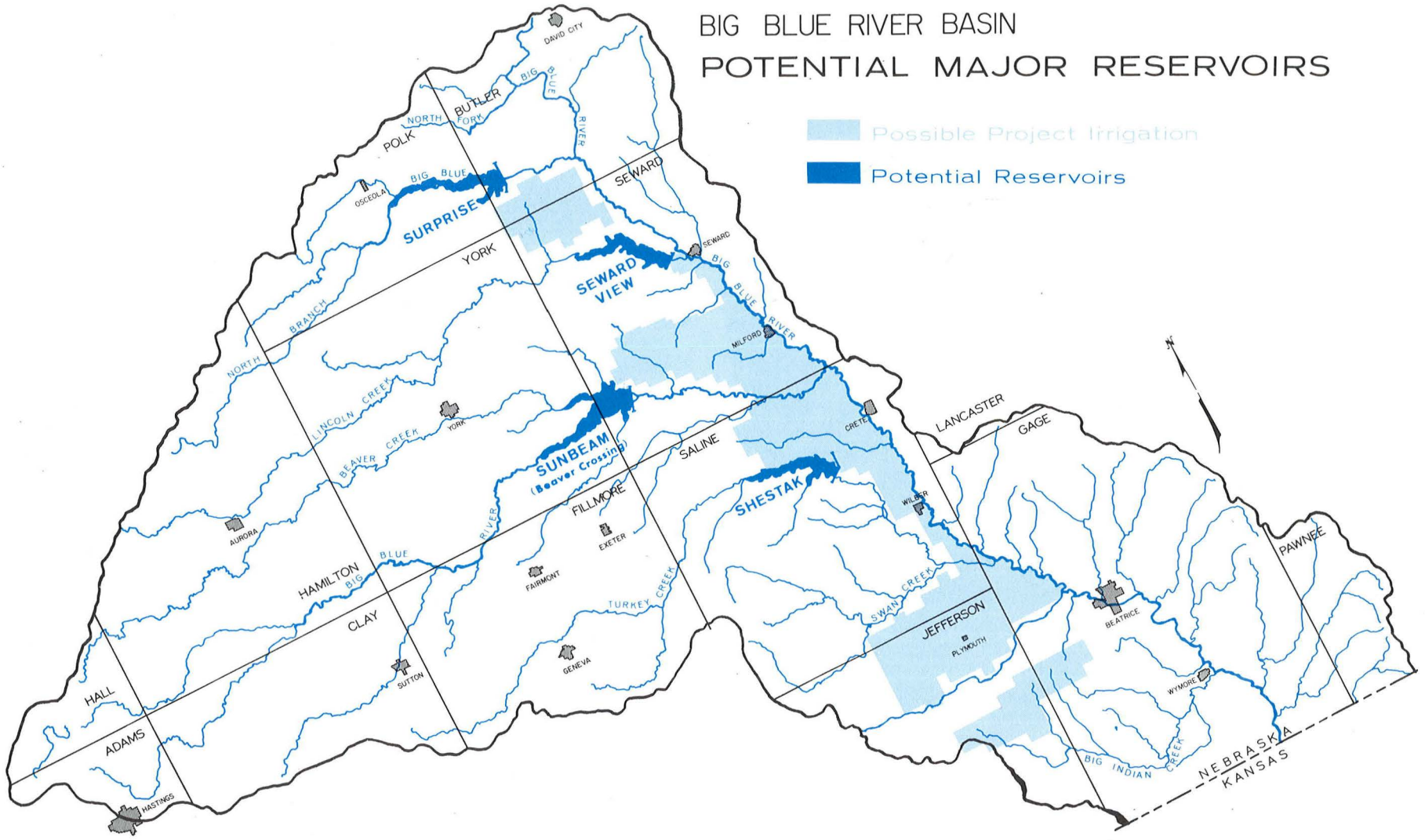
1. All counties should develop a county park system or plan which considers use of existing and proposed water sources.

2. Local sponsors of watershed districts should consider acquisition of land for recreation in conjunction with suitable sized small watershed structures as a means of meeting local recreation demands.

3. State and Federal agencies should be encouraged to consider development of facilities associated with all proposed reservoir sites with special emphasis on the Beaver Crossing site as the primary recreation area.

4. The State Game and Parks Commission and Soil Conservation Service should be encouraged to participate in programs to plan and develop opportunities for fishing, hunting and other recreation.

MAJOR RESERVOIRS in the Big Blue Basin



Multipurpose reservoirs on the mainstem of the Big Blue River can provide water for flood control, irrigation, ground water recharge, low flow augmentation (maintaining streamflow) and recreation.

Situation

At present there are no major reservoirs on the Big Blue River. The local Big Blue River Watershed Planning Board, recognizing the need for overall basin development, asked the Nebraska Soil and Water Conservation Commission to make a study of the soil and water resource development potentials. Federal agencies were asked to participate.

The Bureau of Reclamation investigated numerous sites and proposed four potential reservoirs and three areas of land for possible project irrigation. The sites are named Surprise, Beaver Crossing (sometimes called the Sunbeam Unit), Seward View and Shestak. These are shown on the map, page 18.

The Corps of Engineers investigated 21 sites. They have suggested further investigation and possible development of the same four as proposed by the Bureau plus an additional site at York.

The Beaver Crossing site in the Sunbeam Unit is the only site investigated in detail thus far. The Bureau of Reclamation is now engaged in a study of the engineering and economic feasibility of constructing the unit.

Problems

The drainage pattern within the basin is one of the problems in locating reservoir sites. Sites are limited because of wide valleys and flat slopes of the river.

Maximum use of the reservoirs, including irrigation, recreation, and other purposes, normally requires a large drainage area above the site. This is particularly true in the basin where less than 10 percent of precipitation is discharged as runoff to the river.

Under current conditions, the potential for practical surface water conservation projects is limited to the lower reaches of the basin streams. Here, the water supplies are more nearly adequate for the various needs.

Needs

Flooding of 50,000 acres in the mainstem of the Big Blue River needs to be controlled.

Tuttle Creek Reservoir is in need of back-up storage for the protection of cities downstream in Kansas.

A need exists for water storage sites in the upper and central part of the basin where water tables are declining.

There are about 125,000 acres of land in the Goehner, Dorchester, and Plymouth areas that may need surface water for irrigation in the future.

There may be a need to provide additional water for pollution abatement for Hastings and York in the future.

Water-based recreation is needed in the Big Blue River Basin.

Recommendations and Means of Development

Reservoirs, along with other measures, could help prevent flood damage to Milford, Crete, Wilber, DeWitt, Beatrice, Wymore and Barneston. In addition, annual benefits of $3 million would accrue downstream.

Because of the problems and needs in the Big Blue River Basin, Federal and State agencies have suggested continued investigation and study of the following large reservoir sites:

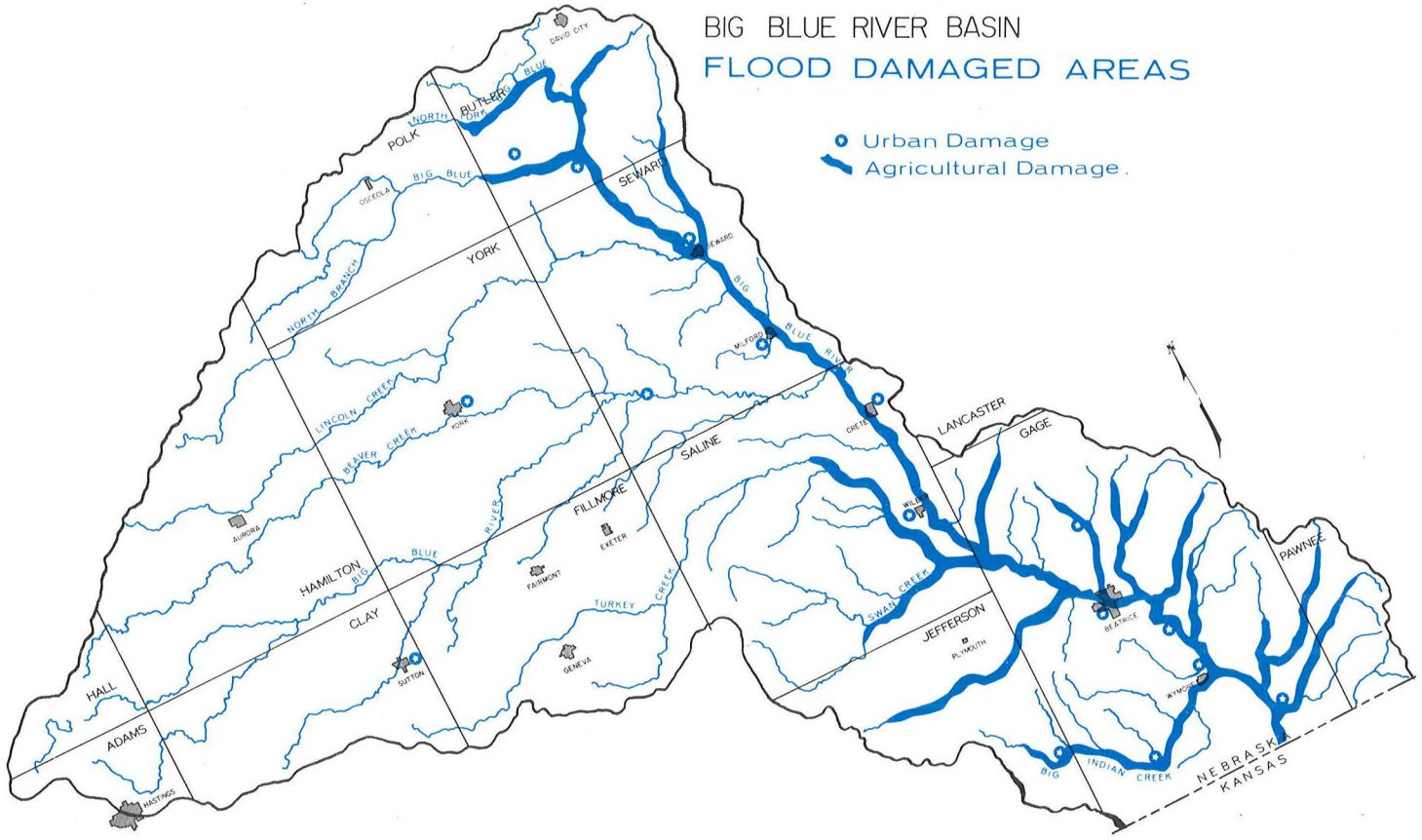
1. *Surprise Dam and Reservoir*—The Surprise Dam and Reservoir site is one and one-half miles west of Surprise, Nebraska, on the North Branch of the Big Blue River. The site, when fully developed, would have a storage capacity of 176,700 acre feet. This site intercepts water from an area of 337 square miles. Since this reservoir is near the headwaters of the mainstem of the Big Blue River it is recommended that it be used to provide augmentation of the low base flows which occur in the Big Blue River, as well as recreation and flood control.

2. *Seward View Dam and Reservoir*—The Seward View Dam and Reservoir site is on Lincoln Creek about two miles west of Seward, Nebraska. This site, when fully developed, would provide a storage of 227,300 acre feet. The dam and reservoir control water from an area of 445 square miles. It is recommended that the site be developed for flood control and recreation with storage available for later use in surface water irrigation.

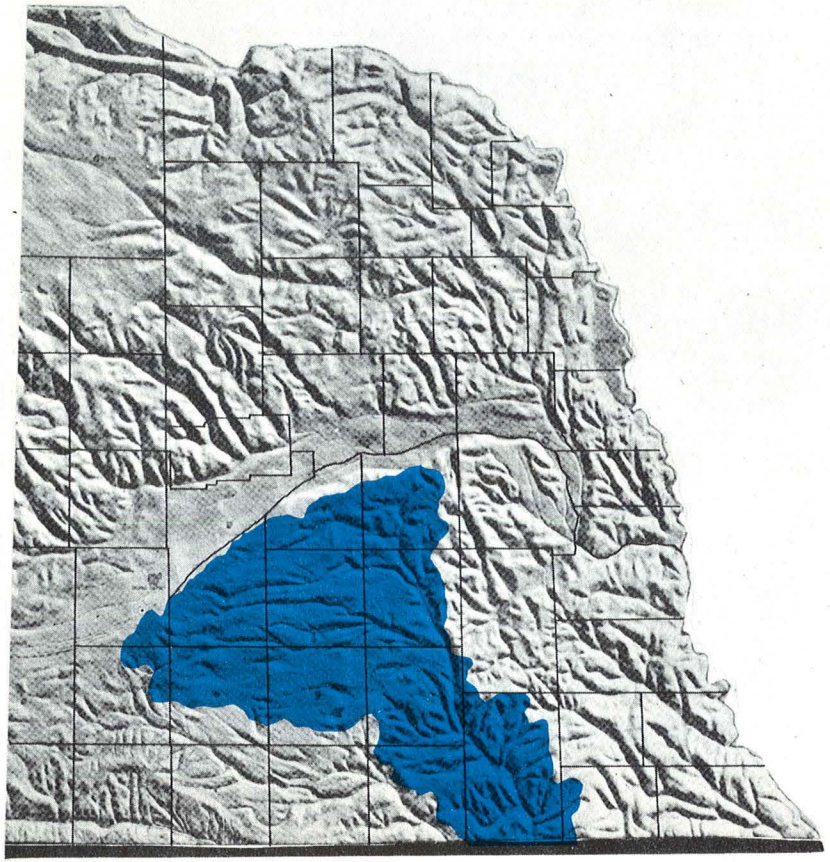
3. *Beaver Crossing Dam and Reservoir*—Beaver Crossing Dam and Reservoir is below the junction of Beaver Creek and the West Fork of the Big Blue River about one mile west of Beaver Crossing. This dam site and reservoir, when fully developed, would have a storage capacity of 538,300 acre-feet. The drainage area upstream of the reservoir is 1,154 square miles. It is recommended that the site be developed for flood control and recreation with storage available for later use in surface water irrigation.

4. *Shestak Dam and Reservoir*—Shestak Dam and Reservoir is on Turkey Creek six miles southeast of Dorchester. Full development of the site would provide a storage capacity of 180,500 acre-feet. The drainage area above the site is 415 square miles. This site should be developed for flood control and recreation with storage provided for future surface water irrigation.

5. There are additional possibilities if large amounts of water could be imported into the basin. If this was done other reservoirs, constructed in the western part of the basin, would increase the amount of land which could be irrigated, would result in flood control storage, would provide for low flow augmentation, and could be used as a supplemental water source for irrigation in those areas where the ground water level is declining. Several additional potential reservoir sites have been investigated by the Corps of Engineers.



The Small Watershed Program in the Big Blue Basin



The topography of the upper Big Blue is relatively flat. Small watershed projects have been most feasible in the lower portion of the Basin.

What Is a Watershed?

A watershed is all land from which water flows into a common creek, lake, or river. It may range in size from a few to many thousands of acres. Basically, a watershed program is an organization of local people working together to reduce soil erosion and flood damage for the benefit of the community.

The small watershed program is primarily designed to alleviate rural flood damages, thereby providing more usable farmland and higher crop yields.

Situation

Total watershed measures to control flow from small upland drainage areas and to achieve a degree of drainage of the depressional regions have been investigated.

There are 33 potential and feasible watersheds in the Big Blue Basin. Table 1 gives the present status of watershed organization and development in the basin. Several other potential watersheds appear feasible for further study and development.

In the lower reaches of the basin watershed structures have been planned, are under construction or are proposed.

Summary of watershed development in the Big Blue Basin:

One watershed completed—Little Indian.

One watershed planned and waiting for funds—Clatonia.

Seven watersheds under construction:

- Big Indian
- Bear, Pierce, Cedar
- Cub Creek
- Mud Creek
- Dorchester
- Mission Creek
- Plum Creek

Three watersheds are being planned:

- Dry Creek
- Swan Creek
- Wolf-Wildcat

Nineteen other watersheds should be investigated.

Problems

A. *Upper Part of Basin*

The topography of this region is flat and channels are poorly defined. Water from heavy storms drains to depressions and thereby causes much flatland flooding. There are about 110,000 acres of land in the basin that have this type of damage.

B. *Central Part of Basin*

The major streams in this area have sufficient capacity to contain the more frequent flood peaks, but dead trees and brush often limit the capacity.

Sheet and rill erosion is serious, especially in hilly areas.

C. *Lower Part of Basin*

Stream bank erosion has caused loss of agricultural land. Flood plain scour has reduced production capacity of some bottomlands.

Fast moving water on steep grades in the lower basin creates deep gullies, often with active overfalls, resulting in loss of cropland.

Sheet and rill erosion is a serious problem.

Watershed organizations are nearly complete in the lower section of the basin. However, as shown in Table 1, only 67 structures out of a total of 179 planned are completed.

Needs

Drainage can be partially controlled by improved channels in the upper main valleys and on the flat lands between major drainage ways.

Channel clearing and removal of dense brush, debris and dead trees needs to be carried out to improve the carrying capacity of the streams.

In the central part, as throughout the basin, drop inlets, drop spillways, concrete trickle channels and vegetative waterways are needed to control gullies. Other land treatment practices for the control of sheet and rill erosion such as terracing, contour farming, seeding of grasses and legumes are needed.

Acquiring sufficient land treatment and easements for proposed structures are holding up the remaining structures planned in the several lower basin watersheds.

Recommendations and Means of Development

All potential watershed areas that have not requested help for planning should proceed with an educational program.

To achieve full flood control of the mainstem of the Blue River and its tributaries, the watershed program should be expedited.

Land treatment and getting the necessary easements are holding up construction in watersheds now authorized. Local initiative for the development of the remaining watersheds is needed to alleviate rural flood damages and to provide more usable farmland and higher crop yields.

Wide valleys and flat stream channels make it difficult to find suitable reservoir sites.

Table 1. Present status of watershed organization and development in the Big Blue River Basin.

Watershed	Counties	Acres	Percent planned	Percent construction July 1967	No. of Structures		Percent damage reduction
					Proposed	Completed	
Watersheds Under Construction							
Big Indian	Gage Jefferson	131,700	100	34	35	16	79
Cub Creek	Gage Jefferson	92,300	100	5	29	1	73
Dorchester	Saline	5,300	100	75	5	4	73
Plum	Gage Pawnee	44,700	100	55	32	22	73
Mud	Gage	38,900	100	45	29	14	79
Bear–Pierce–Cedar	Gage	76,800	100	20	33	10	68
Mission	Pawnee Gage (Kansas)	22,500	100	3	16	0	72
SUB TOTAL		412,200	...	...	179	67	...
Watersheds Planned (Waiting Construction Funds)							
Clatonia	Gage Lancaster	25,300	100	...	8	0	70
Watersheds Completed							
Little Indian	Gage	47,900	100	100	63	63	not available