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City of Browning Watershed Project
Glacier County, Montana

Final Environmental Impact Statement

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Soil Conservation Service

Sponsoring Local Organizations:

City of Browning
Browning, Montana 59417

Blackfeet Tribal Business Council
Browning, Montana 59417

Glacier County Conservation District
Cut Bank, Montana 59427

March 1975

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USDA ENVIRONMENTAL IMPACT STATEMENT

City of Browning Watershed Project
Glacier County, Montana

Prepared in Accordance With
Sec. 102(2) (C) of P.L. 91-190

Summary

- I Draft () Final (X)
- II Soil Conservation Service
- III Administrative (X)
- IV Description of Action: A project for watershed protection and flood prevention in Glacier County, Montana, to be implemented under the authority of the Watershed Protection and Flood Prevention Act (PL-566, 83d Congress, 68 Stat., 666), as amended.
- V Summary of Environmental Impact and Adverse Environmental Effects: Project action will:
- (1) reduce average annual floodwater damages in Browning by 94 percent benefiting 1,182 persons in a 92-acre urban area.
 - (2) reduce dust from sediment deposition.
 - (3) reduce pollution and health hazards.
 - (4) improve community conditions and provide opportunities for urban renewal.
 - (5) encourage park and open space development in Browning.
 - (6) enhance fishery conditions and habitat along 11.6 miles of Willow Creek.
 - (7) periodically provide 12 acres of water surface for waterfowl resting area.
 - (8) create waterfowl resting area in the sediment pool.
 - (9) create an estimated 12 man-years of new employment directly, plus secondary new employment.
 - (10) improve social and business conditions on the Blackfeet Indian Reservation.
 - (11) result in the loss of 0.4 mile of live stream fishery and 3.1 acres of brushy habitat required for dam and 100-year sediment pool. See Appendix D.
 - (12) result in the temporary inundation of 0.3 mile of live stream fishery and 5 acres of brushy habitat required for the 100-year flood pool.
 - (13) result in loss of agricultural production on 9 acres of hayland and 10.9 acres of rangeland required for the dam and 100-year sediment pool.
 - (14) slightly increase air and water pollution during construction.
 - (15) prevent interchange of fish populations along upper Willow Creek.
 - (16) increase flows which will temporarily inundate an additional 7.1 acres of rangeland on the Flat Iron Fork drainage during a 100-year storm.
- VI List of Alternatives Considered: (1) land treatment alone; (2) floodwater channel through Browning; (3) floodwater retarding structures only; (4) floodwater diversion system only; (5) flood plain insurance; (6) flood plain management; (7) combination of numbers (1), (3), (4), and (6); and (8) no project action
- VII Agencies and Individuals From Which Comments Have Been Received: Department of the Army; Department of Health, Education and Welfare; Department of the Interior; Department of Transportation; Environmental Protection Agency; Governor of Montana; Advisory Council on Historic Preservation; Montana Department of Health and Environmental Sciences; Montana Department of Fish and Game; Harold Scriver; Thomas E. Horobik
- VIII Draft Statement Transmitted to CEQ on November 18, 1974.

USDA SOIL CONSERVATION SERVICE ENVIRONMENTAL IMPACT STATEMENT

Title of Statement: The City of Browning Watershed Project, Glacier
County, Montana

Type of Statement: Draft () Final (X)

Date: March 1975

Type of Action: Administrative (X)

Statement:

1. Description

Authority for Project: Federal assistance through Public Law 566,
83d Congress, 68 Stat. 666, as amended.

Sponsoring Local Organizations: City of Browning
Blackfeet Tribal Business Council
Glacier County Conservation District

Purpose of Project: The purpose of the project is to protect the
city of Browning from floodwater damages.^{1/}

PLANNED PROJECT

The project plan provides for conservation land treatment, one floodwater retarding structure, two floodwater diversion structures, and flood plain management.

Land Treatment

Land treatment measures planned for nonfederal land in the watershed are aimed at improving and maintaining good vegetative cover. On rangeland these include proper grazing use, planned grazing systems, ponds, and conservation measures. Conservation plans will be developed to facilitate the installation of land treatment measures.

Proper grazing use is a plant management practice and is applicable to all rangeland in the watershed. It involves grazing rangeland at an intensity which will maintain adequate cover for soil protection and maintain or improve the quantity and quality of desirable vegetation.

^{1/} All information and data, except as otherwise noted by reference to source, were collected during watershed planning investigation by the Soil Conservation Service, U. S. Department of Agriculture.

Planned grazing systems include deferred and rotation deferred grazing. These practices will be applied to meet technical specifications developed for the conservation district. Ponds, strategically located, provide dependable water supplies for livestock and help achieve uniform grazing. Conservation plans aid the landowner in applying sound conservation treatment to all lands for a balanced operating unit.

These land treatment measures applied to date affect 20,000 acres at a cost of \$3,835. Land treatment measures to be applied will affect these 20,000 acres and an additional 1,845 acres at a cost of \$4,100.

Structural Measures

One single purpose floodwater retarding structure and two floodwater diversion systems are planned for the City of Browning Watershed. These structural measures are designed to control runoff from 26.37 square miles (96 percent) of the area contributing to flooding in Browning. See Appendix A, Tables, and Appendix C, Figures, relating to detailed descriptions and locations of planned structural measures.

Investigations indicate project construction will not affect any known archeological or historical site. In the event evidence of archeological, historical, scientific, or prehistorical material is uncovered during construction, the Secretary of the Interior, National Park Service, Montana Statewide Archeological Survey, and the Montana State Historic Preservation Officer will be notified.

An archeological investigation conducted by the Montana Statewide Archeological Survey revealed the presence of a single tipi ring on the southeast abutment of the planned Willow Creek dam. Significant information regarding the ring has been recorded. See Appendix D.

A. Willow Creek Floodwater Retarding Structure

The floodwater retarding structure on Willow Creek will be located in the SE $\frac{1}{4}$ section 12 and NE $\frac{1}{4}$ section 13, T32N, R12W, approximately four miles west and one mile south of Browning. This structure will consist of an earth fill dam, a principal spillway, and an earth emergency spillway. The structure is designed to control the maximum storm expected once in 100 years. The earth emergency spillway is expected to function less than once in 100 years. The reservoir will control runoff from 15.03 square miles or about 57 percent of the drainage area above Browning. Structure life is planned to be 100 years. See Fig. 1 and 4.

The principal spillway will consist of a modified standard covered riser and a 30-inch-diameter conduit located in the right abutment of the dam. The riser will be 14 feet high and equipped with trash rack designed to meet watershed conditions. A 12-inch-diameter pipe will be installed from the upstream toe of the dam to the riser. A gate valve will provide control of this pipe for emergency drawdown of the sediment pool or other operation and maintenance. The crest of the riser will be placed at elevation of the 50-year sediment pool. The discharge through the conduit is 134 cubic feet per second (cfs) and will outlet into an impact basin protected with rock riprap.

The dam will be constructed of compacted earth fill. See Figure 1. The total volume of the embankment, including foundation backfill, is estimated at 124,000 cubic yards. The dam will be 1,835 feet long, 40 feet high, with a top width of 16 feet. The upstream face is planned with a slope of 3 to 1 and protected with rock riprap from elevation 4,574.5 feet mean sea level (msl) to elevation 4,585.5 feet msl. This represents a vertical distance of six feet below the riser to five feet above the top. The downstream face of the dam is planned with a slope of 2 to 1 and a berm 10 feet wide at elevation 4,587 feet msl. Grass will be seeded on the non-riprapped slopes and top of the dam. The dam will have a grassed emergency spillway excavated through a natural saddle in the left abutment. The spillway will be 450 feet wide and have a 500 feet long level crest section. The discharge capacity will be 5,715 cfs. The reservoir will have a storage capacity of 847 acre-feet at the crest of the emergency spillway (4,603 feet msl) and will cover 68 surface acres.

The capacity of the reservoir includes 100-year sediment storage of 98 acre-feet at elevation 4,584.6 feet msl and 749 acre-feet of floodwater storage at elevation 4,603 feet msl.

Borrow materials will be obtained from excavation of the emergency spillway, the foundation excavation, and from portions of the reservoir area. All cuts will be graded, smoothed, and planted with grass to reclaim the disturbed areas and reduce erosion.

About 3.1 acres of brushy habitat will be cleared in the reservoir basin. See Appendix D. About 0.6 mile of fence will be removed and rebuilt and about 2.4 miles of temporary fence will be constructed to protect the dam, spillway, and borrow area during seeding establishment. Approximately 0.75 mile of electric power line and 0.5 mile of telephone line will be relocated. Old buildings, including a small rundown house used intermittently and on a conditional basis by a Browning resident, will be cleared from the reservoir basin.

The installation of the dam and reservoir will require the acquisition of 190 acres, including 96.9 acres of rangeland, 85 acres of valley bottom land, and 8.1 acres of brushy habitat. Of the total, 23 acres are needed for the dam and spillway; 10 acres are needed for the 50-year sediment pool; and an additional 8 acres are needed for the 100-year sediment pool; and 50 acres are needed for flood storage above the sediment pools. The remaining 99 acres to be acquired will facilitate land rights acquisition along legal subdivision lines and will be available for borrow material and construction activities. Land rights to be acquired include 15 acres of privately owned land and 175 acres of Trust Allotment land.

The estimated construction cost of this floodwater retarding structure is \$155,500.

B. Upper Floodwater Diversion

The upper floodwater diversion is planned to intercept peak flood runoff from the area of 9.43 square miles below the Willow Creek floodwater retarding structure and divert it from the Willow Creek drainage into the Flat Iron Fork of Willow Creek. The location of the diversion was selected at the only practical place where water could be collected and diverted from Willow Creek to Flat Iron Fork. This diversion will bypass a major portion of the floodwaters around Browning. See Figure 4, Project Map.

The upper floodwater diversion will require about 8,700 feet (136,000 cubic yards) of excavated channels and about 5,600 feet (31,000 cubic yards) of earth fill dikes. The average channel cut will be 6-8 feet deep with a maximum depth of 16 feet. The dikes will average 6 feet in height with a maximum height of 15 feet.

The first 3,100 feet of the diversion will extend from U. S. Highway 89 across the flood plain to Willow Creek and will consist of intermittent channel and dike sections. This channel reach will have minimum sections with 100-foot and 60-foot bottom widths and 2 to 1 side slopes and will follow natural low areas. The dike will follow a line of low knolls parallel to the constructed channel and have a 10-foot top width with 3 to 1 side slopes. See Figure 2. The excavated sections will be through gravelly and gravelly clay soils. The excavated material will be used to construct the dike and all disturbed areas will be reseeded.

A second reach, about 900 feet long, consists of the natural unaltered channel of Willow Creek. A small dike will be constructed at one low area so that flows will be contained to the point of the diversion structure on Willow Creek. This diversion structure will consist of an embankment with an upstream slope of 3 to 1 and a downstream slope of 2 to 1 and have a top width of 10 feet. The maximum height is 15 feet. Two ungated 30-inch-diameter concrete conduits capable of passing 150 cfs will be placed beneath the embankment to allow uninterrupted passage of fish and normal Willow Creek flows. The upstream slope of this diversion structure will be riprapped and the rest will be seeded with grass.

The third reach of the floodwater diversion channel is 4,700 feet long, goes from Willow Creek to Flat Iron Fork and consists of sections of excavated channel and small embankments. Excavated channel sections will be constructed from Willow Creek to a large glacial pothole and from the pothole into the Flat Iron Fork flood plain. Dikes are constructed from knoll to knoll along the channel and around the pothole to provide freeboard as required. A gated 18-inch-diameter pipe will be installed in the dike near the pothole to provide for a crossing of an existing irrigation facility. Design flows will be contained within the excavated sections except when crossing the pothole. The excavated sections for this reach are 100 feet wide with 2 to 1 side slopes. Excavation in this channel reach will be in glacial till consisting of gravelly clay. The fill sections will have a 10-foot-wide top with 3 to 1 side slopes. The outlet will consist of an excavated 800-foot section across the Flat Iron Fork flood plain on contour. This is designed to overflow onto the flood plain at an even depth with nonerosive velocities. A short reach of dike at the outlet will be riprapped and all other disturbed areas will be smoothed and seeded with grass.

Associated with this diversion system will be an enlargement of the culvert crossings on State Highway 464 about one-half mile north of Browning. The existing crossing will be replaced by four 83-inch by 53-inch oval reinforced concrete pipes. Some channel shaping will be required at the inlet and outlet ends of the pipes.

This upper floodwater diversion system will not require enlargement or realignment of existing channels. The system, in conjunction with reductions provided by the Willow Creek floodwater retarding structure, will control the maximum storm expected once in 100 years from the drainage area above the diversion system. Hydrologic analysis was used to determine the 100-year design storm requirements. The channel sections are designed to have nonerosive velocities for maximum flow conditions.

Land rights will require use easement or acquisition of 210 acres of pasture and rangeland. This includes 197.5 acres of privately owned land and 12.5 acres of Tribal Trust land.

The estimated construction cost of the upper floodwater diversion is \$87,300.

C. Lower Floodwater Diversion

The lower floodwater diversion is planned to intercept runoff from an area of 0.93 square mile south of U. S. Highway 89 and below the upper floodwater diversion west of the fairgrounds. See Figure 4, Project Map.

The lower floodwater diversion will require about 6,800 feet (15,000 cubic yards) of earth fill dikes. The dikes will average four feet in height with a maximum height of six feet.

The first reach is 3,000 feet long. It extends from U. S. Highway 2 northwesterly to U. S. Highway 89 and then continues north across the highway through the fairgrounds along the west side of the race track. This first reach consists of a dike built from borrow material taken from the upstream side. The borrow area will be a shaped channel with a gradient to drain runoff over to Willow Creek. See Figure 2 for typical section. Two new 76-inch by 48-inch oval reinforced concrete pipes will be installed at the crossing on U. S. Highway 89. The dike will average four feet in height with a top width of ten feet and will have 3 to 1 side slopes. The borrow area will be excavated in glacial till, gravelly clay soils.

The second reach will be 3,800 feet long and will consist of a low dike, 2-3 feet high, paralleling Willow Creek from the fairgrounds to the bridge on Hospital Street. The dike will have a top width of 10 feet and 3 to 1 side slopes. No alteration of the Willow Creek channel is planned. The existing drain along West Boundary Street will outlet through this dike by means of a 60-inch-diameter conduit fitted with an automatic drainage gate. The flow gradient in this reach is such that no stabilization measures are needed.

Two short, low bank areas along Willow Creek channel below Hospital Street will be diked to prevent the 100-year flood peak from overtopping the channel. One dike, about 100 feet long and one foot high, will be provided in the Indian agency grounds area. Small dikes on each side of Willow Creek, for about 300 feet above East Boundary Street bridge, are also planned. This will prevent water from flowing south to low areas in Browning. The dike on the north side will be about 300 feet long, two feet high, have a 10-foot top width and 3 to 1 side slopes.

Protective measures for the lower floodwater diversion system will include seeding grass on all disturbed areas. Riprap and a concrete headwall will be provided at the West Boundary drainage gate outlet. The design capacity of the lower floodwater diversion is based on providing protection from the largest storm expected in 100 years in conjunction with planned upstream structural measures.

Land rights for the lower floodwater diversion will require a culvert crossing on U. S. Highway 89 and easements or acquisition of about 27 acres of rangeland for locating the diversion system. This includes about 4.5 acres of privately owned land and 22.5 acres of Tribal Trust land.

The construction cost of the lower floodwater diversion is estimated at \$21,700.

D. Installation Provisions and Summary

During construction the following actions will be taken to control erosion and pollution:

1. Sprinkling will be used to control dust.
2. All runoff from borrow and other disturbed areas will be routed through sediment-settling basins before entering the main channel.
3. Temporary bridges or culverts will be installed by contractors where it is necessary to cross live stream channels with machinery.
4. Provisions will be made to stockpile topsoil and spread it over all areas to be reseeded.

Earth structures and disturbed areas will be reclaimed by the following methods: spreading topsoil and seeding with adapted grasses, locating channels to follow natural drainageways and potholes in most locations, and locating dikes to follow hilltops and topographic highs except where the diversion crosses some small drainageways.

Total installation cost for the project is estimated to be \$448,900 for structural measures.

Nonstructural Project Measures

Flood plain management will be provided by the sponsors in conjunction with structural and land treatment measures to reduce damages for the area that is in the 100-year "with-project" flood plain. See Urban Flood Plain Map, Figure 3. Flood plain management will include the adoption of land use control measures such as zoning, building codes, land acquisition, and flood-proofing to restrict new construction and plan for optimum development. Flood plain management and regulation will be carried out under existing state and federal laws. The Browning-Blackfeet Comprehensive Plan, 1970, supports flood plain management and proposes park and open space development for low areas subject to flooding.

Operation and Maintenance

Land treatment measures will be installed and maintained on private land by individual owners and operators in cooperation with the Glacier County Conservation District and Bureau of Indian Affairs.

The operation and maintenance of the floodwater retarding and diversion structures shall be the responsibility of the City of Browning in compliance with operation agreements satisfactory to the local sponsors and the Soil Conservation Service. An operation and maintenance agreement will be executed prior to signing of a Land

Rights or Project Agreement in accordance with the Montana Watersheds Operation and Maintenance Handbook.

During the first three years following construction, structural measures will be inspected each year by sponsoring organizations and the SCS. Thereafter, they will be inspected by the sponsors annually and following flood events which might adversely affect the structures.

The operation of structural measures shall include, but not be limited to, the following:

1. Operating the Willow Creek structure as a floodwater retarding structure. Water will be stored at the 50-year sediment elevation and normal streamflows will be discharged through the principal spillway riser.
2. Operating the upper and lower floodwater diversions in a functional and efficient manner. The conduits in Willow Creek in the upper diversion dike are to be kept ungated to permit uninterrupted low flows.

The maintenance of structural measures shall include, but not be limited to:

1. Keeping all structures in serviceable condition by replacement and repair as needed during the life of the project.
2. Keeping all water control gates, conduits, culverts, and bridges clear of debris, drifted snow, and ice.
3. Maintaining protective vegetative cover, riprap, and fences as needed.
4. Keeping floodwater diversion channels clear of debris, snow drifts, and ice, especially prior to expected winter or early spring runoffs.
5. Keeping the emergency spillway of Willow Creek structure free and clear of any restrictions at all times.

Operation and maintenance costs include items normally expected for repairs and upkeep on the structural measures. Total annual operation and maintenance costs are estimated at \$2,960.

Project Costs

Total project costs, including land treatment, are estimated \$453,000 with \$364,100 borne by PL-566 funds and \$88,900 borne by other funds. See Appendix A.

ENVIRONMENTAL SETTING

Physical Resources

The City of Browning Watershed is located in Glacier County on the Blackfeet Indian Reservation in northwestern Montana. The watershed contains about 25,210 acres (39.4 square miles) and includes the city of Browning. Browning, with a population in 1970 of 1,700, is 15 miles east of Glacier National Park and about 126 miles northwest of Great Falls, Montana. The population of Glacier County is 10,783.

Glacier County is bordered on the west by the Continental Divide and on the north by the U. S.-Canadian line. All but a small portion of the eastern part of Glacier County is in the Blackfeet Indian Reservation.

The watershed area is about 15 miles long and averages three miles wide. It is located in Water Resource Region 10, Subregion 03, OBE Economic Area 094, and Land Resource Area 046. Browning is located at the eastern edge of the watershed and is the principal town and headquarters for the Blackfeet Tribe, Bureau of Indian Affairs, and the Public Health Service.

Willow Creek, the major watershed drainage, originates in the western end of the watershed and flows northeasterly through most of the watershed. It then proceeds easterly through the northern part of Browning. Willow Creek then continues northeasterly about 14 miles to its confluence with Cut Bank Creek. See Figure 4, Project Map. The average annual yield of Willow Creek at Browning is 5,800 acre-feet. The average annual streamflow is 8 cubic feet per second. High peak flows of short duration often occur in February or March during early snowmelt events. About 50 percent of the annual yield of Willow Creek is produced during May and June. The average discharge in Willow Creek for the months July through April is about 4.8 cubic feet per second.

The drainage north of Willow Creek is designated as the Flat Iron Fork of Willow Creek. Flat Iron Fork has a wide flood plain with a relatively flat gradient that meanders through two large slough areas. It joins Willow Creek below the town of Blackfoot about 7 miles downstream from Browning. Flat Iron Fork is constricted to form a boggy spring area about 4.5 miles west of Browning. This area is the source of Browning's water supply through a shallow well and drain tile collection system. Water flows by gravity in a pipeline from the spring through a chlorinator and storage tank to the city. There is sufficient elevation difference between the chlorinator and the city to fill the city water storage tank.

Stream classification of Willow Creek is "N" (well defined, unmodified channel) above Browning; "M" (previously modified channel--early days to present) within Browning and immediately below the city. This

is a perennial "Pr" stream. Flat Iron Fork of Willow Creek is classified as "O" (practically no defined channel), "E" (Ephemeral--flows only during periods of surface runoff). Streams in this area have been classified as B-D₁ by the Montana Water Pollution Control Council. 2/

The watershed is on the extreme western portion of a wide glacial plain. The general topography is a rolling plain rising westward to the Continental Divide. The area is typical glacial knob-and-kettle topography. Numerous small, shallow, glacial lakes have formed in pothole areas. Runoff from the pothole areas drains into Willow Creek upstream from Browning. In the upper watershed, Willow Creek has a relatively narrow flood plain bordered in most places by steep bluffs of till. The bluffs ascend gradually into a gently rolling upland plain. Near the upper end of the watershed area the upland plain blends into a steep foothill area adjacent to the high Rocky Mountain range bordering Glacier National Park. The flood plain of Willow Creek gradually broadens to a half mile in width at Browning. Browning encompasses about 45 city blocks, of which 25 blocks are located on the flood plain and subject to frequent flood damages. Elevation ranges from 4,330 feet at Browning to 5,730 feet in the upper watershed.

The watershed is covered by a mantle of glacial drift which consists of boulders, cobbles, and clay. The boulders and cobbles are predominantly granite, gneiss, and quartzite. Underlying the glacial drift is the Colorado Formation which consists of bluish gray to black shale with thin irregular stratifications of hard shaly sandstone and limestone in concretions.

There are coal, oil, and gas resources on the Blackfeet Reservation outside the watershed. The development of coal resources has been limited, and the extent to which these deposits exist is generally undetermined.

The Blackfeet Reservation has two oil and gas fields partially within, and one field wholly within, the limits of the reservation. The Cut Bank and Blackfoot fields are partly within the reservation. The Reagan field is wholly within the reservation and located near Twin Buttes. In 1960 there were 1,114 producing wells in the Cut Bank field, 50 wells in the Reagan field, and 480 wells in the Blackfoot field. The rate of production in the Reagan and Cut Bank fields is decreasing, but substantial reserves remain. All three fields are outside the watershed.

2/ State Classification B-D₁ indicates water that shall be maintained suitable for drinking, culinary, and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection, or other treatment necessary to remove naturally present impurities. These waters shall be maintained suitable for bathing, swimming, and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl, furbearers, agricultural, and industrial uses.

Extensive deposits of commercial quality gravels and clays exist in the watershed. One gravel pit, located just north of Browning along the Flat Iron Fork of Willow Creek, is being operated by the Blackfeet Construction firm. Other deposits of gravel and clay exist in the upper portion of Willow Creek drainage in the watershed.

Soils in the watershed are formed in deep glacial till deposits over shale and sandstone. Soils of the upland plains, which comprise the major portion of the watershed, are predominantly deep stony loams and deep clay loams which have a thin, dark-colored topsoil. However, small areas of deep black organic loam soils are common. Soils along the drainageways and in the upland seeped pothole swales are poorly drained. They are predominantly organic loams with gravelly clay loam subsoils.

There is an abundance of ground water available in the valleys of the watershed. Numerous springs and flowing wells exist. There is a high water table in the flood plain area above Browning. Recently installed storm drains have reduced the water table in the city.

The climate type is semiarid characterized by abundant sunshine, low relative humidity, moderate to high wind movement, and large seasonal temperature variations. Most weather is controlled by fronts moving from the northwest out of Canada or from the Pacific. The average annual precipitation as recorded at the weather station in Browning is 15.4 inches with the greatest amount (20 percent) falling during the month of June and two-thirds of the total occurring during the growing season.

The mean annual temperature is 40.5°F. The mean temperature for the coldest month, January, is 18.9°F with the average maximum temperature being 29°F and the average minimum being 8.4°F. July is the warmest month, having a mean temperature of 62.7°F, an average maximum temperature of 78°F, and an average minimum temperature of 45.6°F.

Extreme temperatures of -56°F and 99°F have been recorded. Records show the frost-free period to be about 97 days with the last frost in the spring occurring around June 2 and the first frost in the fall coming around September 8.

Snow accumulates in the watershed during the winter and remains until early summer in the form of windblown drifts. This accumulation produces heavy spring runoff.

Plant and Animal Resources (Flora and Fauna)

The vegetative cover in the watershed is predominantly native grasses. The dominant species include rough fescue, Idaho fescue, bluebunch wheatgrass, green needlegrass, and oatgrasses. Associated species include lupine and other forbs. In poorly drained areas, vegetative cover consists of tall reedgrasses, tufted hairgrass, slender and bearded wheatgrasses, sedges, rushes, cinquefoil, and scattered willows. Aspen groves are common on the steep foothill area in the upper watershed. The area is used primarily for grazing by sheep and cattle. Native meadows along stream valleys are cut for hay.

There are no critical erosion areas in the watershed. Land treatment that focuses on proper grazing use and livestock management contributes to a low rate of sediment production. Good to excellent vegetative cover in the watershed, as evidenced by good to excellent range condition, is expected to continue.

Land use divisions in the watershed are: 21,845 acres (87%) native range; 970 acres (4%) irrigated and subirrigated pasture and hayland; 1,350 acres (5%) timber land and aspen; 370 acres (1%) brushy habitat; 435 acres (2%) urban and built-up; and 240 acres (1%) roads and miscellaneous use.

The watershed supports a variety of wildlife species, including some furbearing and big game animals, game and nongame birds, and fish. The area is inhabited by mule deer, sharp-tailed grouse, and hares. Beaver, mink, and muskrats are trapped along Willow Creek. Waterfowl are the most sought-after game species by non-Indian hunters. Approximately 80 potholes, comprising about 240 acres, provide good nesting sites for ducks as well as resting areas in the spring and fall for migratory species. A variety of song birds, shore birds, and raptors nest and rear their young within the watershed.

Fishing in the watershed is confined primarily to Willow Creek. Local residents creel good catches of rainbow and brook trout. Non-Indian fishing is partially discouraged by the requirement for both a state and reservation license. The upper reaches of Willow Creek are bordered by a thick riparian growth of willows that provides a favorable shaded habitat to trout. See Photo Plate 10 showing the reservoir basin and typical stream habitat in the upper reaches of Willow Creek. This riparian vegetation occurring along Willow Creek and other watercourses in the watershed provide food and shelter for game and nongame species alike, especially during the winter months.

These fish and wildlife resources provide a modest number of hours of outdoor recreation each year in the form of hunting, fishing, trapping, and wildlife observation. All the watershed is within the boundaries of the Blackfeet Indian Reservation with hunting and fishing opportunities being regulated by the Tribal Council.

Economic Resources

Browning is the major trade and social center for the Blackfeet Indian Reservation. Local services available in Browning include schools, hospital, bank, retail stores, tourist accommodations, Indian agency offices, and headquarters for the Blackfeet tribal government. The primary trade area for the Blackfeet Indian Reservation includes Cut Bank (population 4,004), county seat of Glacier County, as well as the neighboring towns of Shelby and Conrad. Great Falls, about 126 miles to the southeast, is the nearest primary wholesale and distribution center.

Browning's population, according to census data, indicates a decline from 2,011 in 1960 to 1,700 in 1970. However, the population for the Browning-East Glacier Division remained constant during this decade. It is evident that more people at Browning are living outside city limits due to recent housing developments. City officials estimate that about 2,800 persons currently live in or adjacent to Browning. The total watershed population, including rural residents above Browning, is estimated at 2,900.

The following is an excerpt from a Bureau of Indian Affairs report and provides an insight into the land ownership features of the watershed:

"The present boundaries of the Blackfeet Indian Reservation encompass 1,526,000 acres. Of this amount, 156,000 acres are owned by the tribe and 775,000 acres are allotted or owned by individuals. The Blackfeet Agency of the Bureau of Indian Affairs had jurisdiction over 1,077,477 acres of land within the Blackfeet Reservation in 1969. This acreage is comprised of 14 percent tribally owned land, 72 percent individually Indian-owned land, and 14 percent federal government and other lands administered by BIA. These Blackfeet Reservation lands are used primarily by Indians with 66 percent in Indian use." ^{3/}

^{3/} U. S. Department of the Interior, Bureau of Indian Affairs, Missouri River Basin Investigations Project, The Blackfeet Reservation Area--Its Resources and Development Potential, Report No. 199, April 1972.

Land ownership on the reservation and in the watershed is very complex. The Blackfeet tribe owns some lands in fee simple title. These lands were purchased by the tribe and are on the tax rolls. The tribe also has direct management and control of certain trust lands. The title of these trust lands rests with the United States of America and they are nontaxable. Lands such as the area for the Indian agency headquarters are in this category. Both trust lands and fee lands were granted to individual Indians. Trust lands are held in the names of the original allottee or his heirs. In many cases the current allotments for a given parcel may rest with a number of persons, all of whom have fractional interests in the parcel. These trust lands are managed by the Indian agency and designated as "Trust Allotted." Individuals, both Indian and non-Indian, may own land in fee simple title. Some lands are also owned by other units of government.

The following is a summary of land ownership status in the watershed: Tribal Trust (USA), 830 acres; Tribal Fee, 1,360 acres; Individual Trust Allotment, 9,230 acres; Individual Fee, 13,410 acres; Glacier County, 50 acres; and other, including city area of Browning, 330 acres.

Cattle and sheep ranch operations are the basic agricultural enterprises in the watershed. Ranchers lease blocks of land which they combine with their privately owned lands. There are 13 ranch operators with headquarters in the watershed. Most of these units are below the 4,580-acre average for Glacier County. Ranchers have access to markets over county roads and state highways.

Crop production in the watershed is confined primarily to harvesting hay along stream valley bottoms. Hay yields average 0.75 to 1.0 ton per acre. Animal stocking rates on rangeland average 0.44 animal unit month per acre.

The economy of the reservation, and in particular the Browning area, is primarily based upon agriculture and its associated services. Most of the oil and gas production on the reservation is derived from the eastern part which has a greater impact on the Cut Bank area. The market value of crops in Glacier County, according to the 1969 Census of Agriculture, was \$4,648,538. The value of livestock and livestock products was \$9,199,985.

A total of 4.3 million barrels of oil was produced in Glacier County in 1969. Data for 1971 indicate oil production in Glacier County totaled 8.6 million barrels, valued at \$26,167,000. 4/

4/ Montana State Oil and Gas Commission

Land values in the watershed average about \$75 per acre for grazing land and \$125 per acre for valley bottom meadow hayland. Homes in Browning generally range in value from \$3,500 to \$15,000. Commercial lots vary in price from \$70 to \$100 per front foot. Residential lots outside improved areas average \$400 for a 50-foot-wide lot. With paved streets and other improvements, lots sell for \$2,000-\$2,500.

The Blackfeet Indian Reservation, including Browning, is classed as a Title IV area by the Economic Development Administration. A high rate of unemployment and underemployment prevails. Unemployment rates traditionally rise during the fall and winter months. A recent study in 1970 showed that 23 percent of the Blackfeet people were unemployed and had made an effort to find employment. This same study showed that another 42 percent were not employed and had not made an effort to find employment. The group interviewed included housewives, retired persons, persons seasonally unemployed, and others not actively seeking employment. 5/

The Blackfeet Tribal Business Council, City of Browning, and other local leaders have been instrumental in getting new businesses and community development projects under way in recent years. This has been a great step forward in offering gainful employment.

Tourism is also a growing basic industry for the Blackfeet Reservation area. The reservation is uniquely located next to United States and Canadian national parks as well as national and state wilderness areas. The Blackfeet Reservation itself attracts a certain amount of tourist interest. The Museum of the Plains Indians and a private museum are located in Browning. Tourists traveling across northern Montana to and from Glacier National Park pass through Browning. Although the tourist season is generally short, an expansion of accommodations in Browning has taken place with the recent development of a large motel.

Industrial development in Browning has expanded during recent years. An initial step was the planning and development of an industrial park on the outskirts of the city. Industrial development has included a sawmill-logging operation owned by U. S. Plywood (formerly Chief Mountain Lumber), Blackfeet Indian Developers Incorporated that builds modular homes, a wood products factory, and a recently constructed pencil factory. Employment at U. S. Plywood averages 45; wood products, 45; Blackfeet Indian Developers, 30; and 70 at the pencil factory.

5/ MRBI Report No. 199, op. cit., p. 18.

Recent growth and development in Browning have included low rent and mutual help housing units. A total of 139 units has been constructed. There are 55 units under construction and another 78 units planned. The 194 housing units constructed or under construction are valued at \$2,716,000. These housing units have helped to alleviate many poor housing conditions that prevail in Browning where it has been estimated that 60 percent of the houses are in a delapidated or deteriorating condition. 6/

Census data for Glacier County indicate that in 1970 there were 3,582 persons in the labor force, with 87.4 percent employed and 12.6 percent unemployed. Employment in the labor force was distributed percentagewise as follows: agriculture, 13.1; construction, 6.3; manufacturing, 2.8; mining, 10.2; transportation and communications, 3.5; utilities, 2.7; wholesale and retail, 24.1; finance, insurance, and service, 15.1; schools, 9.4; welfare, religious, 1.9; legal and professional, 1.9; and public administration, 9.0. The number of persons employed in agriculture decreased 4.9 percent from 1960 to 1970. During this same period, wholesale and retail employment increased 2.5 percent.

Survey data of persons on the Blackfeet Reservation, which are typical of the watershed, indicate the following categories of employment and percentage distribution: agriculture, 7.3; construction, 2.5; transportation and communication, 0.8; wholesale and retail, 5.7; finance, insurance and real estate, 0.8; services, 1.7; government, 16.2; and not applicable or unemployed, 65.0. Income data obtained in 1970 for Indian household on or near the reservation indicates that average household income for 1969 was \$5,428 and per capita income, \$1,048. 7/ During this same period, per capita income in Montana was \$2,696 and in the United States, \$3,119.

Income data were also tabulated by groups for persons in the survey and compared to Montana and U. S. figures. The following data show that there is a much higher percentage of low income households among the Indians as well as a lower percentage of high income households.

6/ Fagg, Harrison and Assoc., Billings, Mont., Browning-Blackfeet Comprehensive Plan, January 1970.

7/ MRBI Report No. 199, op. cit., pp. 14-20.

"Twenty-seven percent of the households had income less than \$3,000. This figure is generally used as the poverty level. Only nine percent of the Indian households had an income of over \$10,000. For the State of Montana, 22.3 percent had income below the \$3,000 poverty level, while 22.2 percent had 17.9 percent below \$3,000 and 31.3 percent with \$10,000 or more." 8/

Recreational Resources

Accommodations for tourists in Glacier National Park are limited. Recently there has been an effort to encourage more private development of facilities in areas near the park. The Blackfeet tribe has started constructing a motel complex on Lower St. Mary Lake shore. A number of other facilities for tourists and local residents are planned near the park and on the Blackfeet Reservation.

Outdoor recreational facilities in the watershed are primarily those provided in connection with the rodeo and ceremonial grounds just west of Browning. Space is provided for overnight camping during special events; however, public use facilities are not provided. The Blackfeet tribe plans to relocate the rodeo grounds and expand the area used for special ceremonies. Overnight camping facilities are planned for several nearby lakes outside the watershed.

It appears that the potential for recreation and tourism development on the Blackfeet Reservation is better than for many other areas in Montana. Browning and surrounding area provide a gateway to many outdoor recreation opportunities and tourist attractions.

Archeological Data

An archeological survey of the potential dam site, reservoir basin on Willow Creek, and channel and dike areas was conducted by the University of Montana Field Director of the Statewide Archeological Survey. A single tipi ring was recorded in the survey area. The Statewide Archeological Survey recorded this fact and considers it to be of no further significance. The report stated that no known antiquities will be endangered by project construction.

Consultation with the Montana State Historic Preservation Officer revealed the proposed project will not affect any sites listed in the National Register of Historic Places or any site eligible for inclusion in the National Register of Historic Places. See Appendix B and Appendix D.

In the event previously unknown archeological resources are encountered during project development, construction activities will be halted and professional assistance sought.

8/ MRBI Report No. 199, op. cit., p. 15.

Soil, Water, and Plant Management Status

The City of Browning Watershed is entirely within the Glacier County Conservation District. Landowners and operators receive assistance from the District to apply land treatment measures. Land management assistance is also provided by the U. S. Department of the Interior, Bureau of Indian Affairs.

Present land use patterns have existed over many years and are expected to continue during the project period. The most common land treatment practices include ponds, proper grazing use, and planned grazing systems.

Five cooperators in the watershed have 9,147 acres of private lands under agreement with the Glacier County Conservation District. In addition, these cooperators control about 10,000 acres of leased lands. Four of the cooperators have basic conservation plans.

About 86 percent of the needed land treatment practices, based on a dollar value, have been applied. This represents more than 90 percent of the presently planned practices. Land treatment measures such as proper grazing use are continuing practices. Application of land treatment practices has been encouraged by the Conservation District, Rural Environmental Assistance Program (REAP) and programs of the Bureau of Indian Affairs.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land Treatment and Water Management

Land treatment problems in the watershed are minor. All the rangeland, which covers 88 percent of the watershed, is in good to excellent condition. The main land use is for livestock grazing with a small portion of the area used for native hay and pasture production. This use is expected to continue because of the restrictions imposed by the cool climate conditions and glacial soil types.

Water management problems in the watershed are negligible. Some subsurface irrigation of hayland and pastureland takes place along Willow Creek. Hay production averages 3/4 to 1 ton per acre with pasture producing less than 0.5 animal unit month per acre.

Floodwater Damage

Floodwater damages occur primarily in the urban area of Browning. Because much of the city, including most of the business district, is located on a low flat flood plain, flooding is almost an annual occurrence. Flooding problems are further increased because some areas in Browning are actually lower than the Willow Creek channel. Water entering the town from the west side runs more readily down the streets paralleling the creek channel than in the creek channel itself. Also, the Willow Creek channel has restricted sections above Browning. This forces water onto the flood plain causing more floodwater to enter

the west side of the city from the flood plain than from Willow Creek. Even small storms create urban flooding because of these conditions.

Attempts have been made to divert floodwaters back into the main Willow Creek channel above the urban area with some channel works. These channels are too small, have little or no grade, and are subject to plugging with the drifted snow which occurs each winter. Drifted snow adds to the flooding problems because it does not always melt before the snow in the upper watershed. This creates further restriction to runoff, particularly snowmelt runoff, and forces even small flows out of bank and into the urban area. Freeze-thaw cycles also contribute to "icing up" and restriction of the channels.

Agricultural damages in contrast to urban damages are usually small. Even though native pastures and hayland become inundated with water, this flooding usually occurs early enough in the growing season causing only slight damages to the crop. Therefore, agricultural damages are usually limited to some fence washouts, disruption of normal spring livestock feeding operations, and debris deposition.

Significant flooding in Browning has occurred six out of the past 11 years. Major floods inundating a 15 to 20 block area have occurred in 1964, 1958, 1948, and 1920. Damages occur primarily to residences and businesses; however, damage has also been done to utilities, streets, highways, and sewers. Health and filth problems are created along with debris deposition, sanitary sewer backup, and water pollution. The Red Cross and the State Public Health Service have been called in during flood periods to assist in evacuation, provide temporary shelter, and perform needed medical services. To date, no loss of life due to flooding has been recorded.

Although most of the floods in the past have occurred in May or June when snowmelt is combined with rain, there have been floods due to snowmelt only. Some have come as early as January when the warm chinook winds, common to the area, produce high and unseasonably early runoff. Floods due to rainstorms only have also occurred. It is not uncommon to have flooding conditions more than once in a given year. Snow accumulations southwest of Browning produce heavy spring runoff during spring thaws.

Total average annual floodwater damages in the City of Browning Watershed are estimated at \$62,270. This includes \$11,980 for damages to businesses; \$38,600 for damages to homes; \$4,530 for damages to streets, sewers, and highways; and \$7,160 of indirect damages, including such things as traffic detours, disruption of community activities, and inoculations. Average annual damages to agriculture are small and unevaluated.

These damages include projected increases expected to occur as the standard of living of the area reaches the level of other surrounding areas. Increased activities in tourist trade, livestock, farming, and local business development will also result in higher levels of damages.

Erosion and Sediment Damages

There are no significant sources of either sheet or gully erosion in the watershed. There is some stream bank erosion occurring along the Willow Creek channel, especially where it flows through Browning. Bank erosion in this area has been accelerated by channel modification as a result of city development. Sediment yields in the watershed are estimated at 0.07 to 0.13 ton per acre per year. Sediment and erosion damages are included in the floodwater damage estimates.

Drainage and Irrigation Problems

Only minor problems regarding drainage or irrigation on agricultural lands are present in the watershed.

A high water table in the urban area of Browning has caused some problems to basements of businesses and homes. However, recent installation of new storm sewers with incorporated subsurface drainage has helped to alleviate the problem.

Municipal and Industrial Water Problems

Browning gets its water supply relatively inexpensively from a large spring area in the Flat Iron Fork drainage west of town. This is accomplished through a system of collector lines, a collection gallery, and a gravity pipeline which transports the water under adequate pressure to the city's distribution system. Three water studies were made by consulting engineers in 1955, 1962, and 1967. These studies indicate that there is an adequate water supply in the spring for present and future needs and potential for expansion of the collection gallery. Shortages have been reported during the mid-winter months, but this seems to be due to a leaky and inadequate distribution system and uncontrolled use of the water. Although the supply is adequate, there is a need to expand the municipal water distribution system to meet the needs of housing projects being developed.

Recreation Problems

Recreational opportunities in the watershed and adjacent areas are ample to meet local needs. There is a need for overnight camping facilities to accommodate summer tourists.

Plant and Animal Resource Problems

Fishery habitat has been reduced in Willow Creek through Browning due to the channel modifications that have been made in this area in attempts to alleviate urban flooding problems. There are several excellent streams and lakes near the watershed, including the nationally recognized Duck Lake which produces many large trout.

There are about 1,720 acres (6.0% of the watershed area) of timber, aspen, and brushy habitat. Big game hunting on the reservation is restricted to members of the Blackfeet tribe. Unrestricted hunting rights of the Indian community have diminished game populations on the reservation to less than would normally be expected.

There are no rare or endangered plant or animal species in the watershed.

Economic and Social

Economic and social problems in the watershed include unemployment, underemployment, low income levels, low education levels, potential loss of property tax base, poverty among a large segment of the population, and poor housing conditions. Per capita income for Glacier County is \$2,119, while per capita incomes for the U. S. and Montana are \$3,119 and \$2,696, respectively.

Browning serves as the social and business center for the Blackfeet Indian Reservation. The reduction of flooding problems is needed for community improvement and improved environmental and health conditions of people in Browning.

ENVIRONMENTAL IMPACTS

The principal effects of installing the City of Browning Watershed project will be: (1) the reduction of floodwater damages to homes, businesses, streets, highways, and utilities in Browning; (2) the enhancement of opportunities for urban renewal and city development; and (3) improvement in the quality of man's environment.

Land treatment measures to be installed by this project will affect 21,845 acres of native rangeland (87 percent of the watershed). These measures will help hold sediment production and runoff at a minimum. Land treatment measures will maintain the good vegetative cover that now exists in the watershed. The watershed ecosystem will be essentially unaffected by land treatment measures.

The urban area flooded by a 100-year storm will be reduced from 92 acres, including the whole city between "F" Street and the Willow Creek channel, to 10 acres of ponded water and minor flow in and along the low "D" and "E" streets areas. See Appendix C, Figure 3. Maximum depths of flow in the urban area will be reduced from four feet to one foot. The 100-year peak flow, including both channel and flood plain flows, will be reduced from 1,850 cfs, most of which would now flow through the urban area, to 500 cfs, most of which would flow in the Willow Creek channel. The rural area flooded by the 100-year storm between the planned lower floodwater diversion and West Boundary Street of Browning will be reduced from 59 acres to 10 acres. Flooding around the museum and the fairgrounds will be reduced to minor ponding during a 100-year storm.

The urban area flooded by the 10-year storm will be reduced from 42 acres of major flooding with depths up to three feet to two acres of very minor ponding with depths less than one-half foot. The 10-year peak flow will be reduced from 620 cfs to 240 cfs. Flows will also be shifted from the urban area to the Willow Creek channel.

The floodwater diversion structures were planned in consideration that large amounts of runoff are produced in the area between the floodwater retarding structure and the city of Browning. Snow and ice may reduce the effectiveness of the structural measures in some years. Snowmelt tends to begin near the city and advance up the valley. This will assist with the operation of the structural measures during the spring runoff. Even with snow accumulation, water would not be expected to overtop the diversion dikes. The floodwater retarding structure will operate in tandem with the lower diversions to reduce flood flows, making the diversions more effective. Some operation and maintenance to clear channels and diversion dikes will be needed. Annual operation and maintenance costs have been included.

Reduced floodwater flows will profit more than 219 residences housing about 1,182 persons and 64 businesses--a total value of private property estimated at 3.9 million dollars. Average annual damages over the life of the project would be reduced about 94 percent from \$62,220 to \$3,970. The prevention of flood damages will allow private home owners to improve their homes, yards, and surroundings. Opportunities will be provided for urban renewal. See table in Appendix A for summary of benefits, costs, and benefit to cost ratio.

The proposed Willow Creek floodwater retarding structure will smooth the peaks from high runoff events and extend flows in Willow Creek at higher than existing base flow rates for periods of one to two weeks. Flows in Willow Creek at the highway crossing four miles west of Browning will be reduced from 1,300 cfs to 300 cfs during a 100-year storm. The present culvert crossing will handle this reduced flow and thereby reduce highway damages and traffic interruptions. Reduced peak flows in a 11.6-mile reach of Willow Creek will encourage vegetative growth, natural wildlife habitat, and enhance the trout fishery. The dam on Willow Creek will create a permanent 10-acre water surface area, providing

waterfowl resting area and a possible fishery. Normal Willow Creek flows will pass through the ungated spillway.

Dikes planned around the low edges of the pothole on the upper floodwater diversion, to contain diverted flows, will also permit occasional storage of 60 acre-feet of water for irrigation. The existing irrigation diversion ditch from Flat Iron Fork to the pothole will not be interrupted. Filling the pothole will create an additional 12 acres of waterfowl resting area while inundating 12 acres of rangeland.

Floodwater diverted into the Flat Iron Fork of Willow Creek drainage will approximately double present peak flows. Peak flows during the 100-year storm would be increased from 420 cfs to 1,090 cfs. Peak flows during the 10-year storm would be increased from 170 cfs to 275 cfs. No flows would be diverted into Flat Iron Fork during a two-year storm. The increased flows will inundate an additional 7.1 acres (from 36.9 to 44.0 acres) of rangeland between the diversion outlet and State Highway 464 during a 100-year storm. The brief, infrequent, additional inundations are not expected to damage rangeland grass species. The diverted flows are not expected to create erosion in Flat Iron Fork because tests indicate that the glacial materials can withstand the flows created by the 100-year storm. However, minor sediment deposition is expected to occur. No flooding of dwellings or other structures will be induced by diverted floodwaters. The existing Willow Creek channel divides near the railroad crossing above Blackfoot and a portion of Willow Creek flows now goes through Blackfoot.

Peak flows diverted into Flat Iron Fork will be dissipated by channel routing and channel storage before Flat Iron Fork reaches Blackfoot seven miles downstream. Flat Iron Fork between the exit of the upper floodwater diversion and the town of Blackfoot flows through a wide, flat flood plain which includes some swamps and pothole areas. The maximum water surface elevation on Flat Iron Fork near Blackfoot will be only slightly increased. Newly constructed homes in Blackfoot are two feet above the computed 100-year with-project flood elevation. The high water surface elevation on Flat Iron Fork will be longer in duration than the existing Flat Iron Fork hydrograph.

Water quality in Willow Creek will be improved through a reduction in streambank erosion, channel scour, and downstream sedimentation. Less dust will be produced as a result of reduced sediment deposition.

The project will result in a loss of existing fish and wildlife habitat. The dam, spillway, and sediment pool will require 28.9 acres of rangeland, 9 acres of pasture and hayland, and 3.1 acres of riparian brush habitat. About 0.4 mile of stream fishery will be inundated. The Willow Creek reservoir will prevent interchange of fish populations on upper Willow Creek. An additional 0.3 mile of stream fishery habitat and 5 acres of riparian brush will be temporarily inundated during large runoff events. Hay production of 0.75 ton per acre will be lost from 9 acres along with 0.44 animal unit month per acre of rangeland production from 28.9 acres. See Appendix D for tabulation of acres required for the Willow Creek floodwater retarding structure.

Construction of diversion channels and dikes will result in disturbing 33 acres of rangeland and 14 acres of pasture and hayland. The upper floodwater diversion will require 96 feet of Willow Creek channel. Normal Willow Creek flows and fish passage will be maintained by the installation of two 30-inch ungated culverts. See Appendix C, Figure 2.

Project construction will temporarily increase air and water pollution.

Visual impacts will result from the installation of structural measures.

Flood plain management will help reduce future flood damages. It will provide opportunities for development of open and green space in Browning.

The project will provide flood protection for two museums and the ceremonial grounds used by the Blackfeet Indian tribe just west of West Boundary Street in Browning.

Improved community conditions will result from the project. The reduction of floodwater damages will be particularly beneficial in helping to alleviate depressed economic conditions. Improved community conditions may attract new basic industries. The project will have a positive impact on the Blackfeet Indian tribe since Browning is their business and social center and about one-third of the 6,000 Indians on the reservation live in the city. The project will reduce the spread of filth, debris, contamination, and health hazards resulting from overland flows that now originate above Browning. An estimated 12.3 man-years of new employment will be created by project construction. An additional 19 man-years of employment will be created in the zone of secondary influence. Project operation and maintenance will create an estimated 0.1 permanent semiskilled job. Anxiety and disruption of normal activities of the 2,800 persons living in Browning will be reduced.

F A V O R A B L E E N V I R O N M E N T A L E F F E C T S

1. About 94 percent of the average annual floodwater damages occurring in Browning will be eliminated, thereby helping to improve depressed economic conditions and benefiting 1,182 persons in a 92-acre urban area.
2. Prevention of flood damages will allow 219 private home owners to improve their homes, yards, and surroundings.
3. Opportunities will be provided for urban renewal.
4. Flood plain management will encourage park and open space development in Browning.
5. Reduced peak flows in 11.6 miles along Willow Creek will encourage vegetative growth and natural wildlife habitat along with enhanced fishing conditions.
6. Dust arising from sediment deposition will be reduced.
7. Less sediment will be carried out of the watershed, thereby reducing water pollution.

8. Water quality will be improved in and below the watershed.
9. A pothole will be filled periodically, creating an additional 12 acres of waterfowl resting area.
10. The dam on Willow Creek will create a permanent 10-acre water surface, providing waterfowl resting area and a possible fishery.
11. Flood protection will be provided to two museums and the Indian ceremonial grounds.
12. Health hazards now associated with flooding will be reduced.
13. Project construction will create an estimated 12.3 man-years of new employment during construction. An additional 19 man-years of employment will be created in the zone of secondary influence.
14. The project will improve social and business conditions for 6,000 Blackfeet tribal members.

A D V E R S E E N V I R O N M E N T A L E F F E C T S

1. The construction and operation of the Willow Creek floodwater retarding structure will require 28.9 acres of rangeland, 9 acres of pasture and hayland, 3.1 acres of riparian habitat, and 0.4 mile of stream fishery, resulting in a loss of fish and wildlife habitat.
2. About 0.3 mile of stream fishery and 5 acres of brushy habitat will be temporarily inundated during large runoff events.
3. Forage production of 0.75 ton of hay per acre on 9 acres and 0.44 animal unit month of grazing per acre on 10.9 acres will be foregone.
4. Air and water pollution will be increased during construction.
5. The Willow Creek floodwater retarding structure will prevent interchange of fish populations on upper Willow Creek.
6. Peak flows in Flat Iron Fork of Willow Creek will approximately be doubled by floodwater diverted from Willow Creek during 10-year storms or larger. The 100-year storm will increase the area of rangeland inundated from 36.9 to 44.0 acres. Small increases in sediment deposition are expected in Flat Iron Fork during periods of peak flows.
7. Diverted flows in the upper floodwater diversion will temporarily inundate 12 acres of rangeland ecosystem around the pothole.
8. Construction of diversion channels and dikes will result in disturbing 33 acres of rangeland and 14 acres of hay and pasture land.

A L T E R N A T I V E S

The basic objective of the sponsors in their application for assistance is to reduce floodwater damages in Browning. Protection from the largest storm expected once in 100 years is considered adequate for this purpose. Another objective of the sponsors is to reduce streambank erosion taking place along lower reaches of Willow Creek.