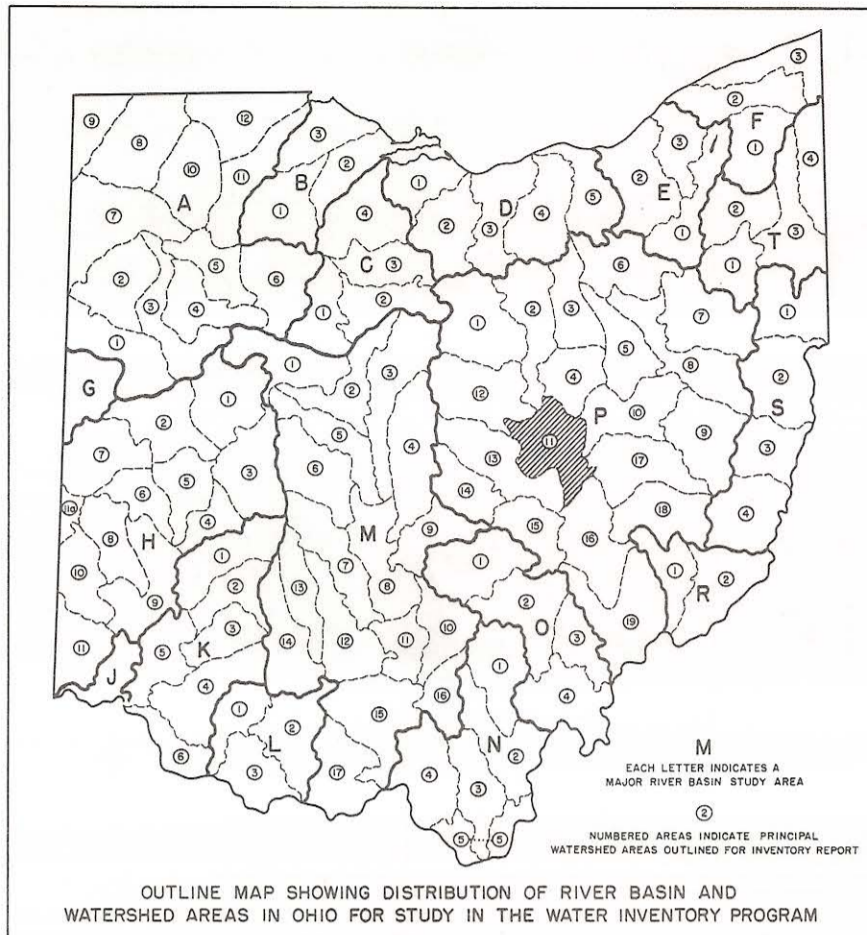


OHIO WATER PLAN INVENTORY
1962

Part of upper portion of the
MUSKINGUM RIVER BASIN
UNDERGROUND WATER RESOURCES

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The presence of underground water beneath the surface of the earth depends on the climate, geology, and the topography of the area. Ground water owes its origin to that portion of the precipitation which seeps into and saturates the cracks, crevices, and minute pores that are present in the rocks. The rocks serve as a vast underground reservoir for the temporary storage of ground water. The amount of water available depends on the number, kind, and size of the water-bearing openings in the rocks.

The rocks within the Upper Muskingum River Basin are essentially consolidated shale and sandstone, and unconsolidated deposits of clay, silt, sand, and gravel. Shale is a rather dense rock and usually a very poor source of underground water. Sandstone formations may yield relatively large quantities of water, locally; however, the degree of cementation of the individual grains and the composition of the formation often change within a short distance from a permeable sandstone to a relatively impermeable sandy shale or shale and variable yields are obtained from drilled wells. The unconsolidated deposits of sand and gravel are the least dense of the various rocks and are thusly the most important source of underground water. The accompanying table includes brief descriptions of the rocks and of their water-bearing characteristics.

Industrial and large municipal underground-water supplies are nonexistent in the bedrock beneath the Upper Muskingum River Basin. Yields of 100 to 1000, or more, gallons per minute are limited to the thick permeable deposits of sand and gravel beneath the flood plains adjacent to the Muskingum River and a portion of Wakatomika Creek. The ancient drainage channel beneath the Muskingum River from Coshocton to Dresden is filled with as much as 135 feet of coarse deposits of sand, gravel, boulders, and thin layers of clay. Proven yields of as much as 1500 gallons per minute have been developed in the vicinity of Conesville.

Domestic wells drilled in the vicinity of Trinway and Dresden encounter 100, or more, feet of sand, and sand and gravel. Maximum yields from these deposits are not known; therefore, test drilling and controlled pumping tests should be made prior to the location of large industrial or municipal well fields.

The more recent drainage channel beneath the Muskingum River from Dresden to Zanesville is filled with essentially coarse sand, some gravel and clay. Although wells drilled for the city of Zanesville report as much as 1200 gallons per minute, the regional potential of the deposits beneath the flood plain is not more than 500 gallons per minute. Since the bedrock may range from 60 to 70 feet beneath the surface, and the regional extent of the water-bearing deposits are confined to the relatively narrow flood plain, the potential is limited to 500 gallons per minute. Detailed test drilling and pumping tests may prove that greater yields are available, owing to the availability of recharge from the Muskingum River.

The bedrock is more than 200 feet beneath the surface west of Frazeysburg. The deposits which fill this ancient channel are essentially clay interbedded with layers of fine sand, silt and relatively thin layers of sand and gravel. Potential yields range from five to 20 gallons per minute, depending on the proper construction of the well.

Wells developed in the bedrock range from 30 to more than 200 feet deep, although the average depth is less than 100 feet, depending on the location of the well with respect to the local drainage. Yields range from less than five gallons per minute to more than 20 gallons per minute since the thickness and regional extent of the water-bearing sandstone formations are extremely variable. The principal bedrock formation in the western portion of the basin is the so-called "Big Injun" sandstone. Yields range from five to 15 gallons per minute. However, saline waters are reported from this formation in the central and eastern portions of the basin at depths of 175 feet to 300, or more, feet. Many wells drilled into the bedrock in the central part of the basin yield little or no ground water. Cisterns and dug wells are used for farm and domestic water supplies.

FILE INDEX
P-11

GENERALIZED STRATIGRAPHIC SEQUENCE OF THE
ROCKS IN THE UPPER MUSKINGUM RIVER BASIN

System or Series	Group or Formation	Character of Material	Water-bearing Characteristics
Quaternary	Recent	Clay, silt and alluvium deposited on the flood plains of the principal valleys.	Generally a poor source of ground water owing to absence of coarse materials.
	Pleistocene	Relatively thick layers of sand and gravel deposited by glacial meltwaters as surficial valley trains or buried outwash.	Potential ground-water yields depend on thickness, permeability and source of recharge. Properly constructed wells have a potential yield of as much as 500 to 1000 gallons per minute.
		Heterogeneous deposit of clay, fine sand, and sand and gravel interbedded with lenses of sand and gravel. Deposits fill ancient drainage channels to a depth of as much as 200, or more, feet.	Adequate ground-water supplies for farm, home, and small industrial requirements may be developed. In some areas wells may be developed in the underlying sandstone formations.
Pennsylvanian	Allegheny	Medium to coarse grained sandstone, and shale.	Sandstone formations are principal aquifer. Yields depend on location of well with respect to drainage.
	Pottsville		
Mississippian	Logan	Fine to medium grained sandstone, silty to sandy shale, siltstone, and shale.	Farm and domestic supplies may be available. Yields less than 10 gallons per minute.
	Cuyahoga	Alternating layers of fine to coarse grained sandstone, siltstone, and shale.	Yields of wells range from 5 to 15 gallons per minute, although saline waters reported at depths of more than 175 to 300 feet.

QUALITY OF UNDERGROUND WATER

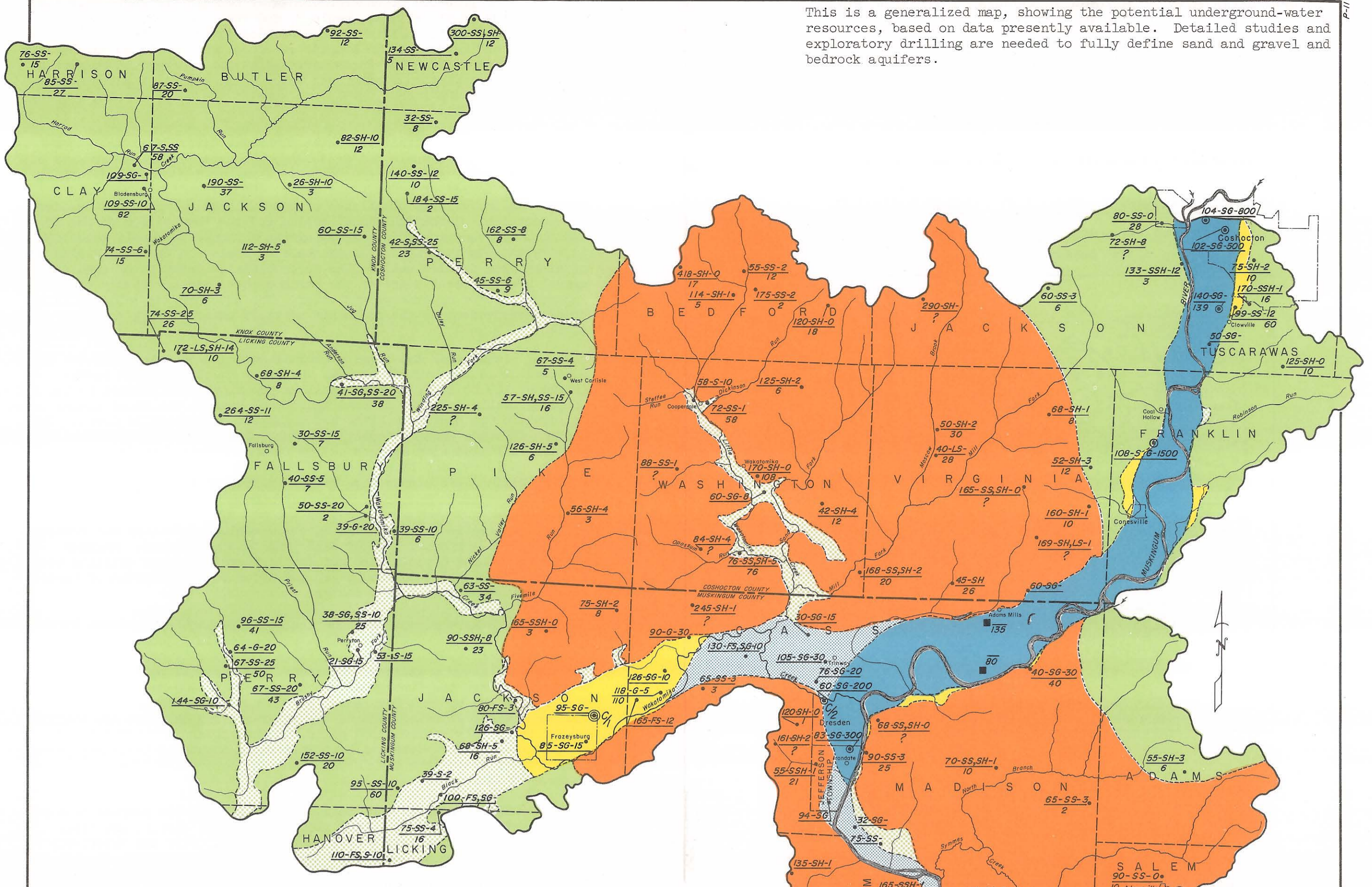
Partial analyses are shown in the following table. The analyses were made by the Ohio Department of Health in 1961. The analyses for C-2 and C-3 were made on samples of raw water from more than one well. The analysis for C-1 was collected from well number one, which is 95 feet deep. The depths shown for C-2 and C-3 are representative for each well field and not a specific well.

Well number	C-1	C-2	C-3
Depth (Ft.)	95	80	65
Water-bearing formation	Sand and gravel	Sand and gravel	Sand and gravel
	Parts per million		
Iron	2.1	0.25	0.3
Chloride	6.	25.	150.
Dissolved solids	255.	342.	735.
Total hardness	210.	250.	420.
pH	7.75	7.4	8.0

Since these analyses are from sand and gravel aquifers, the principal source of recharge is from the surface streams flowing over them. When these streams contain undesirable mineral constituents, the ground water will eventually contain the same constituents. The quality of the water from the Muskingum River has in the past contained a relatively high content of chlorides and total solids. This was reflected in the municipal and industrial wells recharged by this river. The cause of this condition has been partially remedied in the headwaters of the Tuscarawas River which has resulted in the reduction of the chlorides and total solids in water from the river and adjacent wells.

The ground water from C-1 should be treated for iron removal and the water from C-3 should be softened.

This is a generalized map, showing the potential underground-water resources, based on data presently available. Detailed studies and exploratory drilling are needed to fully define sand and gravel and bedrock aquifers.



EXPLANATION OF SYMBOLS

- Domestic well
- ⊙ Industrial well
- ⊙ Municipal well
- Seismic test (depth to bedrock)
- s Sand
- g Gravel
- fs Fine sand
- LS Limestone
- SS Sandstone
- SH Shale
- SSH Sandy shale

$\frac{1}{2}$ Chemical analysis in text.

Total depth (Ft.) - Water-bearing formation - Yield (gpm)
Depth to bedrock (Ft.)

AREAS IN WHICH YIELDS OF AS MUCH AS 1000, OR MORE, GALLONS PER MINUTE CAN BE DEVELOPED

Permeable deposits of sand and gravel beneath the area adjacent to the Muskingum River yield as much as 1000, or more, gallons per minute to properly constructed drilled wells.

AREAS IN WHICH YIELDS OF 100 TO 500 GALLONS PER MINUTE CAN BE DEVELOPED

Limited to regionally extensive, thick permeable deposits of sand and gravel. Yields depend on regional extent of water-bearing formation and source of recharge. Sustained yields may exceed 500 gallons per minute and test drilling is necessary to locate coarser deposits.

AREAS IN WHICH YIELDS OF 25 TO 100 GALLONS PER MINUTE CAN BE DEVELOPED

Thin to thick lenses of sand and gravel interbedded in relatively thick layers of clay and fine sand. Yields depend on proper well construction and depths may range from 40 to more than 200 feet.

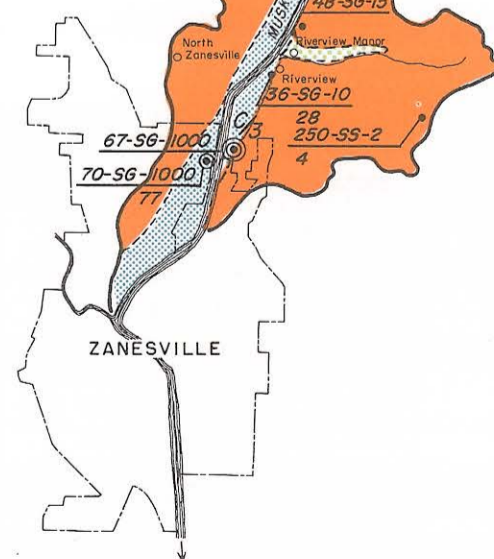
AREAS IN WHICH YIELDS OF 5 TO 25 GALLONS PER MINUTE CAN BE DEVELOPED

Alternating layers of sandstone, shale, and limestone of variable thickness beneath an average of 24 feet of unconsolidated deposits. Yields range from less than 5 to as much as 25 gallons per minute, however salt water is reported at depths greater than 250 feet.

Remnants of ancient drainage systems partially filled with clay, silt, and fine sand interbedded with thin isolated layers of sand and gravel. Yields seldom exceed 10 gallons per minute and large diameter drilled or dug wells may be necessary to provide maximum yields.

AREAS IN WHICH YIELDS OF LESS THAN 5 GALLONS PER MINUTE CAN BE DEVELOPED

Alternating layers of shale and thin sandstone. Drilled wells seldom yield more than 3 gallons per minute, and salt water is reported at depths of more than 175 feet. Dug wells, cisterns, and springs are generally used as the principal source of water.



MAP OF A PART OF THE UPPER PORTION
MUSKINGUM RIVER BASIN
SHOWING
AVAILABILITY OF
UNDERGROUND WATER