

# LEGEND

- |                     | COMPLETED OR UNDER CONST. | AUTHORIZED | PROPOSED* |
|---------------------|---------------------------|------------|-----------|
| RESERVOIR           |                           |            |           |
| LOCAL PROTECTION    |                           |            |           |
| AGRICULTURAL LEVEE  |                           |            |           |
| CHANNEL IMPROVEMENT |                           |            |           |
- \* UNDER CONSIDERATION IN LIEU OF OR IN ADDITION TO AUTHORIZED PROJECT.

## MISSOURI RIVER BASIN WATER RESOURCES PROJECTS

50 25 0 50 100 150 200 250  
SCALE IN MILES  
SEPTEMBER 1953







CORPS OF ENGINEERS, U. S. ARMY  
Office of the District Engineer  
Garrison District  
Riverdale, North Dakota

T E C H N I C A L   L I A I S O N   B R A N C H

For: Release

No.

Date:

Garrison Dam  
Corps of Engineers, U. S. Army,  
Riverdale, N. Dak.

This aerial shot shows the completed dam embankment with the intake structure on the left, upstream side of the dam, and the powerhouse on downstream side of the embankment. The intake structure houses openings for the five power tunnels and three ~~xx~~ flood control and regulatory tunnels. The old original river is shown in the center right, where it was blocked off in 1953 and diverted through the tunnels on the upstream side. Scheduled in 1955 is a highway over the crest of the dam and spillway crest structure.





# MISSOURI RIVER, GARRISON DAM & RESERVOIR, NORTH DAKOTA

CORPS OF ENGINEERS, GARRISON DISTRICT, RIVERDALE, NORTH DAKOTA

## FEATURE OR CONTRACT:

General (aerial)

## CONTRACT NO:

## DATE OF PHOTO:

4 November 1954

## PHOTO NO:

11073

## LOCATION & SUBJECT:

From southeast of damsite, looking northwest.  
General view of Spillway Structure in foreground and Main Embankment at center. The Powerhouse and Intake Structure appear in far center. Reservoir pool is shown at right and in the background.



CORPS OF ENGINEERS, U. S. ARMY  
Office of the District Engineer  
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Riverdale, North Dakota

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Garrison Dam  
Corps of Engineers, U. S. Army  
Riverdale, N. Dak.

This aerial view shows the spillway section in the foreground and embankment extending through the center of the picture with the powerhouse on the left and intake structure on the right in the background. The spillway, the insurance policy for the dam, has 28 gates, each measuring 29-feet high and 41-feet wide. A highway will be built in 1955 over the crest of the spillway and extend over the dam. Water is now being impounded behind the dam for power production in 1955.





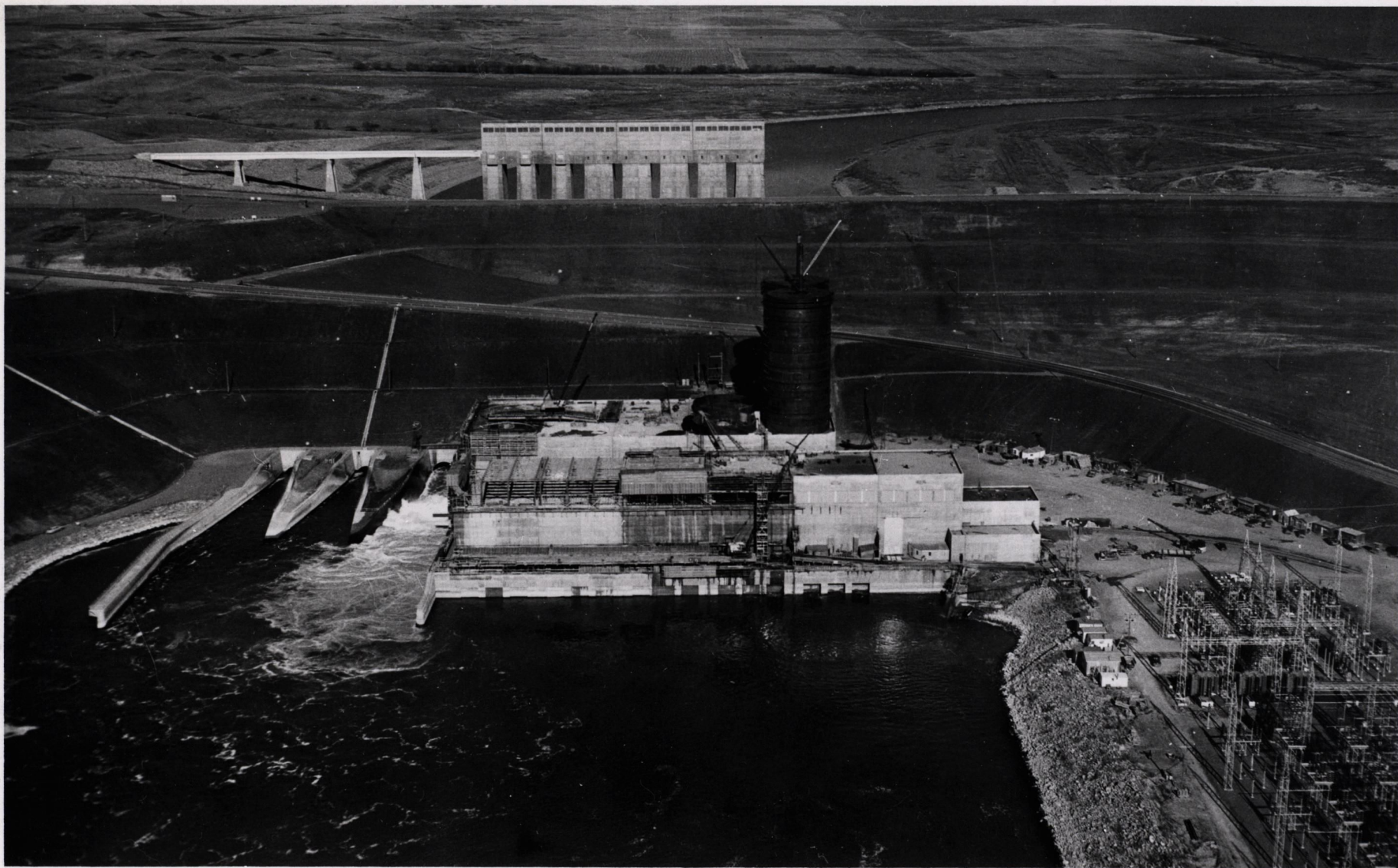


Garrison Dam  
Corps of Engineers, U. S. Army  
Riverdale, N. Dak.

This is a ~~19~~ July 1953 aerial shot of the project showing the center section under construction and the diversion channel on the left used to divert the water through the intake structure and by eight tunnels to the powerhouse and outlet channel. Three of the tunnels are for flood control and regulatory purposes and do not go through the powerhouse area. The government owned and operated town of Riverdale, N. Dak. is shown in the upper left corner.

##





# MISSOURI RIVER, GARRISON DAM & RESERVOIR, NORTH DAKOTA

CORPS OF ENGINEERS, GARRISON DISTRICT, RIVERDALE, NORTH DAKOTA

## FEATURE OR CONTRACT:

General (aerial)

## CONTRACT NO:

## DATE OF PHOTO:

4 November 1954

## PHOTO NO:

11074

## LOCATION & SUBJECT:

Outlet Channel, looking north along centerline of outlet works.  
General view of Switchyard at right, Powerhouse and Surge Tanks at center, and Intake Structure on far side of embankment. The reservoir pool appears in the background.



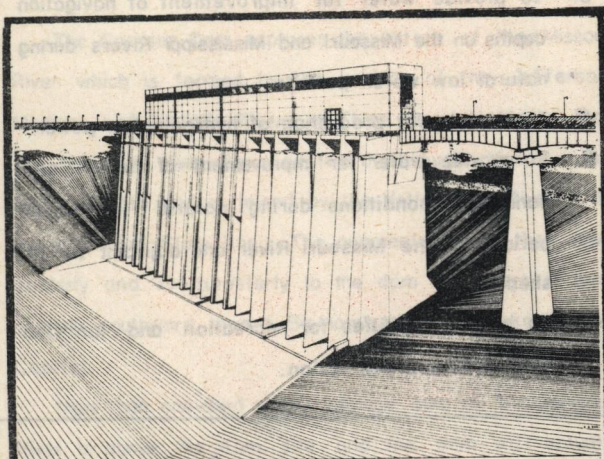
Garrison Dam  
Corps of Engineers, U. S. Army  
Riverdale, N. Dak.

Some general cutline material is contained in insert at bottom of picture.

The Corps of Engineers is now authorized to build and put into use three power units. The first unit is scheduled to go "on line" next spring or summer, depending on available reservoir water supply. The project is designed for a future total of five power units. The Bureau of Reclamation will pick up the power for transmission from the switchyard shown in the lower right corner.



# GARRISON DAM ON THE MISSOURI



Intake Structure

U. S. ARMY  
CORPS OF ENGINEERS  
GARRISON DISTRICT  
BISMARCK  
NORTH DAKOTA



## THE GARRISON DAM AND RESERVOIR PROJECT

The Garrison Dam and Reservoir Project is being constructed by the Corps of Engineers, U.S. Army, under the supervision of the Division Engineer, Missouri River Division, Omaha, Nebraska. Design and field operations are being accomplished at the immediate direction of the District Engineer, Garrison District, Fort Lincoln, Bismarck, North Dakota.

The town of Riverdale was built to house the personnel engaged in the design and construction of the dam and appurtenances thereto. The town houses about 4,000 persons. It is modern and equipped with proper facilities; such as, recreation building, stores, churches, hotel, hospital, fire and police stations, schools, telephone exchange, family quarters and administration buildings necessary for a town of this size.

The dam and town are located on the Missouri River approximately 77 river miles north of Bismarck, North Dakota, in McLean and Mercer Counties. The site is 60 miles south of Minot, North Dakota. The Government town of Riverdale may be reached by automobile from Bismarck or Minot, North Dakota, via U.S. Highway 83 to the Soo Line Railroad Station at Riverdale Junction, and thence west 11 miles on the Access Highway.

### PICK-SLOAN PLAN

The Garrison Dam and Reservoir will be one of the key units in the comprehensive plan for control and development of the water resources of the Missouri River Basin. This comprehensive plan, which envisions the construction of some 105 reservoirs, is known as the "Pick-Sloan Plan" from its co-authors Lieut. General Lewis A. Pick, Chief of Engineers and W.G. Sloan, former Field

Representative (now retired) of the United States Department of Interior, Missouri Basin Inter-agency Committee.

### HISTORY

Though development of the Upper Missouri River was considered and investigations for suitable dam sites were initiated by the Corps of Engineers prior to 1900, it was not until 1944 that Congress authorized the Garrison Dam and Reservoir Project. The Project authorized by the Flood Control Act of 1944 is one of a system of multiple-purpose reservoirs on the Missouri River included in the general comprehensive plan for the development of the water resources of the Missouri River Basin.

The job, then, of harnessing the Missouri River and its tributaries to serve man usefully and not destructively has been assigned jointly to the Corps of Engineers and the Bureau of Reclamation under the comprehensive "Pick-Sloan Plan". Other Federal and State agencies such as the Federal Power Commission, the Department of Agriculture, National Park Service, Fish and Wildlife Service, Public Health Service, Bureau of Indian Affairs and Public Roads Administration are co-operating to assure development and co-ordination of all inherent benefits of the unit.

On 4 October 1947, the first shovel of dirt was turned on the excavation of the dam proper. This was preceded by approximately one year of preparatory work, during which some temporary housing, the connecting highway and railroad, and the construction bridge were built. By 31 December 1951, approximately 46,900,000 yards of material had been excavated and 34,400,000 yards of this material segregated and placed in the dam.

### SOME FIGURES

#### THE DAM

Type	Rollled earth fill
Length	12,000 feet
Width Base	2,600 feet
Width Top	60 feet
Height	210 feet
Elevation (Top of Dam)	1875' above mean sea level
Volume of earth fill	70,000,000 cubic yards
Volume of excavation	86,000,000 cubic yards
Concrete	1,500,000 cubic yards
Riprap	650,000 cubic yards

#### CONTROLS

##### Spillway

Type	Gated chute
Tainter crest gates	28 - 29' x 40'
Fixed crest elevation	1825' above mean sea level
Length	1444 feet

##### Control Tower

Type	Reinforced concrete
Height	210 feet

##### Tunnels

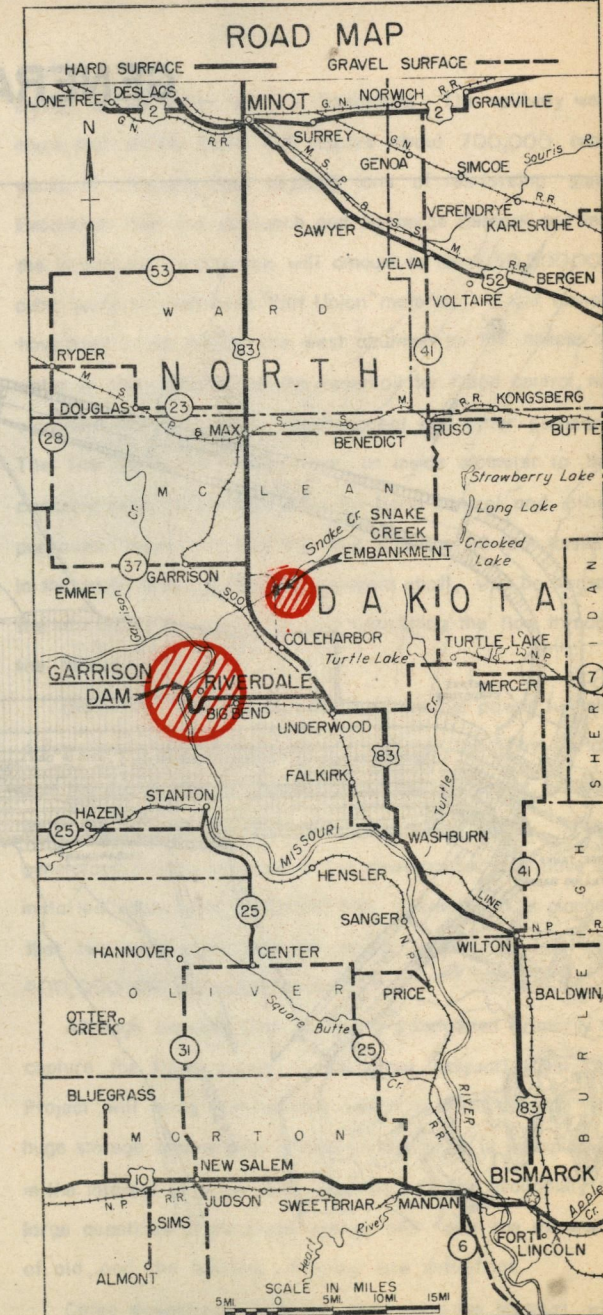
Type	Circular, concrete lined, West Abutment
Use	Flood control, power, conservation
Number & size - Flood control	1 - 26' and 2 - 22' finished diameter
Power	.5 - 29' finished diameter

#### POWER

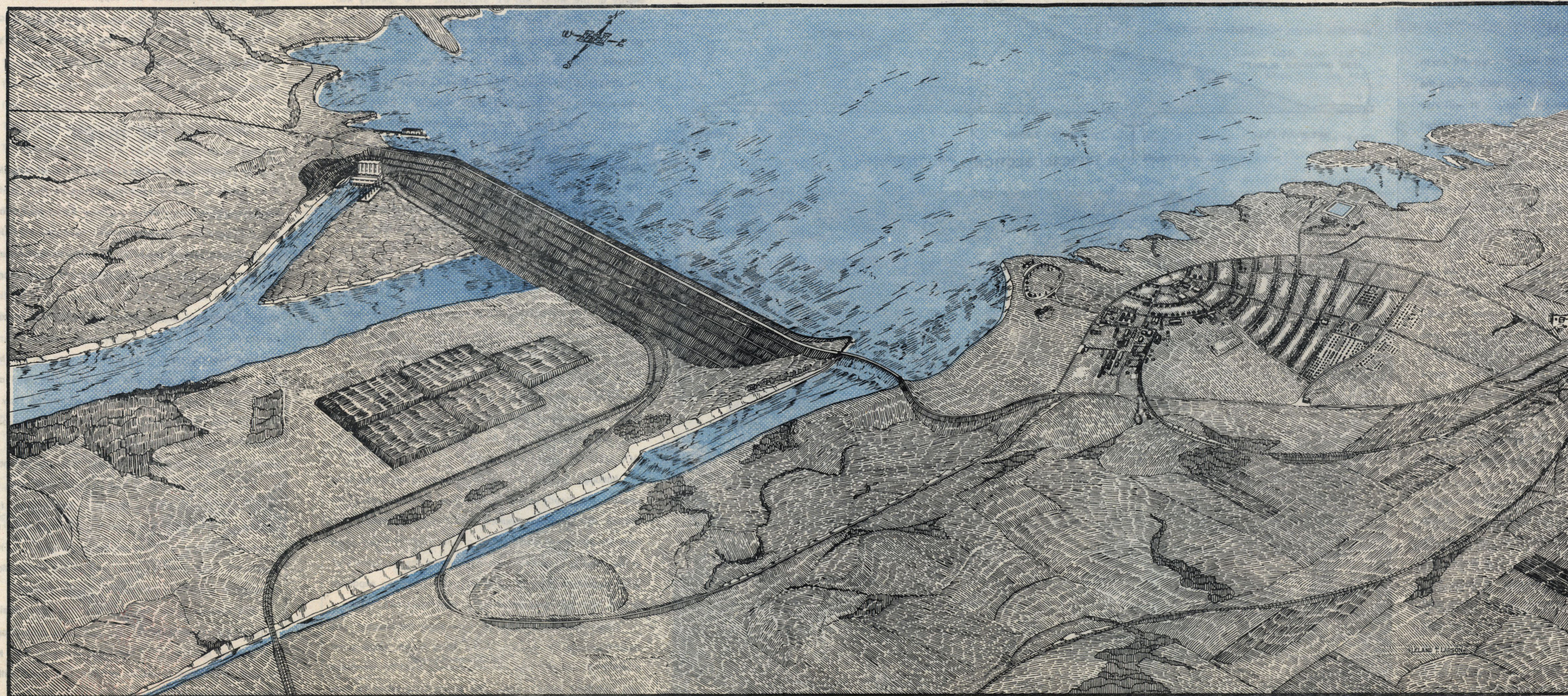
3 Units, initially; capacity	240,000 KW
5 Units, ultimately; capacity	400,000 KW

#### RESERVOIR

Drainage area above dam	180,940 square miles
Capacity -	
Maximum normal pool	23,000,000 acre ft.
Flood control	4,250,000 acre ft.
Multiple purpose uses	13,850,000 acre ft.
Dead storage	4,900,000 acre ft.
Area	
Maximum normal pool	390,000 acres
Length	200 miles
Minimum pool	133,000 acres
Length	120 miles







## GARRISON DAM HIGHLIGHTS

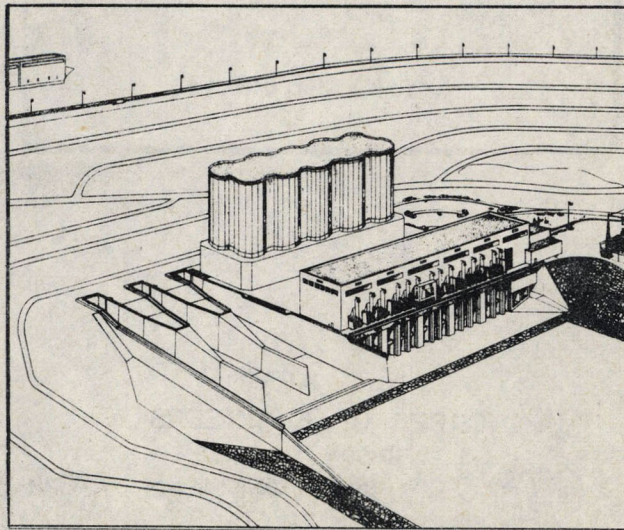
1. One of the world's largest rolled-fill earth dams.
2. Reservoir - surface area largest in world.
3. Concrete used would fill 30,000 freight cars.
4. Rock used would fill 13,000 freight cars.
5. Excavation would make a hole a city block square over 4 miles deep.
6. Power tunnels are large enough for train tunnels.
7. Ultimate electrical energy for city of 1,200,000.



## THE PURPOSE

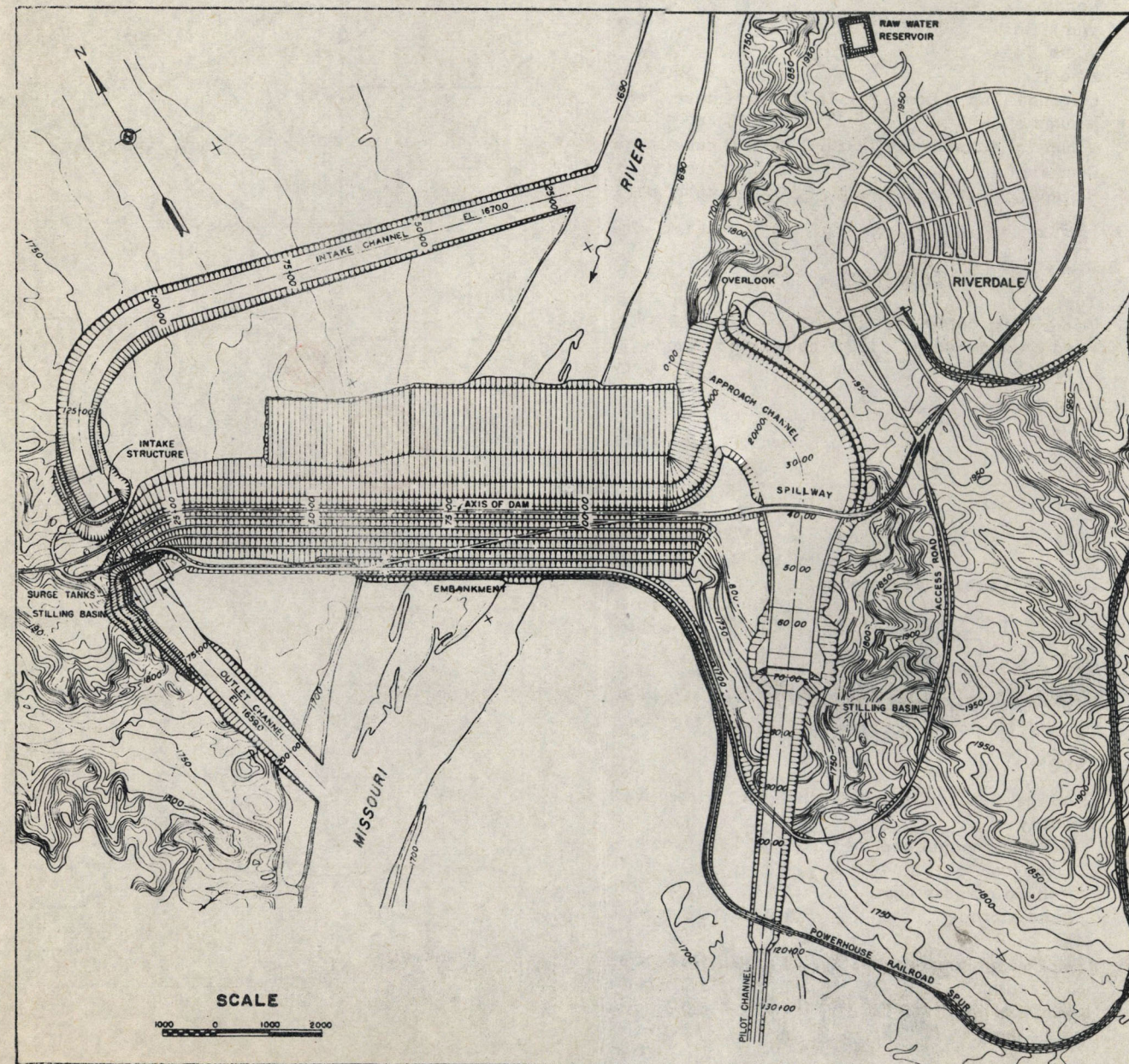
The objectives to be achieved by the Garrison Dam and Reservoir Project are sixfold:

1. To provide for control of floods and prevention of flood damages along the Missouri River downstream from the dam.
2. To provide water for irrigation in the Dakotas.
3. To provide water for improvement of navigation depths on the Missouri and Mississippi Rivers during natural low water periods.
4. To provide for production of hydroelectric power.
5. To provide water for improvement of health and sanitation conditions during natural low water periods on the Missouri River and adjacent watersheds.
6. To provide facilities for recreation and for fish and wildlife preservation.



POWER PLANT  
GARRISON DAM, N. D.

## GENERAL PLAN



## THE RESERVOIR

It has been calculated that at maximum normal operating pool the reservoir will contain 23,000,000 acre feet of water (7,494,573,000,000 gallons). When full, the reservoir will be a huge man-made lake 200 miles long, better than 14 miles across at some points, and over 200 feet deep along the former river channel upstream from the dam. The shore line approximately 1500 miles long, will surround a surface area of 390,000 acres.

The Garrison Reservoir will impound the flood waters from 180,940 square miles of the Missouri River Basin and release this water in controlled amounts for producing electric power, for improvement of navigation, for irrigation, for maintaining a minimum low water flow on the lower Missouri in the interest of sanitation and stabilization of municipal water supplies and will, in addition, provide facilities for recreation and for wildlife preservation.



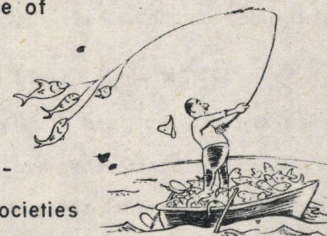
## RESERVOIR RECREATION

The Missouri River is aptly known as the "Big Muddy" but that identity will be lost in Garrison Reservoir. The long miles of lake behind Garrison Dam will be clear, sparkling, blue water, ideal for fishing, boating, swimming and camping during vacation time.

A study called the "Master Recreation Plan" is being developed in order that the fullest advantage may be taken of the potentialities for outdoor sports inherent in this man-made lake. This development will be made in the public interest and with the co-operation and advice of civic groups, Federal, State and Municipal agencies.



When completed, all necessary facilities for the enjoyment of the reservoir area will be provided for the safety and convenience of visitors. In addition to plans for public recreation, studies are being made, in co-operation with other societies and agencies concerned, for the preservation of the natural resources and establishment of a favorable habitat for the conservation of fish and wildlife in the Project area.



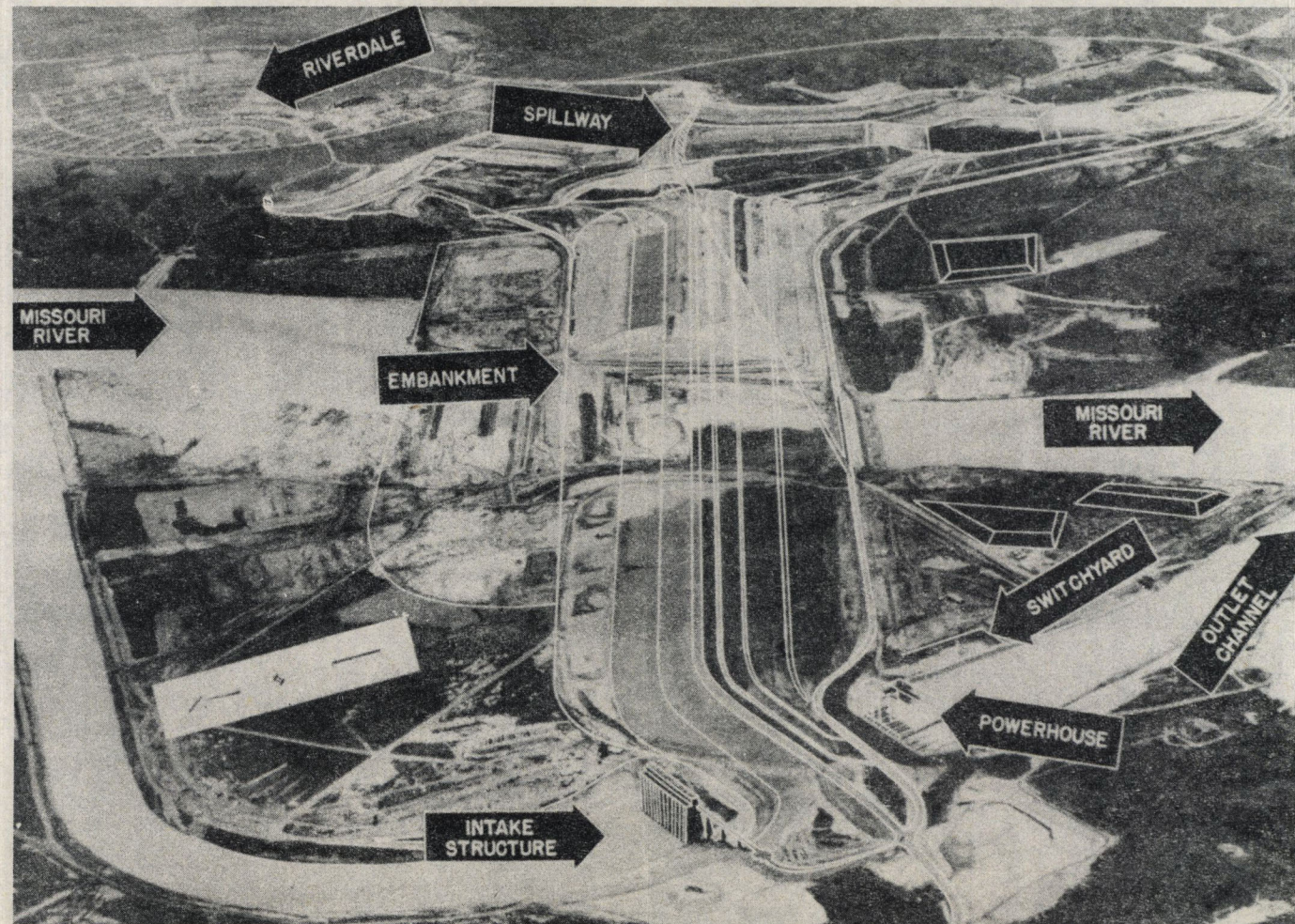
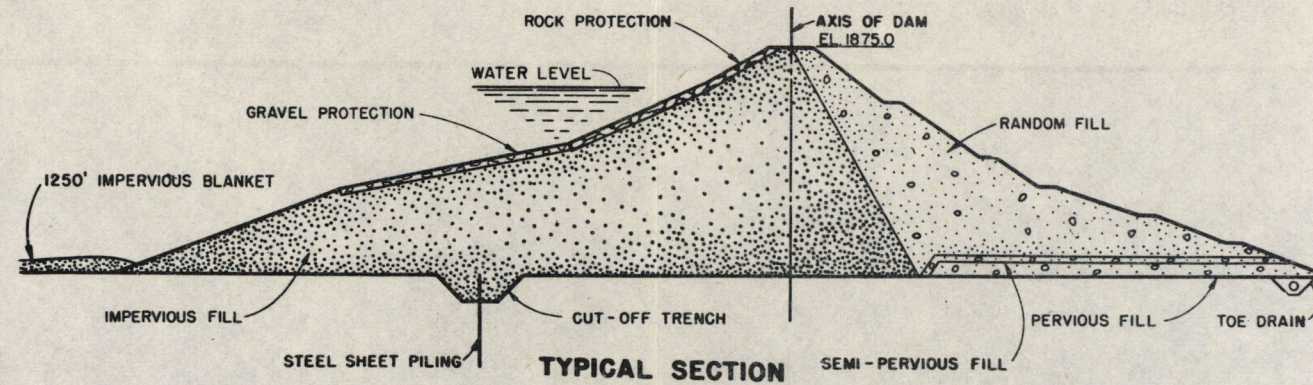


## THE DAM

Garrison Dam will be one of the largest rolled-fill earth embankments in the world. The dam will stretch across the Missouri River valley for more than two miles. It will rise more than 200 feet above the stream bed, contain about 70,000,000 cubic yards of carefully selected and segregated materials, be faced with approximately 650,000 cubic yards of rock to protect against wave erosion, have 525,000 square feet of steel sheet piling driven 85 feet below the foundation earth to prevent under seepage, and carry on its crest re-located Highways 8 and 28.

By looking at the drawing and picture you can see how the selected materials will be separated, placed and compacted. There will be an impervious earth blanket extending 1250 feet upstream from the toe of the dam, placed over the old river bottom to prevent leakage through the valley sands. The upstream portion of the dam will be of dense impervious earth to seal off and hold back the reservoir water while the downstream portion will be semi-pervious with a pervious drainage blanket over the old stream bed to permit any seepage from below or from within the structure to escape without damage.

The spillway in the east abutment, will have its crest at elevation 1825 feet above mean sea level and will be able to discharge at maximum pool elevation over two times the discharge of the greatest flood of record. This feature will adequately prevent any possible combination of floods from ever endangering the dam. There will be 28 Tainter crest gates, each 29 feet by 40 feet, along the 1444 foot crest of the ogee-type concrete spillway. Controlled discharge from the spillway weir will flow along a chute about 3200 feet long into a stilling basin where most of the moving



energy of the water will be dissipated. The spillway weir, chute, and stilling basin will require about 700,000 cubic yards of concrete and 18,000 tons of reinforcing steel. Excavation from the approach and discharge channels and from the structural excavation will amount to some 50,000,000 cubic yards of impervious "Fort Union" material. Eight tunnels have been driven through the west abutment for the release of water in the operation of the reservoir for flood control, navigation, irrigation, power development and other purposes. The five power tunnels have an inside diameter to the concrete lining of 29 feet, while for flood control and other purposes there are two 22-foot and one 26-foot tunnels. In the intake tower, a 210-foot concrete shaft, will be housed the machinery for operating and controlling the flow through the tunnels.

Below the downstream portals of the five power tunnels, a powerhouse will be constructed. Between the tunnel portals and the powerhouse, for preventing sudden changes of pressure within the penstocks, will be built the surge tanks. Three generators, initially installed in the powerhouse, will have an installed capacity of 240,000 KW. Ultimately, it is planned that two more units will be added, making a total of 400,000 KW installed capacity.

Although Garrison Dam is being constructed primarily to capture the flood waters of the Upper Missouri River, the Project will bring immeasurable wealth to North Dakota. The huge storage volume will afford a wide range of manipulation in the interest of power and irrigation and the availability of large quantities of electrical energy will favor the expansion of old, and the building of many new industries.

Cities downstream from the dam along the Missouri will benefit directly by removal of the flood threat. Other communities around the reservoir will benefit from the increased and stabilized water supply. The people living within the area

to be protected, watered and supplied with electrical power by the Garrison Dam not only will receive these tangible benefits but the health, safety and economic stability of the people and their livelihood will be enhanced.

## THE RIVER

The Garrison Dam captures the waters of the Missouri River which is formed by the junction of the Jefferson, Madison and Gallatin Rivers at Three Forks, Montana. From this point, the river flows eastward through Montana and North Dakota and is joined by the Yellowstone River at the North Dakota State line. The augmented river then flows easterly and southeasterly to the dam site, where it turns sharply southward, toward Bismarck, the North Dakota State Capital.

More than one-third of the drainage area of the Missouri River is above the dam site and the dam will actually control nearly one-third of the total volume of flow of the Missouri River at its confluence with the Mississippi River. Maximum and mean discharges at the dam site are approximately 350,000 and 25,000 cubic feet per second.

The two periods, March and June, of each year are the usual times for disastrous floods. The earlier flood is caused by rain and snow melt on the southward reaching tributaries and by ice jams on the main stem. The June floods are occasioned by snow melt in the Rocky Mountains, coincidental with the rainy season on the prairies.

The Garrison Dam, together with the other main stem units of the comprehensive plan and local protection works, will prevent recurrence in the main valley of the Missouri, of such disastrous floods as occurred five times within the period 1943 to 1952.



